

Individuals, Images, and Investments

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Abstract

For a discipline having individual choice as one of its fundamental tenets, finance pays surprisingly little attention to the individual. We all know that people value investments differently, because if they didn't, there would be no financial market activity. But if in the long run on average people didn't value investments correctly (and identically), whatever person didn't would be out of the market. We believe in so-called "rational" financial models because we can't believe that people can be very wrong for very long. From an economic standpoint "rational behavior" is a problematic concept, but from one common sense standpoint, with which the economic standpoint, whatever it may be, must be in agreement, "rational behavior" is "not consistently being wrong". Of course the market is our measure of what is wrong, and the market is made up of people, but economic "fundamentals" ensure that the market itself cannot be very wrong for very long. Because economic fundamentals discipline the market which disciplines people, we can eliminate the individual from our models. Both rationality and the excision of the individual have received extensive critical commentary in the literature, but the argument against them has been largely based on their unreality. And this unreality is readily conceded; however, the common sense argument in their favor has thus far been too strong to yield to it. Using recent findings in cognitive science concerning images, this paper proposes a new concept of rationality and a new argument for the restoration of the individual in finance models.

I. Introduction

For a discipline having individual choice as one of its fundamental tenets, finance pays surprisingly little attention to the individual. Consider discounted cash flow (DCF) valuation, which is a solution to one of the most important problems with which finance has concerned itself. Whether you are valuing a bond, a stock, a capital project, or a business acquisition, the process is essentially the same: forecast the cash flows, determine the discount rate, compare the costs and the benefits (using some method such as Net Present Value (NPV) or Internal Rate of Return (IRR)), and then make a decision regarding the investment.

Of the first three steps, the third (compare the costs and the benefits) is clearly a mechanical process that with the appropriate training everyone will be able to perform in the same ways. But as anyone who has actually attempted to value an investment themselves can attest, the first two steps are not so clear cut. The second is an especially complicated problem, requiring estimates of the risk of the investment, of the required rate of return exclusive of risk (to compensate for the deferral of consumption and for inflation) and of some sort of premium for the risk. And this is a problem which has engaged an untold number of researchers for many years. All told, no matter what type of investment it is that is being valued, the valuations by different investors will differ.

And they *should* differ. First, people have different information and different ways of making use of that information and will form different estimates of cash flows and rates. Second, people have different attitudes in general towards the deferral of consumption and towards risk and will require different compensation for them. There are other sources of differences because every investment implies a personal choice between that investment and other uses of resources, including whether or not additional resources ought to be acquired to undertake the investment. The first of these is that people have different opportunities available to them and furthermore will have different attitudes towards the deferral of consumption and inflation in light of them. And the second is that the Fisher Separation Theorem notwithstanding, people have different access to financing which leads to different perspectives on the discount rate as a whole. Finally, the actual decision regarding the investment will include an assortment

of other personal considerations that for whatever reason were not incorporated in the preceding steps in the process.

All of these are well-known, as are the assumptions made by finance to cope with them. First, everyone has the same information and the same ways of making use of it. Second, everyone has the same opportunities and the same access to resources. Third, although it may not be easy to tease out exactly what they are, there is a market consensus on the appropriate compensation for the deferral of consumption, for inflation, and for a unit of risk. Fourth, although it may not be easy to compute exactly what it is, there is a market consensus (via the Capital Asset Pricing Model for example) on the appropriate amount of risk of an investment. And fifth and most viscerally compelling, if anyone were systematically erroneous in their forecasts of cash flows or estimates of discount rates, this would quickly become obvious in the form of systematically inferior decisions.

This last point cannot be overstressed. We all know that people value investments differently in the ways we have described. If they didn't, there would be no financial market activity. But if in the long run on average people didn't value investments correctly (and identically), whatever person didn't would be out of the market. We believe in financial models such as the one for DCF valuation because we can't believe that people can be very wrong for very long. From an economic standpoint "rational behavior" is a problematic concept that we will be concerned with later in the paper. But from one common sense standpoint, with which the economic standpoint, whatever it may be, must be in agreement¹, "rational behavior" is "not consistently being wrong". Of course the market is our measure of what is wrong, and the market is made up of people, but economic "fundamentals" ensure that the market itself cannot be very wrong for very long. Because economic fundamentals discipline the market which disciplines people, we can eliminate the individual from our model of DCF valuation and from all other models in the discipline of finance.

¹ Paul Samuelson (1963) proposed this as "Samuelson's Razor":

All economic regularities that have no common sense core that you can explain to [an intelligent non-specialist] will soon fail. (Samuelson, 1963, page 235).

Both rationality and the excision of the individual have received extensive critical commentary in the literature, but the argument against them has been largely based on their unreality. And this unreality is readily conceded; however, the common sense argument in their favor has thus far been too strong to yield to it. Consistent with Friedman's (1953) positivist methodology, reality is simply not an issue. Using recent findings in cognitive science, this paper proposes a new concept of rationality and a new argument for the restoration of the individual in finance models. Section II briefly discusses imagery, its relation to the acquisition, storage, and processing of information, and its implications for a distinction between "rational" and "logical" behavior. Section III surveys the extant literature which has already begun to address the role of imagery in financial decision making. The paper concludes in section IV with the implications for DCF valuation in particular and finance theory and research in general.

