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JUDGMENT: ITS ROLE AND VALUE FOR STRATEGY

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JUDGMENT: ITS ROLE AND VALUE FOR STRATEGY

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"Many times what are described as today's implementation failures
are really yesterday's foresight failures in disguise."
Hamel and Prahalad (1994, p75)

Introduction

Chess is an intellectually demanding game played by millions of people around the world. Yet unlike tennis or other competitive sports there are few changes in the rankings of chess players. There have only been twelve world chess champions (see Table 1) since the official title was first established in 1886. Emanuel Lasker held the title for twenty-seven years (between 1894 and 1921), Aleksandr Alekhine for seventeen, and Mikhail Botvinnik for thirteen. The last world champion, Anatoly Karpov, held the title for ten years between 1975 and 1985. In 1985 the current champion, Gary Kasparov, was the youngest player, at the age of twenty-two, to win the world chess title, which he has successfully defended since. Below the world champion there are grandmasters, masters, and many levels of chess experts, in addition to the great numbers of common people playing chess. Yet grandmasters (including the world champion who is the top among the grandmasters) consistently win against all other chess players.

The popular view is that grandmasters are highly intelligent people with a photographic memory and the ability to calculate the implications of various moves with amazing speed. Yet research has shown that the intelligence of grandmasters is not different from that of other people of the same education and socioeconomic background. Moreover, grandmasters

do not have a better or more photographic memory than the general public while their power of calculation is not faster than that of other people. Finally, the number of moves ahead considered by grandmasters and masters as well as chess experts is the same. They all usually examine two to three moves ahead, with a maximum of five (de Groot, 1965; Chase and Simon, 1973). The interesting questions are then: why do they consistently win, and why have there only been twelve world champions in the more than 110 years of the official title championships?

Grandmasters possess *two* interrelated talents: the first permits them to *effortlessly and speedily* recognize chess patterns *correctly*, the second allows them to know *the best* move *intuitively and instantly*. Chess experts and novices do not have these talents while masters possess them to a lesser degree (de Groot, 1965; Chase and Simon, 1973).

Grandmasters can reconstruct a chess board, after they have looked at it for only *five* seconds, with ninety percent accuracy. In the other ten percent of cases the mistake(s) involved is (are) usually small - involving minor pieces such as pawns. However they cannot reconstruct boards where the pieces have been put randomly. The board must be that of an actual game between, say, grandmasters after the twentieth move when the starting game had ended and few pieces had been won or lost (this makes the arrangement of the pieces on the board the most complex while it cannot be asserted that the pattern can be "remembered" from memory because it is that of an opening game).

Related to this great ability of instant pattern recognition chess grandmasters possess an additional one that allows them to intuitively know the best next move. In order to study and

understand the way grandmasters play chess, researchers have placed cameras below the chess board which capture, among other things, all eye movements. Using such cameras it has been shown that once the opponent has made his move the grandmaster's eyes *start*, three out of four times, at the best move which he begins examining. Consequently, he then evaluates alternative moves to return and play (three out of four times) the move he considered first. Remembering that in games between grandmasters every single chess move must be highly creative (whatever is obvious can be seen by even novice players) and powerful it is hard to explain scientifically or rationally how grandmasters can intuitively and instantly know which is the best move the great majority of the time.

Furthermore, grandmasters are capable of playing simultaneous chess games against as many as fifty expert opponents and they win the great majority of them. This is a considerable achievement as their opponents have ample time to analyze and carefully evaluate a great number of moves while the grandmaster is playing against each of the remaining opponents he is simultaneously facing. The grandmasters' two unique talents of *effortlessly and speedily* recognizing patterns *and* of *intuitively and instantly* seeing the best move overcome the ample time available to their opponents and prove the limitations of pure analytical evaluation or thinking. Finally, although a minimum of approximately 50,000 hours (or about ten years) of knowledge acquisition and intense practice is required to become a grandmaster (Simon, 1985) there are many chess experts who have also spent equal or longer periods playing chess. Thus, the ability of grandmasters to consistently win in chess games cannot be explained rationally; somehow, they possess, and/or have cultivated, at least *two* unique talents which provide them with the ability to stay at the top, very often for extended periods of time that cover more than one decade.

At the other extreme from grandmasters are financial market professionals whose actual decisions (judgments) or recommended choices for buying stocks, bonds, or other investment instruments are, on average, worse than random selections of similar portfolios (Bernstein, 1996; Glassman, 1997; Graham and Harvey, 1995; Rothchild, 1988)). Such random selections do not, obviously, require any knowledge or experience/expertise yet they beat, on average, those of "professionals" who use their judgment which incorporates their knowledge and experience/expertise of many years. Are there some financial professionals who, like the grandmasters, significantly beat the market over long periods of time? The answer to this question is probably no (references) although there are many people who think otherwise. The interesting question then becomes "why the majority of knowledgeable 'professionals' with many years of experience cannot do better than random choices?" The implications of answering correctly this question are considerable to better understand the role and value of our judgment.

Evaluating the performance of CEOs and other top executives in business organizations is not as easy as that of chess players or investment analysts. Success and failure in business can be the outcome of many factors making it difficult to pinpoint the isolated contribution of judgment in such success or failure. However, if we study the performance of many firms and associate it with the ability of their CEOs we can definitely identify some CEOs who have performed considerably above average over long periods of time, others who have consistently been below average, and some who started and stayed well above average for long time spans and then underperformed or even bankrupted their firms. There are, in addition, some CEOs who have succeeded after many setbacks, or even bankruptcies.

However, the great majority of firms and CEOs perform, by definition, average over the long run. As CEOs are mainly concerned with the strategy of their firms and as their good or bad judgment is the primary factor determining the success or failure of these firms, it is not clear how CEOs succeed or fail and when there is a reversal from success to failure or vice versa.