II. Information as Images

There has been an active debate in the field of cognitive science over how information is stored and processed in the mind: pictorial versus descriptonal (Block, 1981), spatial versus syntactic (Kosslyn, 1983), nonformal versus symbolic (Rollins, 1989), a-logical versus logical (Margolis, 1987), concrete versus abstract, continuous versus discrete, holistic versus articulated (Pylyshyn, 1981), and analog versus digital (Schwartz, 1981).² In each of these

² The debate is not a simple either-or issue. Of course some believe that all knowledge must be in one of the forms (Pylyshyn (1981) supports all descriptonal and Damasio (1994) all pictorial), even though sometimes knowledge may seem as if it is in the other form. But some believe that some knowledge can be in one form and some knowledge in the other (Kosslyn, 1983), and some believe that combinations of the two forms are possible. (Fodor, 1975) It may also be that different individuals store and process their knowledge in different forms. (Forisha, 1983) Pinker (1997) points out that if there are two forms, we must be able to transform the pictorial into the descriptonal:

Pictures are ambiguous, but thought, virtually by definition, cannot be ambiguous. Your common sense makes distinctions that pictures by themselves do not; therefore your common sense is not just a collection of pictures. If a mental picture is used to represent a thought, it needs to be accompanied by a caption, a set of instructions for how to interpret the picture--what to pay attention to and what to ignore. . . . When vision leaves off and thought begins, there's no getting around the need for abstract symbols and propositions that pick out *aspects* of an object for the mind to manipulate. (Pinker, 1997, page 297)

pairs, the first term corresponds to mental representation in the form of images and the second to propositions. The difference between information storage and processing of images (pictorial, spatial, concrete, nonformal, a-logical, continuous, holistic, and analog) and propositions (descriptive, syntactical, abstract, symbolic, logical, discrete, articulated, and digital) has important implications. In short, the debate can be boiled down to the question whether the mind can be replicated on a computer. (Rollins, 1989)

While finance has not had to explicitly answer this question, the answer implicit in its traditional research methods -- the use of mathematical models and more recently expert systems and neural nets, not to mention the habitual references to “rationality” -- is “yes”.³ Even in behavioral finance, which is an attempt to temper the “rationality” assumed by traditional finance with what psychologists have discovered about human decision making, the methods are not so different. We still assume that the financial information (which in behavioral finance is, however, allowed to be incomplete) which we are exposed to is in some way stored intact in some location within our minds in much the same way as it would be stored in computer memory and enters into some programmable algorithm to yield a decision. We may not arrive at an optimal decision, since we appear to have a number of inferential heuristics hard-wired into us through evolution designed for efficient use of cognitive effort and not judgmental accuracy as measured against some normative model. But this more realistic behavior can still be mathematically modeled, and these “boundedly rational” models are not necessarily less tractable than the “rational” ones. (Conlisk, 1996)

If knowledge and knowing are more in the form of images than of propositions, then the computer metaphor and the research methods consistent with it in finance, traditional *or* behavioral, may have limited ability to explain investor and analyst behavior. If investors are not all alike nor can be expected to become all alike under the discipline of the market we may have to readmit the individual into the investment process.⁴

Unfortunately, Pinker is too narrow in his concept of “pictorial”. Most regard an image as a multisensory construct -- it is not just visual. (Neisser, 1972)

³ Notwithstanding the anthropomorphic character of *expert* systems and *neural* nets.

⁴ Behavioral finance does admit individuals into its models, but in small numbers of homogeneous groups such as “informed” and “uninformed” or “rational” and “irrational” investors.

Just what an image is, and more specifically a *corporate image*, with which we are concerned in this paper, has been quite elusive and certainly very difficult to specify for empirical purposes as noted in section III. In the countless definitions and descriptions of *corporate image*, though, at least one common characteristic does appear which all would agree is true of the concept. Corporate images are subjective; that is, they exist in the minds of the members of the corporate audience. And because they are subjective, they are also singular, as everyone's perceptions of a corporation and everyone's values through which they filter these perceptions are different. This is in marked contrast to the corporation in finance, which is a quite objective and, on the strength of the "rational and homogeneous expectations" assumption common in traditional finance theory, the same for everyone.

If we do rely upon images to store and process information, then variables such as expected cash flows and risk are likely to be more than just numerical quantities. But what about *rationality*, which we have assumed characterizes the DCF valuation process in which we use the information we have to estimate such variables and select investments in corporations by ranking them in terms of NPV, IRR, or other such method. Indeed, one definition of economic rationality is the ability to do such tasks correctly. Devlin (1997), however, draws a clear distinction between *logical* and *rational*. The former resembles the processes such as DCF valuation which we find in traditional finance and which finance has called *rational* and the latter what we find in behavioral finance which finance has called *irrational* (or at least *quasi-rational* (Thaler, 1991) or *boundedly rational* (Conlisk, 1996)). *Logic* can certainly provide us with a clear normative standard for the use of knowledge in the form of propositions, and we might call *rationality* the normative standard for the use of knowledge in whatever form it exists in our minds. If our knowledge is made up of propositions, then rationality and logic are the same, but if our knowledge is made up of images, rationality may be something quite different.

So far we have asserted that images have no role in traditional finance, which assumes that information storage and processing, such as that which would be involved in DCF valuation and the investment decision, occur in the form of logical propositions and can thus be replicated on a computer. It turns out, however, that images have already been linked to finance, primarily

in the marketing and management literature concerning corporate images, but also in the finance literature itself.

III. Images and Investments

Practitioner “Theory”

It’s an unusual company, and a shortsighted one, that is not concerned with the image it presents to its shareholders and the rest of the financial world. Perceptions of a corporation by investors, stock analysts, portfolio managers, and brokers tend to affect a company’s basic market value. (Gregory, 1991, page 135)

A company’s ability to raise needed capital depends largely on how investors perceive and value the business. And the image the company projects strongly affects that perception. (Margulies, 1979, page 16)

Businesses clearly advertise to the financial community, and the financial community considers this advertising to be important. (Hutton, 1991)

We’re also convinced that our corporate [image] advertising has an influence on our stock price . . . is a good long-term investment . . . not something you turn off to save money or turn on when you have an extra dollar. (Gregory, 1991, page 138, quoting CSX Chairman Hays Watkins)

One purpose of advertising in general is to communicate information, and one could argue that this is the purpose of business advertising to the financial community. Using the standard argument that underlies so much of finance theory, if business are advertising to the financial community, not only must the benefits of communicating information via this advertising exceed the costs, but such advertising must be the most efficient way of communicating the information. But the information which investors, stock analysts, portfolio managers, and brokers are supposed to use in their decision making is not the sort that we usually expect to be best communicated by advertising. We often associate advertising with an emotional appeal

that would not be present in financial reports, for example, and emotions are not supposed to play a role in financial decision making. The information is supposed to speak for itself.⁵

So is image advertising to the financial community consistent with the models of finance theory or isn't it? Let us first consider a selection of statements by marketing practitioners regarding the supposed value of this advertising.

When impacting the financial community it's vital to know and understand your audience. Stock analysts and brokers, shareholders and potential investors, bankers, and other lenders all need to know the hard financial facts of a corporation. . . . But besides hard financial facts, the shareholders need to know corporate policies, plans, and product developments--the kind of facts they cannot learn from electronic quotation systems and statements of condition. (Gregory, 1991, page 138)

Advertising may indeed be an effective way to communicate the qualitative information (corporate policies, plans, and product developments) which finance considers to be no less important than quantitative information (hard financial facts).

We've talked to analysts and [they say] they're not swayed by advertising. But they are well aware of it. . . . Analysts also say things like: is there something coming across in the advertising that we may not be picking up--a change in business they're not talking about? [Analysts and investors look] for all sorts of messages. (Gregory, 1991, page 149, quoting United Technologies' advertising manager Thomas Haas)

Nonetheless, there may still be more being communicated than just facts.

Corporate advertising influences market valuation by . . . changing the expectations of investors regarding future returns and risks, by providing them with information which better enables them to interpret financial performance when making their investment decisions. (Gregory, 1991, page 136, quoting Eugene P. Schonfeld of Northwestern University)

Certainly the statement that the information in corporate advertising affects expectations regarding returns and risk is quite conventional and fully consistent with the models of finance

⁵ Even so-called "financial reports" themselves can be problematic. Gasparino (1999) describes a questionable practice in which financial services firms issue favorable "reports" on companies from which they have received stock warrants. The firms claim that the compensation they have received in the form of warrants is for "investment advisory services" and not for the publicity.

theory. But the statement that the information affects the interpretation of financial performance suggests complications. On the one hand, no one would disagree that qualitative information can make quantitative information more meaningful. On the other hand, quantitative information always enters “as is” into the models of finance theory and is assumed to “speak for itself”. We must therefore ask: Does the assumption that everyone has the same “information” include having the same “knowledge”?

Another dimension to the issue of meaning is credibility.

The cornerstones of any program for investor relations are disclosure and communication. CEOs must learn to disclose even bad news. This builds shareholder trust by creating the impression that the corporation has nothing to hide. (Gregory, 1991, page 138, quoting attorney Susan Thomases)

Once again, on the one hand the credibility of the information concerning an investment decision might simply be another dimension of the expectations regarding the riskiness of the investment. On the other hand, as we noted in the introduction, finance theory assumes a market consensus on the appropriate amount of risk of an investment, and it is not clear that this assumption incorporates the credibility of the information concerning the investment. Different sources of information will have different credibility; therefore, we must ask: does the assumption that everyone has the same information include getting it from the same source and having the same faith in it?

Still another dimension to the issue of meaning is attention.

A good financial-communications program is [no] substitute for sound financial performance. All things being equal, however, the company with a balanced, sophisticated communications program stands a much better chance of gaining the financial world’s attention than does the company that assumes that financial performance will necessarily speak for itself. (Gregory, 1991, page 141, quoting Harry O’Neill of Opinion Research Corporation)

Yet again, on the one hand all information we have matters. On the other hand, some information may matter more than other information, and it is not clear whether having a piece of information means also having information how it should be weighted in making our decisions.

Therefore here we must ask: Does the assumption that everyone has the same information include paying the appropriate amount of attention to it relative to all other information?⁶

These brief comments from marketing practitioners on the value of image advertising have posed a very important question: When we talk about *interpretation*, *credibility*, and *attention*, are we talking about matters which are a part of the traditional propositional view of the storage and processing of information or about matters which concern a different sort of storage and processing of information involving images and which may demand that we readmit the individual into the investment decision? Are we talking about just facts, or is there an essential emotional component the individual brings to the facts? According to Thomas Haas, advertising manager of United Technologies concerning a prominent corporate image campaign, “It’s rather trite, but the more you know us the more likely you are to favorably consider us.” (quoted in Gregory, 1991, page 146) Is this just because there are good things about us you don’t know, or because just knowing more somehow makes things look better?⁷

Empirical Findings

The obvious problem with a review of the extant empirical work concerning images and finance is just what it is we are looking for when we are looking for images. There has been some confirmation of the practitioner observations discussed in the preceding subsection, but for the most part such studies do not meet finance’s evidential standards and have not been published in finance journals.

O’Neill (1978) reported some interesting results obtained from a survey of security analysts. He confirmed the importance of the qualitative information to be gleaned from assorted forms corporate communications especially annual reports. But one of his most

⁶ In other words, if we are willing to characterize our decision making as “bounded rationality”, have we implicitly been assuming that the rationality of all of us has the same bounds?

⁷ According to Gordon Bowman, head of United Technologies creative programs:

The investment community buys the future, not the present, and the qualities these ads suggest are the things the investor looks for and has to feel subliminally about a company. (quoted in Gregory, 1991, page 150)

important findings was that there were a large number of firms that did not receive much attention from analysts, and there was a connection between the performance (which may be related to fashionability) of an industry and the number of analysts following the median firm. As quoted above, he concluded that corporate communication was necessary to attract this attention. Of course this inattention by analysts is often used to explain assorted anomalies associated with small firms.

Niefeld (1980) found that corporate advertising accounts for 4% of the variance in stock price, which is described as small in percentage terms but significant in terms of a large 33 to 1 return on advertising expenditures. What is perhaps more interesting about the study is that 55% was accounted for by financial fundamentals leaving an unexplained 41% she attributed to the “romance of the market”, which is described in terms which generally relate to image.⁸ Higgins and Bannister (1992) conducted a survey of security analysts and found that companies having what they call “strategic credibility” created through corporate communications may have a positive impact on share price.

That there is a lot missing from our current explanatory models of stock market returns comes as a surprise to no one. Richard Roll made the problem the theme of his 1988 Presidential Address to the American Finance Association. (Roll, 1988) But we are certainly not justified in attributing the failure of our explanations of stock market returns to different images held by individual investors. An alternative approach is to locate some factor that might be associated with imagery or be a component of an image and ask whether it has an influence on stock market returns.