The purpose of this chapter is the study of the role and value of human judgment and its contribution to strategy. Is human judgment a "superb piece of work! Noble in reason! Infinite in faculty!" as Shakespeare believed, or are "errors of judgment ... often systematic rather than random, manifesting bias rather than confusion" causing us to "suffer from mental astigmatism as well as myopia" (Kahneman and Tversky, 1979)? Answering, or even better understanding, whether (or under what circumstances) Shakespeare or Kahneman and Tversky are right or wrong is critical for strategic decision-making as obviously Shakespeare's view of human judgment holds in the case of grandmasters while that of Kahneman and Tversky in the case of financial analysts.

This chapter is organized as follows: first the role of judgment, in particular as it relates to strategy, is examined; second the ability of human judgment to assess the likelihood of forthcoming events is discussed together with the various judgmental biases and limitations that negatively affect it; third, various dimensions of developing a strategy are proposed. Finally, in the concluding section, we discuss the need for future research in developing better foresight and improving the judgmental processes required in formulating and evaluating successful strategies.

The Importance of Judgment in Strategy

Strategy, whatever definition we accept (Makridakis and Héau, 1987), deals with future events and requires predictions about them. If the predictions (or lack of them) do not correctly identify important forthcoming events or critical changes in the business environment, there is little chance that strategy will be successful. Examples abound. The inability of American automobile firms in the early 1970s to foresee the changes in consumer attitudes towards smaller, oil efficient cars opened the door to their West European and Japanese rivals to take a big chunk of the America market (Magaziner and Patinkin, 1989). The inability, or unwillingness of IBM to recognize the revolutionary changes being brought about by the personal computer resulted in the end of its dominance of the computer industry and in huge losses that brought this giant close to bankruptcy (Makridakis, 1997). Similarly, the high rate of unemployment in the great majority of EU nations that started in the early 1990s has been the consequence of not anticipating the negative repercussions of the welfare state on the long-term ability of their economies to adapt to technological and other changes. European nations opted, therefore, to save jobs in the short term but in doing so they increased long-term unemployment a great deal as job security laws, market and labor regulations, as well as numerous bureaucratic obstacles halted the creation of new business firms and reduced the number of new jobs. Finally, even Japan, the superstar of the 1970s and 1980s, found itself in serious trouble as its firms and politicians did not predict the obvious: that is, that other nations and firms would learn and imitate the successful practices of Japanese businesses and apply these to compete on more equal terms against them. Many current problems are, therefore, the consequence of yesterday's failures of foresight, as the quotation at the beginning of this chapter indicates.

We must be extremely careful when studying the implications of good or bad forecasts. Predictions are different from explaining what has happened in the past, after the fact. Explaining the past is easy (Makridakis, 1997). Predicting the future is an extremely difficult task, in particular when strategic events are involved. The most important lesson we have probably learned in the field of forecasting in the last two decades is that the model that best fits historical data (the equivalent of explaining the past) is not necessarily the most accurate one for predicting the future that is beyond available data (Makridakis, 1997). Such a lesson has serious implications for strategy for two reasons. First, real predictions cannot be based simply on extrapolating the past, or alternatively on just historical information. Second, studying and imitating past successes is not enough to guarantee future ones. This means that to succeed in the future we must go beyond recipes, models, and/or theories that provide a procedure, or sequence of steps, for formulating or implementing a successful strategy (Micklethwait and Woldridge, 1996). Examples abound: from companies discussed in *In Search of Excellence* (Peters and Waterman, 1982), a book that provided advice from America's best run companies (these companies found themselves in serious trouble not long after the book was published - Makridakis, 1990) to Japan which after four decades of spectacular success has found itself with very serious economic and competitive problems - including a recession and slow growth for the last six years.

In the field of business strategy one of the authors of this chapter (Makridakis, 1997, b) has for instance identified eighteen theories that have appeared during the last thirty years. All of these theories have attempted to provide analytical tools to deal with strategy and have, with no exception, all failed. Strategy must be, among other things, unique. Otherwise a large number of firms can apply it thus minimizing its value and reducing the benefits from its

successful implementation to "average," as it is usually impossible for everyone to succeed in a big way. This means that above average success requires something "unique" which can only be based on judgmental inputs (including creative thinking) that, among other things, must correctly anticipate forthcoming events and changes, and then do something to exploit their potential benefits, or avoid their negative consequences.

At present there is a great deal of debate about the future of the Internet and the potential benefits, as well as dangers, it holds for business firms, and even whole nations. At the level of computer firms if the Internet and the NC (Network Computer) prevail there will be billions of dollars of revenues shifting from Intel and Microsoft to firms like Netscape and Sun (Schlender, 1996). Beyond the computer firms huge opportunities for teleshopping, telework, and all sorts of entertainment over the Internet can open up as the price of computers and communications will continue to fall. The big question is, therefore, whether or not these predictions about NC which costs the same as a color TV set, and global communications over the Internet that cost the same as a local call will materialize. Moreover, timing is critical so that it can be decided when a practical strategy can be formulated and then implemented. Obviously, success cannot be guaranteed by accurately predicting the future implications of low-cost, or even practically free, computing and communications. At the same time we can say with near certainty that many of the existing firms will lose their dominant position if they do not follow the new developments in computers and telecommunications and do not manage to adapt themselves to the new reality of the Internet. Today, however, the timing with which Internet communications will flourish is not known. Some say it will take a couple of years while others estimate a couple of

decades. Thus, making the vast investments required to harness the benefits of NCs and the Internet is a hard strategic choice with much uncertainty involved.

In one or two decades, by which time what has already happened will be clear, it will be easy to go back and explain why the winners won and to say that the losers lost because of their inability to foresee forthcoming changes and take bold actions to exploit their benefits and/or avoid the dangers involved. Today, however, neither the evolution of computers and the Internet nor the exact timing of such evolution are obvious. This makes it difficult for firms to formulate a strategy that exploits the opportunities and avoids the dangers that will develop. Moreover, neither is the extent of the potential competition clear nor is the way that firms will maintain competitive advantages known, even if such advantages can be gained through large, initial investments (Grove, 1996).

There is an irony surrounding accurate forecasts and their practical value to business firms. For a forecast to be useful it must provide firms with the opportunity to exploit potential benefits and/or stay clear of forthcoming dangers. But if people can correctly predict the future they will definitely develop strategies and take steps to gain from these predictions. Yet this will certainly affect the course of future events and in many cases alter or even invalidate the forecasts. For example the prediction that the NC will replace the PC will definitely draw reactions from Intel and Microsoft who will be the major players to lose from the NC. They have already started to formulate their own strategies for substantially reducing the price of PC computers and that of related softwares. They offer such software (often free of charge) over telecommunications networks, including the Internet, and even offer their own versions of the NC which will be a stripped-down version of a PC computer offering

everything an NC can do while still possessing some of the most desirable features of a PC - but at a price not much higher than that of an NC. At the same time those pushing NC will react to the anticipated moves of Intel and Microsoft by attempting to maximize their own benefits while reducing those of their opponents.

There are many other players besides just computer firms. Telecommunication companies, entertainment outfits, news organizations, travel, insurance, and brokerage firms, just to mention a few, will also be involved as they can gain a big market by doing business over the Internet. As there are billions of dollars of potential profits or losses at stake, there is no doubt that anticipations will play a critical role and that through such anticipations the various players will attempt to change the course of future events to fit their own purposes. As a matter of fact, the more certain it is that the forecasts will materialize the greater will be the attempt by companies to take concrete steps to invalidate these by developing and implementing strategies that will attempt to change the course of future events to fit their own purposes and achieve their goals. In a strategic setting, where many people are involved as decision-makers, there is never certainty about the future. The final outcome depends on the natural course of events and on actions, reactions, and counter actions. Successful strategies must take all these factors into account necessitating judgment of the kind possessed by grandmasters rather than financial analysts.

Human Judgment: Its Biases and Limitations

Not many of us can remember the telephone numbers of our favorite restaurants, what we ate for lunch a month ago, or all of our appointments for next week. However, we are well aware of the limitations of our memories. We know we cannot remember everything, so we take

steps to avoid the negative consequences involved. We write down the names of people and businesses in alphabetical order, along with the addresses and phone numbers in order to be able to retrieve them easily. For appointments we use an organizer or a calendar to enter the names of people to see, telephone calls to make, or meetings to attend, along with the times, under the correct date. A simple glance at the calendar reveals the day's schedule.

The fact that we do not entrust these things to memory and take remedial action to compensate for its deficiencies and limitations does not mean that our memory is deficient. On the contrary, the human memory is an exceptional organ, of infinite value. Even the most sophisticated computer cannot achieve a fraction of its marvelous workings. The human memory's complexity is estimated to be roughly the equivalent of sixty times that of the US telephone system, and its capacity five hundred times that of the entire Encyclopaedia Britannica (or 500,000 times if redundancies are counted). Yet even this enormous capacity would be filled in a few days if everything were indiscriminately stored. Thus, one of the most important functions of our memory (and mind) is to know what is important to remember and what can be ignored. Furthermore, it can determine when something stored has to be pushed back or be forgotten to accommodate new, more important information. It is because the memory is a such a sophisticated mechanism that we should write down all the things that can be easily retrieved. The more it is relieved of the burden of storing trivial facts, the greater its capacity to store and easily retrieve more important information.

The ability of our brain to process information and make decisions is very similar to memory, on which it depends a great deal. There are many tasks our mind can do extremely well. But, as with memory, there are other tasks it cannot accomplish as well or cannot do at all. Think,

for instance, of finding the square root of 53591468115. Unless one is a computational genius, or perhaps an idiot savant, the task cannot be achieved directly by the brain alone. As with memory, our mind must make compromises in order to accomplish many different and often conflicting tasks. For instance, novel problem-solving and creativity require abilities at the opposite extreme from those needed to make computations or deal with routine, repetitive situations. Similarly, learning requires trial and error (it therefore necessitates making mistakes), which is dysfunctional in stable situations when no change is involved.

The big difference between memory and judgment is that while we accept the deficiencies and limitations of our memory (and so write down useful addresses or things we want to remember later on) we rarely do anything to remedy the deficiencies of our judgment, mainly because we are unaware or unwilling to accept that our judgment can be faulty or biased. Because they are almost never presumed to exist, it is extremely important to expose judgmental biases. Empirical evidence demonstrates, beyond all reasonable doubt, their existence and their negative, damaging consequences (Dawes, 1988; Dixon, 1976; Goldberg, 1970; Kahneman et al., 1982; Meehl, 1954). Research shows that judgmental biases do not mean stupidity, for their presence is clearly discernible among highly intelligent people. Rather, they result from the way the mind operates and reflect its endeavors to achieve the optimal reconciliation of conflicting objectives.

Clearly, business executives, like everybody, are not free from biases (Hogarth and Makridakis, 1981). Thus, a great deal of attention is required to deal with judgmental biases and limitations as they affect strategy (and decision-making in general) whose success or failure can have a substantial impact on the well-being of organizations. In the remainder of

this section those biases relevant to forecasting and strategy are described and ways of minimizing or neutralizing their negative impact are proposed.