In the 1970s and early 1980s, there were a number of studies concerning the relationship between “corporate social responsibility” and economic performance. The results of these studies were surveyed in Ullmann (1985) and Aupperle et. al. (1985), and both of these papers also included extended discussions of the problems with measuring corporate

⁸ Niefeld’s definition of “romance of the market” is

. . . the configuration and psychology of the total market, the configuration of a specific category, the effect of public relations activities, the editorial treatment a company

social responsibility, since some sort of measurement is of course required for any empirical work. Ullmann (1985) summarized his survey of the literature with the phrases “inconsistent findings” and “no clear tendency” and Aupperle et. al. (1985) with “varying results”. The latter performed their own tests and found “no statistically significant relationships”, and concluded their paper with a rare statement of the fallibility of finance methods:

“Perhaps this issue, whether or not corporate social responsibility is related to profitability, will never be completely resolved.” (Aupperle et. al., 1985, page 462)

Toward the end of the 1980s, studies were undertaken using the results of annual surveys conducted by *Fortune* magazine concerning the perceptions of eight attributes⁹ of American corporations by executives, securities analysts, and outside directors. One study (McGuire et. al., 1988), reflecting the terminology of the prior literature, referred to the aggregate of these attributes, which included both financial and non-financial factors, as a measure of “corporate social responsibility” and described this as an “image”. As in earlier studies, they found that social responsibility and concurrent stock-market-based measures of performance were insignificantly correlated, but also found that high financial performance preceded a favorable image of social responsibility and that low financial performance followed it. Interestingly, McGuire et. al. (1988) interpreted their correlations in terms of financial performance predicting corporate social responsibility and not vice versa.

Sobol and Farrelly (1988) also used the *Fortune* data, but called it a survey of “corporate reputation” and not “corporate social responsibility”. They also looked at the impact of financial variables on this “corporate reputation” and not vice versa and found that the P/E ratios, earnings per share, and dividend yields from prior years could explain between 28.9% and 38.3% of the eight attributes, both financial and non-financial.¹⁰ This is consistent

receives from various publications and services, the ‘push’ by institutions and brokers, etc.” (Niefeld, 1980, page 68)

⁹ These were: “1. financial soundness, 2. value as a long-term investment, 3. use of corporate assets, 4. innovativeness, 5. ability to attract, develop and keep talented people, 6. quality of products or services, 7. quality of management, and 8. community and environmental responsibility.” (Sobol and Farrelly, 1988, page 46)

¹⁰ They attribute the unexplained portion to:

with McGuire et. al. (1988) and the theory that it is financially strong corporations that undertake socially responsible activities. In a subsequent book aimed at practitioners, Sobol et. al. (1992) report that *Fortune* itself looked at financial performance and found only slight differences (both positive and negative) between the returns of firms regardless of their rank in the survey. (Makin, 1983; Baiq, 1987)

Bromley (1993) reported the results of a third study conducted by Fombrunn and Shanley (1990) which found that profitability, market value, and risk were all highly correlated ($r=.44$, $.49$. and $-.39$ respectively) with the reputations of 300 firms, as determined by the Fortune magazine survey. (Hutton, 1986) These three factors along with media visibility accounted for 27-35% of the variation in reputation.¹¹ According to Bromley (1993), Fombrunn and Shanley (1990) say that “reputation crystallizes a variety of facts and opinions into a manageable, well-defined image with several facets.” (Bromley, 1993, page 174)

Finally, Bosch and Hirschey (1989) used an event study to investigate the connection between a corporate name change, which is a key component of corporate identity and of corporate image, and financial performance. They concluded that the valuation effects were only modest and transitory, with a rise in value shortly before the announcement of the change and a decline shortly afterward.

Although behavioral finance is still in its infancy, behavioral accounting has a long research tradition in which a number of studies relevant to the issues in this paper have been undertaken. While much of this literature is concerned specifically with how accounting information is used in financial decision making, some results suggest that more than accounting information is involved. (Maines, 1995) A series of papers in the 1970s (Elias, 1972; Hendricks, 1976; Acland, 1976) found that specific costs related to human resources management tasks such as recruitment and training, which one would not expect to have a very

... characteristics such as the age of the firm, lifecycle stages of products, reports in the managerial and/or financial press, and public relations activities.” (Sobol and Farrelly, 1988, page 37)

¹¹ Contrary to traditional finance, which assumes that more information is better, media visibility had a negative effect on reputation. One explanation is that media visibility is correlated with negative information and not information in general. (Bromley, 1993)

great direct influence on financial performance, and even information concerning matters such as employee morale influenced investment decisions. Also in the 1970s, Hofstede (1972) found that the president's comments in the annual report influenced readers' earnings per share forecasts. Following up later, Kaplan et. al. (1990) also found that the president's letter in the annual report had an effect on readers' predictions of future performance and on their investment decisions. More recently, Kida and Smith (1998) found that emotional responses were stored in the minds of analysts along with numerical data and played a role in the subsequent use of that data in decision making

A somewhat tangential but nonetheless suggestive line of research has concerned the effects of the display of financial information. If the same numbers have different effects when presented differently, then something other than the numbers must matter. The most general work on the effects of graphical presentation has been done by statisticians (Bertin, 1981; Tufte, 1983; Cleveland, 1985; Cleveland and McGill, 1987; Tufte, 1990); however, the discussion of the article by Cleveland and McGill (1987) contains a number of statements indicative of how rare work on the subject of graphics has been even among statisticians. Some work has been done specifically in accounting and has found that graphic presentation can result in better decision performance if the form of the presentation is an appropriate one for the decision (Blocher, Moffie, and Zmud, 1986 and Davis, 1989) but that the improvements resulting from the use of graphics may be slight. (DeSanctis and Jarvenpaa, 1989). Nonetheless, there are many opportunities for future research. (DeSanctis, 1984)

One example of an ingenious attempt to devise a literal "image" that is a multidimensional gestalt of several variables is the Chernoff face. (Chernoff, 1973) The theory behind the Chernoff face is that humans have the ability to integrate a number of facial attributes into a single interpretation of a facial expression. It is possible to represent up to twenty-one variables using a cartoon face as shown in Figure 1.