One of the judgmental biases that we often encounter is inconsistency. It happens when we change our minds (or decisions) when there is no need to do so. Consider, for instance, a production manager who must decide how much to manufacture for each of ten products in the coming month. Bowman, back in the 1950s, found that production managers' decisions about how much to produce fluctuated from month to month for no apparently good reason, and that making their decisions consistent improved profitability. Bowman's findings have been reproduced in a great number of studies. The conclusion is always the same. Repetitive, routine decisions can be improved if inconsistency is removed. People are often unable or unwilling to apply the same criteria or procedures when making similar decisions. Sometimes they forget; other times they are influenced by their mood at the time (think of a decision made the morning after a quarrel with one's spouse and a sleepless night); still other times they might be bored and want to try something new; finally, they might believe that conditions have changed when they actually have not.

Production managers are not the only ones whose decisions are inconsistent. Meehl (1954), in a small but influential book, concluded that decision rules using a few variables to predict do better than people, mostly because the models can consistently apply the same variables and decision criteria, while people are inconsistent in their choice of variables on which to base their decisions and in the criteria they employ.

Meehl's conclusions have been confirmed by hundreds of additional studies. Decision rules in the form of simple statistical models have been found to outperform expert judges when repetitive, routine decisions were involved. These decisions included medical diagnosis, psychological predictions about people's personality traits, selection of students to be admitted to colleges or universities, predicting future earnings of companies, and so forth. There is hardly any evidence showing that expert decision-makers do better than decision rules. Obviously, these studies refer to repetitive, routine decisions, but even then their conclusions are surprising, as in the case of medical diagnosis. Garland (1960), for instance, reported a study in which experienced X-ray specialists, when examining X-rays, failed to recognize the presence of lung disease that was definitely visible on the X-ray film about thirty percent of the time. Similarly, studies found that radiologists changed their minds about twenty percent of the time *when given the same X-ray on two different occasions*.

Inconsistency can be avoided by formalizing the decision-making process (in our day it is called "building expert systems"). This would require deciding first, what factors are important to consider in making a certain repetitive decision; second, how such factors should be weighted (one might be twice as important as another); and third, what objective should be optimized. The usefulness of decision rules derives from the fact that several people can get involved in determining them, thus making it possible to select the best factors, an optimal weighting scheme, and a viable objective. Since the rule will be used again and again, it makes sense to devote effort and resources to come up with the best one possible. The rule can subsequently be applied on a routine basis, freeing considerable human resources. Consider, for instance, when credit officers decide on a case-by-case basis whether or not a purchase by an American Express cardholder should be approved. This takes numerous

credit officers and becomes an expensive operation. Now consider finding all important factors that are used by credit officers to decide whether or not to approve a credit request. Since many such officers can be consulted and a great deal of effort can be devoted to the process, the most relevant factors can be found and included in a statistical model, which would determine if such factors are indeed important and how much weight should be given to each. A decision rule will thus be established, allowing a clerk to enter the required information and let the model reach a decision. Credit officers would be consulted only in the exceptional case where the model indicates a gray area and cannot decide. Fewer officers are required, and decisions will be consistent (based on the decision rule accepted) and objective. Given today's computer technology and telecommunications capabilities, decision models of the type just described can be economically developed and profitably applied on a routine basis. American Express has indeed applied one such decision-making model (called an expert system) and has reported considerable improvements in efficiency and profits.

Similarly, a decision rule that to some extent selects stocks at random can considerably improve the performance of the great majority of professionally managed investment funds (Dawes, 1988). As such selection is trivial it will result in a substantial cost reduction of a fund's expenses as no high paid investment professionals will be needed. This would mean charging consumers less money for administering the investments while providing them with higher returns (a win/win situation). Richard Branson's Virgin Funds select stocks randomly and charge very low management fees to their clients.

Obviously, decision rules can neither be used indefinitely nor be always appropriate for strategic purposes. The environment changes, as does competition, new objectives might be

set, and so on. In addition decision rules that can be applied by everyone become competitive requirements which offer no strategic advantages in the long run. Too much consistency in strategy can be even more dangerous than inconsistency, for it excludes learning and leads to another more critical bias that affects strategy, that of conservatism. Such conservatism arises when organizations become incapable (or unwilling) of recognizing that the changes in the environment are affecting them and that they must do something to deal with these changes.

This is the problem with biases - in trying to avoid one we might cultivate another. A bias in this case exists precisely because our minds must ensure consistency, but must also allow for learning. The challenge facing all of us, therefore, is to be consistent while at the same time introducing mechanisms to ensure learning and eventually changes in the decision rules to adapt to new conditions.

Another prominent example of a judgmental bias is recency (remembering more vividly recent events, which consequently influence our judgment to a greater extent than less recent events). Consider the oil prices between 1950 and 1988. During that period basic economic facts were ignored and many mistakes were made because of this recency bias, as organizations and governments overreacted to the latest price levels and developed strategies assuming first that decreasing real oil prices between 1955 and 1973 and then increasing ones between 1973 and 1981 were going to last for very long periods of time, if not for ever. The negative consequences of this recency bias for strategy were enormous. Utility companies, for instance, switched in the late 1960s or early 1970s from burning coal to burning oil to generate electricity while whole countries like France undertook huge investments in nuclear

energy whose financial costs (not to mention the environmental ones) have been considerably higher than conventional utility plants using coal or oil.

Searching for supportive evidence is another bias (often called the confirmation bias) which can have serious negative consequences. Wason and Johnson-Laird (1972), cognitive psychologists, made it their lives' goal to learn more about how people search for and use information. They found that as much as ninety percent of all the information we are searching for aims at supporting views, beliefs, or hypotheses that we have long cherished. Thus, if a CEO thinks that a certain strategy will be beneficial s/he will look for supportive evidence to prove that that belief (or, more precisely, hypothesis) is correct. Unfortunately, however, it is practically impossible to prove the hypothesis that the strategy being considered will work since it will take many years, if not decades, to do so and there are many factors, including luck, involved which cannot be isolated.

Moreover, we tend to remember information that confirms our beliefs far better than information that disproves them. In experiments, believers have tended to remember confirming material with one hundred percent accuracy, but negative material only about forty percent of the time. Thus, not only do we search for supportive evidence, but once we find it we tend to remember it more accurately. Consider the implications of these facts. If we believe something, we tend to search for information that proves our point of view. If we come across conflicting evidence, we are inclined to disregard it as irrelevant. Furthermore, our memories retain supportive evidence better than disconfirming evidence. Finally, the higher up a manager is in an organization, the more the information he or she receives is

filtered by several levels of subordinates, assistants, and secretaries. They know, or think they do, what the manager wants to hear and selectively present such supportive information.

It is possible to minimize or avoid confirmation biases, that is, the search for and selective remembering of supportive evidence. This can be done by setting up procedures in an organization that encourage the search for disconfirming evidence. First of all, disconfirming, rather than supportive, evidence must be collected. This is not always a practical thing to do. For example, one cannot stop implementing a certain strategy to find out whether or not one's firm will go bankrupt. However, there are ways of getting round the problem. In meetings, for instance, disconfirming evidence must also be deliberately elicited when new projects, ideas, or strategies are considered, for example, by encouraging someone to play the role of devil's advocate or always including people with opposing views in the same meeting. Or, an executive can pretend that his choice is the opposite of what he/she really wants. If he/she can be convinced he/she is wrong, this would be an effective way of obtaining disconfirming evidence to prove that his or her belief or hypothesis is correct.

Describing all the known judgmental biases is beyond the scope of this chapter, as much of this is covered in other chapters of this book. However, Table 2 describes biases that mainly affect forecasting and strategy, or future-oriented decision-making in general. Also listed in Table 2 are some suggestions for avoiding these biases.

Another class of biases that can threaten the effectiveness of strategy arise from conventional wisdom. We have grown up in a culture where we accept certain statements as true, even though they may not be. For instance, we believe that the more information we have, the

more accurate our decisions will be. Empirical evidence does not support such a belief. Instead, more information merely seems to increase our confidence that we are right without necessarily improving the accuracy of our decisions. This is a conclusion reached by Oskamp (1965) and many other researchers, who warn against devoting energy and resources to gathering a lot of information. In reality, the information found is usually redundant and provides little additional value. Another example of conventional wisdom is that we are capable of discriminating between useful and irrelevant information. Empirical research (Kahneman et al, 1982) indicates that this is rarely the case. In experiments, subjects supplied with "good" and "bad" information are not capable of distinguishing between the two. In addition, the irrelevant information is often used to decrease the effectiveness of decision-making.

Table 3 summarizes relevant biases that arise from conventional wisdom. As with the judgmental biases discussed earlier, the biases linked to conventional wisdom can greatly influence our decisions and negatively affect the success of our strategy. Attempts must therefore be made to avoid such biases. Table 3 also lists suggestions for trying to overcome the negative influences of conventional wisdom.

Can biases be avoided if decisions are made in groups? Unfortunately not - in fact there is evidence (Janis, 1972) suggesting that groups amplify bias by introducing groupthink (a phenomenon that develops when group members become supportive of their leader and each other, thus avoiding conflict and dissent during their meetings). Moreover, group decisions are more risky, as responsibility for the decisions cannot be attributed to any single individual (reference).

The Three Aspects of Strategy

In certain dimensions, today's supercomputers are not even comparable to a small child. Among other things they cannot exhibit even elementary intelligence or reasoning leave alone superior cerebral functions such as imagination or creativity. Moreover, computers are not capable of learning, not to speak of adjusting their behavior to temporary changes or adapting it to permanent ones. Computers are capable of storing billions of pieces of information but they cannot turn this information into useful knowledge or use it for higher level decision-making. They can calculate with literally the speed of light but cannot demonstrate common sense or understand humor. At the same time practically all humans possess the above-mentioned abilities and apply them a great many times each day, effortlessly and unconsciously. There are also some talented humans who exhibit superior abilities to those of the average. Great artists, superb philosophers, distinguished politicians, and first rate CEOs, in addition to the grandmasters mentioned at the beginning of this chapter, display outstanding abilities, often lasting a lifetime, that distinguish them from the rest of the people.

Yet all people, from the greatest artists to the world chess champion, display the judgmental biases and limitations described in the previous section. Computers, on the other hand, are super-rational exhibiting no biases or computational limitations. This human contradiction of phenomenal cerebral abilities coupled with numerous biases and serious limitations is something that must be accepted and dealt with, in particular in the case of judgmental inputs required for strategy. It becomes of paramount importance then to exploit our judgment's unique abilities while minimizing its biases and limitations exposed in the earlier section.

There are two main criticisms that can be levied against academics and business consultants working in the field of strategy. First, they have attempted to formalize and standardize its use through their attempts to develop tool boxes that could be applied across various firms and industries; and second, they have emphasized the intended outcome rather than the judgmental process involved while developing and/or modifying a certain strategy. In this section we describe strategy as a high-level judgmental process that requires a combination of both intuitive and analytical inputs. In the final analysis it is the quality of this process and the worthiness of these inputs that determine its overall value and eventual success. It is essential, therefore, to look at both such processes and inputs in order to discuss their role and value to a sound strategy.