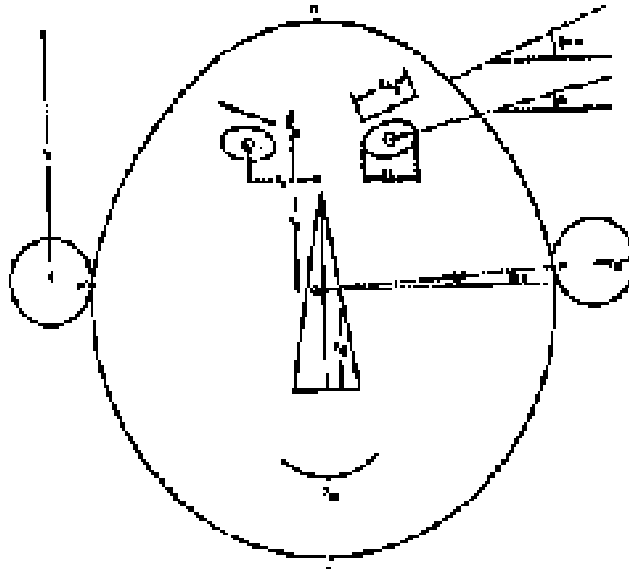


Figure 1 (Huff and Black, 1978. p. 202)

A number of studies have attempted to use Chernoff faces for the assessment of the financial conditions of firms. (Moriarty, 1979; Huff, Mahajan, and Black, 1981; Stock and Watson, 1984, and McKay and Villarreal, 1987). Moriarty (1979) and Stock and Watson (1984) found that Chernoff faces improved the ability to detect deteriorating financial performance. McKay and Villarreal (1987) found that with Chernoff faces, all variables were considered simultaneously, and there was less likelihood of placing excessive emphasis on random changes. The faces, however, tended not to reveal problems indicated only by changes in a small number of variables. Rather, such problems were more likely to be detected using tabular data.

Perhaps the most fascinating aspect of the method of Chernoff faces is its anthropomorphism. The faces have been used for a variety of multivariate data sets for which the facial expression itself has no special relevance.¹² For the assessment of financial condition,

¹²See the articles in Wang (1978) for examples.

however, the expression has been meaningful. Figure 2 shows the faces for the minimum values of the data and the maximum values of the data respectively.

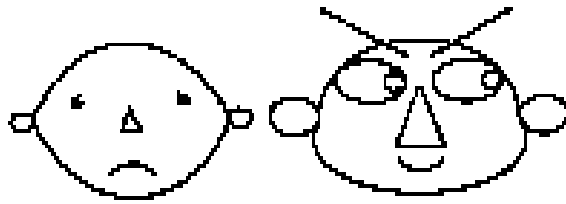


Figure 2 (Huff, Mahajan, and Black, 1981, p. 56)

The joy and excitement of the face on the right are obviously associated with superior financial condition in a non-arbitrary way. Moriarty (1979) did recommend future research on whether individual variables should be represented by smiles or frowns, and Huff, Mahajan, and Black (1981) noted that the emotional associations of the faces might have an influence on the evaluation of the data. The other authors appear to have taken the assignment for granted.

Summary

Practitioners think that investment requires more than just the financial numbers; that is, that corporate communication is necessary to attract attention to them, enhance their credibility, and facilitate their interpretation, and there is some evidence to suggest that this is true. Maybe this is just a part of an objective process in which information is acquired and assembled in a logical way into rational expectations of return and risk, but maybe this ensures that they are wrapped up in a favorable subjective corporate image. And while there are theoretical reasons for a causal linkage between an image of social responsibility or reputation and financial performance -- in economic terms a good reputation is the less costly equivalent of a contract. (Sobel, 1992; Frank, 1988) -- aside from anecdotal evidence suggesting it (Bromley, 1993) researchers have failed to find it. But researchers have also managed to explain only a small

part of what it is that accounts for stock market returns and the subjective images of individual investors cannot be ruled out as having something to do with them.

We cannot, however, ignore the possibility that as far as finance is concerned, image may still be just another objective attribute of a company. It is not that investors form subjective images of a company; rather, they form objective estimates of the effects of the subjective images that customers or suppliers, for example, form of the company. Any apparent concern with images on the part of investors may simply be a consequence of the effect images may have raising sales revenues or lowering operating expenses. Even if researchers were to find a good way to measure them and incorporate them in financial models, someone's corporate image having an effect on financial performance might still be consistent with the excision of the individual from the investment process.

IV. Individuals, Images, and Investments

The preceding sections have presented us with some critical questions:

1. Are investment decisions based upon propositions, or are they based upon images?
2. If they are based upon images, then are "rational" investment decisions still also "logical" ones, or are they something else?
3. If they are something else, how is it that the discipline of economic fundamentals and the market does not force "rational" decisions to be "logical" ones?
4. Is the optimal investment decision independent of the person making it?

Let us consider these questions in order. Cognitive science has certainly accumulated impressive experimental evidence in favor of mental images (Kosslyn, 1983), and it now appears as if memory is made up of something more similar to images than to propositions. (Schank, 1990) But as Pinker (1997) points out, what we call thought requires that images be transformed into propositions. The first question then becomes one of the effect that storage in the form of images has on information which may have originally been in propositional form.

For example, we may locate the P/E ratio of Microsoft on an on-line information service and use this P/E ratio to decide whether or not we will invest in Microsoft stock. Now it is unlikely that we have a “Microsoft P/E ratio” brain cell in which that bit of information is stored between the time we acquire it and the time we use it. Rather, Microsoft’s P/E ratio is integrated in some subjective way with other information we already have in the form of some sort of image of Microsoft. Even though we may be able to retrieve the precise number from our memory that we originally placed in it, something may happen to that P/E ratio while it is resident in our minds as part of an image of Microsoft that makes it somehow different. This was just the effect found by Kida and Smith (1998). If on the other hand we build an investment decision making model on a computer and P/E ratio is one of the decision variables, we certainly will have a location within the computer’s memory where Microsoft’s P/E ratio resides. Nothing happens to it while it is there and it is exactly the same in every use as it was when it went into memory. Psychology research long ago showed that a person’s expectations are not explicitly retrieved from memory as they would be by a computer, but are constructed when needed out of the most readily available material. (Carroll, 1978)¹³

Now there may be some clever way to differentiate propositional financial information which has been stored as part of an image from propositional financial information which hasn’t, but we have not been able to think of one. If it is true, however, that computers are always superior at tasks of integrating information (Fiske and Taylor, 1991; Maines, 1995)¹⁴, as occurs in making an investment decision, why aren’t we letting our computers invest? We let them screen massive data bases for investment possibilities, and we allow them to exploit arbitrage opportunities created by price differentials, but we do not let them invest. If investment is a “rational” process in the traditional sense of the term as synonymous with “logical”, then a computer can be programmed to do it, and it will do it much better than any human. Of course there may be certain legal issues that would need to be addressed and human pride is

¹³ The availability of an image not only increases assessments of its probability (Tversky and Kahneman, 1973), but increases the likelihood that a person will perform the imagined action. (Gregory, Cialdini, and Carpenter, 1982).

¹⁴ According to Camerer (1995), the only exceptions to the superiority of a weighted linear combination of variables over human judgement are for certain rare medical diagnoses.

undoubtedly a consideration, but the potential for profit would be so great that it could not be passed up.

As we saw in section III, the empirical evidence supporting the importance of images in finance is weak and anecdotal, and more rigorous empirical tests have been both indirect and inconclusive. And even when we suspect the use of images, we cannot be certain whether we are talking about something different from propositions or not. But we do not really need to know how the mind works in order to answer the first question posed at the beginning of this section, and our answer is one which ought to be very familiar in finance. If investment decisions were based upon propositions, which can be mathematically modeled and the decision process were able to be replicated on a computer, they would be. Because humans still make investments, then investment decisions must be based on something unique to humans. And given our knowledge of how the human mind works, we might as well call this something *images*.

In any decision, we face the *frame problem* that we must know what to include and what not to include in our decision making process, and there is no rational way to do this in a finite length of time. (Pinker, 1997) Although it appears as if we can rationally determine what is and is not relevant to a decision, we must retrieve things that turn out to be irrelevant, in order to determine that they *are* irrelevant, and without an emotional input, this process would never end. We would be paralyzed. (de Sousa, 1987) There are cases of particular forms of brain lesions, which damage emotions and cause just this sort of behavior. (Damasio, 1994)

Now economics would seem to have dealt with this issue. Clearly, there is a point beyond which the costs of further deliberation exceed the benefits to be obtained from it, and at this point we rationally bound our rationality. But when there are costs associated with optimizing, we also face the problem of optimizing our process of optimizing, and so on *ad infinitum*. This is referred to as the “regress issue”, and the literature concerning it is summarized in Conlisk (1996). We cannot assume that this process converges to a determinable optimum of an optimum of an optimum etc. -- there is no rational solution to the problem in the traditional sense of rational as synonymous with logical. Rather, there are times when it is rational to be illogical.

To answer the second question, since all decisions must be rational in some sense that is not logical, so must investment decisions. There is always a point beyond which we shouldn't bother to acquire more information concerning an investment even though there is of course always more information that we could acquire. It is rational to stop, but there is no logical way to tell when to stop.

Just because we cannot know exactly at what point to stop searching for information concerning an investment does not mean that we can not come close enough to that point. Some searches will be clearly too short and some too long. The market will be sure to discipline anyone who doesn't get it approximately right. Or will it? The third question goes to the heart of the issue raised in the introduction. We believe in market efficiency, for example, not because of the empirical evidence but because we cannot believe that there is money lying around out there waiting for someone to pick it up. Likewise we believe in rationality, whether perfectly logical or not, because the determinedly irrational could easily be systematically fleeced by the rational and driven out of the market. Even if someone did not know how to be rational, they would learn to act as if they were.

These beliefs are difficult to refute, but Conlisk (1996) tries in defense of bounded rationality. The conditions for effective learning ("rewards, repeated opportunities for practice, small deliberation cost at each repetition, good feedback, unchanging circumstances, and a simple context" (Conlisk, 1996, page 683)) are not often present in the economy. So if we are unfortunate enough to start out irrational, there are limits to how quickly and how well we can learn to be rational. Acting in our favor is that we have some defense against discipline on the part of the market. We do not have to know how to fleece others in order to avoid being fleeced ourselves; we can just not trade. And while we may not know how to optimize our returns, we don't need optimal returns in order to live comfortably and happily. Unfortunately, these arguments, while true, are not especially compelling compared to the beliefs they are intended to counter.

While the argument may not be much better, consider optimization itself. Regardless of what it is you are trying to optimize, you can never know how to do it, you can never know if you've done it, if you accidentally did it you can never why you did it, and you certainly cannot

do it for more than one thing at the same time. Looking only at companies, even if we accept the finance dictum that they should first and foremost maximize shareholder wealth, no one knows how to do this, ever knows if it has been done, and if it has how they did it. Although finance texts describe normative models which theoretically maximize shareholder wealth, there is no empirical evidence that they do. We cannot show that companies that do anything of what we tell them to do do better than those which don't. One reason is that we cannot tell people how to do in practical terms what we tell them to do in theoretical terms. Every normative model, including DCF valuation, eventually requires input for which there is no normative model. For example, we cannot tell anyone how to estimate future cash flows, and while we can tell them to discount at the weighted average cost of capital (WACC), we cannot tell them how to compute a cost of equity. And even if we accidentally get it right, we cannot know that. For individuals it's even more complicated, because individual investors are not just trying to optimize wealth. Although economic fundamentals may prevent us from doing anything totally stupid, the market is just as ignorant concerning optimization as the companies and individuals that make it up. There are numerous ways in which we can all just blunder along.

Finally we come to the key question of the paper. According to the Fisher Separation Theorem, the investment decision is independent of the financing decision. Whether or not something is a good idea has nothing to do with where or even whether you can get the money to do it. Is there an equivalent theorem for investment, as finance has implicitly assumed; that is, is the investment decision really separate from the investor? Does whether or not something is a good idea have anything to do with whose idea it is?