For strategy to be successful it must be *foresighted*, *creatively unique*, and, of course, *sustainable*. Such characteristics require a combination of intuitive and analytical skills: intuitive and creative in coming up with imaginative alternatives and analytical in evaluating predictions and strategies for their practicality and profitability. We strongly believe, therefore, that successful strategies exclude recipes, algorithms, or any kind of "canned" theories that can be applied across many firms and industries. Such strategies cannot, by definition, be imaginative, creative, or unique. Consequently, we suggest that strategy development is a multifaceted judgmental process that can be based neither in pure intuition nor in elaborate analysis. Rather we need to combine the two to develop strategies which are company-, industry-, and time-specific. Grandmasters, as we discussed at the beginning of this chapter, combine in a sophisticated manner such intuitive and analytical judgmental skills.

Grandmasters have developed an exceptional ability of pattern recognition. Furthermore, they are capable of coming up with highly creative, effective moves and, most importantly, of doing so in an intuitive, effortless manner. However, they also possess strong analytical skills that allow them to evaluate a number of pertinent and critical moves for both their uniqueness and greatness - because in games among grandmasters good or simply satisfactory moves lead to defeat. Finally, they develop and pursue a game plan that is based on an overall strategy of simultaneous defense and attack (de Groot, 1966). They develop an overall game plan (see below for more details) as the match progresses which they pursue with great insistence even after having to abandon it temporarily (Znosko-Borovsky, 1980).

Good business strategists must go a step beyond grandmasters because the environment within which they operate constantly changes while this is not the case with chess where the rules of the game are well known and fixed. Moreover, in chess games there is a single opponent who is well known and whose moves are restricted within those allowed by the rules. This is not, however, the case in business situations where there can be many competitors who are not obliged to follow established rules as long as their actions are not illegal. This brings business strategy closer to that of generals (Liddel Hart, 1957; Beaufre, 1985) in war than to chess playing. Finally, strategy and its success depends a great deal upon the goals of the CEO and his or her top executives (Makridakis, 1990). If the goals are set low a certain strategy can be more easily achieved. At the same time the benefits are of lesser significance. This tradeoff between demanding and easier goals is not different from that of athletes who must set the level (local, regional, national, international) at which they want to compete and then strive to develop the appropriate competences required to succeed at such a level.

Below we describe the three aspects of strategy we consider essential for its eventual success. Two of these three aspects are mainly intuitive (foresight and creative uniqueness) and the third (sustainability) is mostly formal or analytic.

Foresight

Strategies must be future oriented, spanning the long term. As such they require numerous predictions about the industry, economy, technology, and competition, as well as social and demographic trends, consumer needs and attitudes, and similar factors that may affect the course of future events and, therefore, strategy. However, these predictions can rarely be found by extrapolating historical information. By now it is clear that the future will, in all probability, be different than the past making it necessary to go beyond known or popular predictions to insightful ones that are based on an understanding of forthcoming changes, a grasp of the timing with which such changes will start affecting the industry, and an awareness of the implications involved for the firm. Most importantly executives must be capable of forming their foresight as well in advance of their competitors as possible and of using such foresight to create a clear vision of where their industry is heading and, subsequently, to develop a strategy for their firm which will be capable of making such a vision a reality. It is by doing so that they can become the industry leader, shaping its progress and directing its advancement.

Correct and useful foresight is not trivial, requiring much more than technical skills in formal, analytical forecasting. Analytical forecasting is based on the extrapolation of established patterns and relationships and as such cannot predict changes from such patterns

/relationships. At the same time, historical patterns and relationships are seldom stable, thus making intuitive judgments crucial for predicting the future.

Intuitive judgments can be negatively influenced by the biases of conservatism, availability, and recency. Conservatism predisposes people towards the status quo. They feel secure and comfortable at the present and are not willing to consider future changes, in particular when such changes are threatening. Moreover, the more threatening the change the greater people's unwillingness to contemplate it. It is like hiding one's head in the sand and believing that the danger is not there. Availability influences people to overweigh information that is easily recalled from memory as such that we read about in business publications or the general press. This information, however, is readily available to practically everyone and as such it is of little value in the development of foresight which ought to consider the future in an imaginative and distinctive manner. We can say that by the time a story or idea has made headlines it is too late to consider it in a foresighted manner. Instead its only use should be to examine its possible implications for defending a firm against others which will have already sought to exploit the potential advantages involved. Finally, recency induces people to utilize more recent information which they tend to remember more easily. This information, however, may not be the most appropriate for strategy which is concerned with the long term. Figure 1 shows the huge danger of recency. By not using Figure 1(d) which contains information about the long-term behavior of real copper prices we can draw the wrong conclusions about the trend in such prices depending upon how recent the information we are using is. The worst case is to use Figure 1(c) which although it covers a time span of more than thirty years is still not appropriate as business and economic data are greatly influenced by cycles whose length some times extends to more than sixty years.

Foresight must be both imaginative and common sensical. In addition to looking at the future with an open mind, the following types of common sensical questions need to be considered and answered:

1. Where will our industry be in ten years time, or will there even be an industry as we know it today? Will there be banks, for instance, or book and music stores, or will we use smart cards for money and the Internet (or some other network) to do our financial transactions and to order, or even download to our computer, books or music from suppliers located in any part of the world?
2. What will our customers want and how will we best be able to satisfy their needs, particularly, when their freedom of choice will be enormous as they can buy products or receive services from around the world? What services, for instance, will a bank will have to offer to attract customers to its branch if people can do all their transactions through the Internet?
3. Where will our firm be in ten years time if we continue on our established course?
4. Where do we want our firm to be in ten years time? Moreover, if we had the chance to start from scratch without any constraints how would we organize and how would we operate our firm? What would be the major differences between the present and the brand new firm started from scratch without any of the constraints we are facing at present when we want to introduce change?
5. Which of the predicted, popular forthcoming changes would we adopt?
    - Provide our customers with as wide a freedom of choice as possible
    - Supply our products and/or offer our services as speedily as possible
    - Offer our customers the lowest cost with the best service

- Customize our products and services for each of our customers

6. In which of the predicted, popular directions would we go?
    - From products to services
    - From satisfying existing needs to identifying and fulfilling new ones
    - From mass markets to niche markets
    - From traditional organization to virtual organization
    - From a single business entity to a network of global alliances
7. Which of the popular management tools/ideas would we follow?
    - Continuous improvements
    - Empowerment and self-directed teams
    - Groupware
    - Reengineering
    - Benchmarking
    - Core competencies
    - Value chain analysis
    - Shareholders value added
8. As there is a very high chance that our competitors will be using the majority of the forthcoming changes mentioned above how would we distinguish ourselves and gain or maintain competitive advantages?
9. What new tools/ideas would we utilize before or better than our competitors so that we can gain and/or maintain some competitive advantages?

Answering, or even carefully thinking about, the above questions can provide organizations with a framework for their discussions about the future and a guide to come up with practical

foresight about major, forthcoming changes and their implications, and help them develop a consensus about the future.

Creative Uniqueness

No strategy can be developed in a vacuum. It must be based on individual organizations with their particular cultures, specific goals, values and needs, special resource and other constraints, and definite conceptions about risk taking. Moreover, the place where a firm operates, its size, its existing and potential competitors, as well as the timing of intended strategy are critical factors. It is inconceivable, for instance, for a medium-sized firm operating in Greece or India to have the same strategy as a Japanese or an American one. Further, successful strategies of even the early 1990s are obsolete today. Strategies must be unique and specific. Most importantly, as the following quotations show, they must emerge gradually and must take into account the latest information about the present and the organizational foresight about the future (Znosko-Borovsky, 1980).

> It is impossible to play a satisfactory game without following a strategic plan, which sooner or later will have to be evolved. To settle on a plan too late means an advantage to the opponent, who will be ahead of us in his threats; to have no plan at all would render our play inconsistent -- without logic and therefore without strength. ... It must not be thought that a plan will occur to us fully worked out in all its details at a given moment, like Pallas Athene arising fully armed from the head of Zeus. Step by step, after the tentative manoeuvres of the opening, it takes shape in our mind, at first in vague outlines, gaining gradually in definition and character.
>
> Where the position is simple and the advantage well defined, there is no difficulty in formulating at once a suitable strategic plan. But it is not possible to do this at will in obscure and complicated positions of no definite character, where both sides have equal chances, or, worse still, where the formations are symmetrical".

Creativity is the single most important prerequisite for coming up with a unique strategy, one that is not only distinct from that of the competition but also one which is consistent with one's goals, risk attitudes, and constraints. The biases of conservatism and selective perceptions can become serious barriers. While these biases have to be avoided, creativity must play an important role in strategy formulation.

Creativity is exciting but also elusive; moreover it is not always in harmony with the more mundane, everyday operational tasks required for running a business firm. Operational effectiveness and efficiency demand consistency, conformity to standards and time pressures, while creativity calls for ample time to think and to go beyond (or even reject) traditional thinking and conventional wisdom. Yet creativity is an ordinary judgmental process as the following quote indicates (Simon, 1985):

> It is not necessary to surround creativity with mystery and obfuscation. No sparks of genius need be postulated to account for human invention, discovery, creation. These acts are acts of the human brain, the same brain that helps us dress in the morning, arrive at our office, and go through our daily chores, however uncreative most of these chores may be.

The big challenge for developing a successful strategy is to come up with a common sensical but also creative and practical strategy that utilizes the organizational foresight developed about the future and also takes into account the uniqueness of the situation of a firm (goals, attitudes towards risk, constraints, competition etc.).

The subject of creativity is huge and beyond the scope of this chapter. The interested reader ought to turn to the vast literature on the subject for further reading. In this chapter we are

mainly interested in stressing the need for novel, creative strategies that can be successfully applied against tough and determined opponents who have their own strategies and who are also determined to win, as the following quotation from another grandmaster (Kotov, 1985) indicates:

> There is probably no other strategic concept which the student of the game has dinned into him as much as the concept of conceiving a plan.... when you meet a strong inventive opponent and he counters every one of your intentions not only by defensive but also by counter-attacking measures, it is far from simple to carry out a simple strategic plan.

Although creativity cannot be taught there are certain necessary prerequisites for becoming more creative, even though such prerequisites cannot, by any means, guarantee high-quality creative output.

The Acquisition of a Knowledge Base and Substantial Experience. Simon (1985) and other researchers (de Groot, 1966) suggest that a prerequisite for substantial creative output is the acquisition of considerable knowledge and experience. Simon cites studies estimating that at least ten years are required to acquire such knowledge or experience and to develop appropriate skills that increase one's chances of producing high-level creative output. For instance, Simon writes, no world-class expert has reached his or her level without at least ten years of intensive effort.

High Motivation and Persistence. Knowledge and expertise are not enough. In addition, creative breakthroughs require considerable motivation in the form of hard work and complete immersion in the task or problem at hand. James Gleick (1987) describes the work

habits of a scientist who discovered a major theory in physics: "He worked for two months without pause. His functional day was twenty-two hours. He would try to go to sleep in a kind of buzz, and awaken two hours later with his thoughts exactly where he had left them" (Gleick, 1987). Similarly Levy describes how a computer terminal was completed "that took six weeks of fourteen- to seventeen-hour days, seven days a week" (Levy, 1984).

The same is true of great artists. Great art is rarely produced in flashes of imagination. A detailed monograph on Van Gogh or Picasso would reveal that a multitude of drawings, studies, and unfinished paintings are done in preparation for the final version of a great work. Moreover, great scientists, artists, or creative thinkers must be self-motivated, because money, competition, or fame alone can never adequately explain their hard work and desire to excel.