Hopefully, we have established that investment, while rational, is not logical. It cannot be done by a computer. Investment commits resources to the future, and the future exists only in the mind. More importantly, it exists in the form of images and not in the form of numbers. Once an investment is taken out of one mind and entered into another, it becomes something different. Without minds; that is, without investors, there are no investments.

Bibliography

- Acland, D., "The Effects of Behavioral Indicators on Investors' Decisions: An Exploratory Study," *Accounting, Organizations, and Society*, Volume 1, (1976), pages 133-142.
- Aupperle, Kenneth E., Archie B. Carroll, and John D. Hatfield, "An Empirical Examination of the Relationship Between Corporate Social Responsibility and Profitability," *Academy of Management Journal*, Volume 28, Number 2, (June, 1985), pages 446-463.
- Baiq, Edward C., "America's Most Admired Corporations," *Fortune*, Volume 115, Number 1, (January 19, 1987), pages 18-30.
- Bertin, Jacques, *Graphics and Graphic Information Processing*, (Berlin: Walter de Gruyter, 1981).
- Blocher, Edward, Robert P. Moffie, and Robert W. Zmud, "Report Format and Task Complexity: Interaction in Risk Judgements," *Accounting, Organizations, and Society*, Volume 11, Number 6, (1986), pages 457-470.
- Block, Ned, "Introduction: What Is the Issue?" in *Imagery*, ed. Ned Block, Cambridge, Massachusetts: The MIT Press, 1981), pages 1-18.
- Bosch, Jean-claude and Mark Hirschey, "The Valuation Effects of Corporate Name Changes," *Financial Management*, (Winter, 1989), pages 64-73.
- Bromley, D. B., *Reputation, Image, and Impression Management*, (Chichester: John Wiley & Sons, 1993).
- Camerer, Colin, "Individual Decision Making," in *The Handbook of Experimental Economics*, ed. John H. Kagel and Alvin E. Roth, (Princeton, New Jersey: Princeton University Press, 1995), pages 587-703.
- Carroll, John S., "The Effect of Imagining an Event on Expectations for the Event: An Interpretation in Terms of the Availability Heuristic," *Journal of Experimental Social Psychology*, Volume 14, (1978), pages 88-96.
- Chernoff, Herman, "The Use of Faces to Represent Points in k-Dimensional Space Graphically," *Journal of the American Statistical Association*, Volume 68, Number 342, (June, 1973), pages 361-368.
- Cleveland, William S., *The Elements of Graphing Data*, (Monterey, California: Wadsworth Advanced Books and Software, 1985).
- Cleveland, William S., and Robert McGill, "Graphical Perception: The Visual Decoding of Quantitative Information on Graphical Displays of Data," *Journal of the Royal Statistical Society A*, Volume 150, Part 3, (1987), pages 192-229.
- Conlisk, John, "Why Bounded Rationality?" *Journal of Economic Literature*, Volume 34, (June, 1996), pages 669-700.
- Damasio, Antonio R., *Descartes' Error: Emotion, Reason, and the Human Brain*, (New York: G.P. Putnam's Sons, 1994).
- Davis, Larry R., "Report Format and the Decision Maker's Task: An Experimental Investigation," *Accounting, Organizations, and Society*, Volume 14, Number 5/6, (1989), pages 495-508.
- DeSanctis, Gerardine, "Computer Graphics as Decision Aids: Directions for Research," *Decision Sciences*, Volume 15, (1984), pages 463-487.

DeSanctis, Gerardine, and Sirkka L. Jarvenpaa, "Graphical Presentation of Accounting Data for Financial Forecasting: An Experimental Investigation," *Accounting, Organizations, and Society*, Volume 14, Number 5/6, (1989), pages 509-525.

de Sousa, Ronald, *The Rationality of Emotion*, (Cambridge, Massachusetts: The MIT Press, 1987).

Devlin, Keith, *Goodbye, Descartes: the End of Logic and the Search for a New Cosmology of the Mind*, (New York: John Wiley & Sons, Inc., 1997).

Elias, N., "The Effects of Human Assets Statements on the Investment Decision: An Experiment," *Journal of Accounting Research*, Volume 10, (1972), pages 215-233.

Fiske, Susan T., and Shelley E. Taylor, *Social Cognition*, second edition, (New York: McGraw-Hill, Inc., 1991).

Frank, Robert H., *Passions Within Reason: The Strategic Role of Emotions*, (New York: W.W. Norton & Company, 1988).

Fodor, Jerry A., *The Language of Thought*, (New York: Thomas Y. Crowell Company, 1975).

Fombrun, C.J., and M. Shanley, "Keeping Score: Institutional Assessments of Corporate Performance," New York University, Graduate School of Business Working Paper, (1990).

Forisha, Barbara L., "Relationship between Creativity and Mental Imagery: A Question of Cognitive Styles," in *Imagery: Current Theory, Research, and Application*, ed. Anees A. Sheikh, (New York: John Wiley & Sons, 1983), pages 310-339.

Friedman, Milton, "The Methodology of Positive Economics," in *Essays in Positive Economics*, (Chicago: The University of Chicago Press, 1953), pages 3-43.

Gasparino, Charles, "Hired Help: Starved for Attention, Small Companies 'Buy' Wall Street Coverage," *The Wall Street Journal*, (July 14, 1999), pages A1, A10.

Gregory, James R., *Marketing Corporate Image: The Company As Your Number One Product*, (Lincolnwood, Illinois: NTC Business Books, 1991).

Gregory, W. Larry, Robert B. Cialdini, and Kathleen M. Carpenter, "Self-Relevant Scenarios as Mediators of Likelihood Estimates and Compliance: Does Imagining Make It So?" *Journal of Personality and Social Psychology*, Volume 43, Number 1, (1982), pages 89-99.

Hendricks, J., "The Impact of Human Resource Accounting Information on Stock Investment Decisions: An Empirical Study," *The Accounting Review*, Volume 51, (1976), pages 292-305.

Higgins, Richard B. and Brendan D. Bannister, "How Corporate communication of Strategy Affects Share Price," *Long Range Planning*, Volume 25, Number 3, (1992), pages 27-35.

Hofstede, T., "Some Behavioral Parameters of Financial Analysis," *The Accounting Review*, Volume 47, (1972), pages 679-692.

Huff, David L., and William Black, "A Multivariate Graphic Display for Regional Analysis," in *Graphical Representation of Multivariate Data*, ed. Peter C.C. Wang, (New York: Academic Press, 1978), pages 199-218.

Huff, David L., Vijay Mahajan, and William C. Black, "Facial Representation of Multivariate Data," *Journal of Marketing*, Volume 45, (Fall, 1981), pages 53-59.

Hutton, Cynthia, "America's Most Admired Corporations," *Fortune International*, Volume 113, Number 1, (January 6, 1986), pages 32-43.

Hutton, Peter, "Corporate Image," in *Researching Business Markets*, ed. Ken Sutherland, (London: Kogan Page Limited, 1991), pages 325-339.

Kaplan, S.E., S. Pourciau, and P.M.J. Reckers, "An Examination of the Effect of the President's Letter and Stock Advisory Service Information on Financial Decisions," *Behavioral Research in Accounting*, Volume 2, (1990), pages 63-93.

Kida, T. and J.F. Smith, "The Effects of Encoded Memory Trances for Numerical Data on Accounting Decision Making," *Accounting, Organizations, and Society*, Volume 23, (1998), pages 452-466.

Kosslyn, Stephen Michael, *Ghosts in the Mind's Machine: Creating and Using Images in the Brain*, (New York: W.W. Norton & Company, 1983).

Maines, Laureen A., "Judgement and Decision-Making Research in Financial Accounting: A Review and Analysis," in *Judgement and Decision-Making Research in Accounting and Auditing*, ed. Robert H. Ashton and Alison Hubbard Ashton, (Cambridge: Cambridge University Press, 1995), pages 76-101.

Makin, Claire, "Ranking Corporate Reputations," *Fortune*, (January 10, 1983), Volume 107, Number 1, (January 10, 1983), pages 34-44.

Margolis, Howard, *Patterns, Thinking, and Cognition: A Theory of Judgement*, (Chicago: University of Chicago Press, 1987).

Margulies, Walter P., "Corporate Image and the P/E Ratio: They Often Go Hand in Hand," *Management Review*, (October, 1979), pages 16-19.

McGuire, Jean, Alison Sundgren, and Thomas Schneeweis, *Academy of Management Journal*, Volume 31, Number 4, (December, 1988), pages 854-872.

McKay, David B., and Angelina Villarreal, "Performance Differences in the Use of Graphic and Tabular Displays of Multivariate Data," *Decision Sciences*, Volume 18, (1987), pages 535-546.

Moriarty, Shane, "Communicating Financial Information Through Multidimensional Graphics," *Journal of Accounting Research*, Volume 17, Number 1, (Spring, 1979), pages 205-224.

Neisser, Ulric, "Changing Conceptions of Imagery," in *The Function and Nature of Imagery*, ed. Peter W. Sheehan, (New York: Academic Press, 1972).

Niefeld, Jaye S., "Corporate Advertising," *Industrial Marketing*, (July, 1980), pages 64-74.

O'Neill, Harry, "The Research Behind a Corporate Campaign," *Crosscurrents*, Volume 7, (1978), pages 29-42.

Pinker, Steven, *How the Mind Works*, (New York: W.W. Norton & Company, 1997).

Pylyshyn, Zenon, "The Imagery Debate: Analog Media versus Tacit Knowledge," in *Imagery*, ed. Ned Block, Cambridge, Massachusetts: The MIT Press, 1981), pages 151-206.

- Roll, Richard, "R²," *The Journal of Finance*, Volume 43, Number 2, (July, 1988), pages 541-566.
- Rollins, Mark, *Mental Imagery: On the Limits of Cognitive Science*, (New Haven, Connecticut: Yale University Press, 1989).
- Samuelson, Paul, "Problems of Methodology -- Discussion," *American Economic Review*, Volume 53, (May, 1963), pages 231-236.
- Schank, Roger C., *Tell Me a Story: A New Look at Real and Artificial Memory*, (New York: Charles Scribner's Sons, 1990).
- Schwartz, Robert, "Imagery--There's More to It Than Meets the Eye," in *Imagery*, ed. Ned Block, Cambridge, Massachusetts: The MIT Press, 1981), pages 109-130.
- Sobel, J., "A Theory of Credibility," *Review of Economic Studies*, Volume 52, (1985), pages 557-573.
- Sobol, Marion G., and Gail Farrelly, "Corporate Reputation: A Function of Relative Size of Financial Performance?" *Review of Business and Economic Research*, (Fall, 1988), pages 45-59.
- Sobol, Marion G., Gail E. Farrelly, and Jessica S. Taper, *Shaping the Corporate Image: An Analytical Guide for Executive Decision Makers*, (New York: Quorum Books, 1992).
- Stock, Duane, and Colin J. Watson, "Human Judgement Accuracy, Multidimensional Graphics, and Humans versus Models," *Journal of Accounting Research*, Volume 22, Number 1, (Spring, 1984), pages 192-206.
- Thaler, Richard H., *Quasi Rational Economics*, (New York: Russell Sage Foundation, 1991).
- Tufte, Edward R., *The Visual Display of Quantitative Information*, (Cheshire, Connecticut: Graphics Press, 1983).
- Tufte, Edward R., *Envisioning Information*, (Cheshire, Connecticut: Graphics Press, 1990).
- Tversky, A., and D. Kahneman, "Availability: A Heuristic for Judging Frequency and Probability," *Cognitive Psychology*, Volume 5, (1973), pages 1124-1131.
- Ullmann, Arie A., "Data in Search of a Theory: A Critical Examination of the Relationships Among soivial Performance, Social Disclosure, and Economic Performance of U.S. Firms," *Academy of Management Review*, Volume 10, Number 3, (1985), pages 540-557.
- Wang, Peter C.C., editor, *Graphical Representation of Multivariate Data*, (New York: Academic Press, 1978)