Taking Risks. It might be possible to systematize incremental creativity by designing procedures that contribute to small increases in creative output. Marginal improvements in products or production processes, or slight variations in existing services can be achieved through R&D, engineering, or "creative" departments. However, breakthroughs can rarely be systematized or planned for (Nayak and Ketteringham, 1986; Von Hippel, 1987). As our previous examples show, moreover, not all creative ideas succeed. The more far-fetched the idea, the greater its chance of failure will be.

Thinking Differently from the Crowd. It is possible that people who do not like to follow tradition, have no taste for formal education, or take little interest in the work of others can come up with new ideas. Their thinking is virginal and not influenced by conventional

wisdom, so they can follow paths no one else has discovered and hit upon new solutions. Although the chances of failure might be higher among rebels or unconventional thinkers, so is their chance of coming up with new creative ideas.

Adopting an "Open-Minded" Attitude. Important creative ideas or solutions and creative breakthroughs require adopting an open-minded attitude whereby assumptions are questioned, unusual or even improbable solutions are considered, stereotypes are avoided, and reverse thinking is used. An open-minded attitude also encourages learning about how similar problems are dealt with outside the area of one's expertise, and in general being capable of thinking in different ways from the majority of people. That is a key element of novelty; ideas are regarded as new and original because the majority of people have not been able to discover them through conventional thinking.

Creative Accidents. A great deal is made of the occasional creative ideas or discoveries made by accident. However, recognizing accidents and exploiting their significance also requires an open mind and the ability to accept that conventional wisdom does not always hold. Even accidents favor the prepared and the open-minded, who can recognize their implications and use them to come up with original ideas or discover novel solutions.

Finally, Table 4 summarizes some of the factors that facilitate creativity and which become important if we are to escape conventional thinking and manage to look at the world with a different pair of glasses which would allow us to both look further away and, at the same time, more clearly.

Sustainability

Whatever strategies have been formulated must be carefully evaluated, preferably by a person or team other than that responsible for their development. Such an evaluation must systematically advance disconfirming evidence as the most appropriate form of testing the long-term viability of the strategies being advanced. Illusory correlations, underestimation of uncertainty, confounding of forecasts by wishful thinking, and anchoring and availability biases must be avoided.

In this aspect of strategy, certain decision analytic tools such as *decomposition* (Webby and O'Connor, 1996; Goodwin and Wright, 1993; McGregor and Armstrong, 1994; Holloway, 1979) can play a very useful role. Decomposition is best illustrated by a simple example. Suppose that top management is considering whether to undertake a large promotional campaign to increase market share of a product. A key judgment then required is about the likelihood of market share going up, or not going up, given the promotional campaign. The simple tree diagram in Figure 2 shows two branches with these possibilities. The tree in Figure 3 decomposes the two possibilities, making them conditional on various other events - the state of the economy, the movement of the overall market for the product, and the actions of the competition. In any case, attempts to elicit opinions from someone about the two possibilities directly (market share going up and not going up, as in Figure 2) would in most cases lead to conditional statements of the type "it depends on what the competition does, and on what happens to the economy..." and so on. Decomposition merely formalizes this process.

Such decomposition has two main advantages (MacGregor and Armstrong, 1994). First, it reduces a complex task of judging an event into smaller and cognitively more manageable parts. It should be easier to think about whether the market share of the company will increase or not increase conditional on, for example, the economy improving, the overall market increasing, and there being no increase in promotional campaigns by the competition. This also makes the dependence between the various events more explicit. Second, decomposition enables one to receive input from more than one expert, from each according to his or her ability. In the example presented here, one can use an economist to give a judgment about the economy, an industry analyst in the company to generate judgments about the overall market of the product, and someone who follows the moves of the competition to make a judgment about the likely actions of the competition. Such a breakup of the problem would ensure that all available expertise is used and, in each case, for the appropriate judgments.

There remain, however, some further issues regarding how the decomposition should be done. For example, what should be the scale of the decomposition, i.e, how much conditioning should one do? Clearly, there cannot be any universal rule. Too much conditioning might make the tree very bushy, thus increasing the chances that a disproportionate share of the effort will be on events which ultimately have minor influence on the event of interest. On the other hand, inadequate decomposition might not simplify the judgmental problem into intuitively manageable parts and might not enable in a clear manner full use of the information and expertise that is available. In general, decomposition, at a minimum, should be adequate enough to enable full use of in-house expertise and use of information from external sources that is readily available at a low cost. Working with a

select team of diverse experts and brainstorming about a list of major events on which the event of interest might be dependent would surely be helpful.

Another issue that might arise is the sequencing of the events in the conditioning. Consider the example given above. Should the state of the economy precede the state of the overall market, or vice versa? The sequencing would depend on what is easier to think about intuitively. For example, it might be easier to make judgments about the state of the overall market given that the economy does well or does not do well, rather than to think about whether the economy will do well given that the overall market for the product increases or does not increase (of course, this might not be true in all contexts).

Nevertheless, decomposition can serve as a very useful tool for generating judgments and evaluating the sustainability of different strategies, by breaking up a complex task into more manageable parts and by enabling the use of different experts within an organization.

Conclusions

This chapter has looked at strategy as a high-level, multifaceted judgmental process. Human judgment presents us, however, with a big contradiction. On the one hand it exhibits some sophisticated capabilities such as those of the grandmasters; On the other hand it is plagued by numerous biases and serious limitations, as in the case of the investment professionals, which diminishes its value and endangers the development of successful strategies. In this chapter we argue that we must accept this contradiction and use our judgment to come up with intuitive strategies. At the same time we must do our utmost to first eliminate or

minimize the negative consequences of the biases/limitations while at the same time subjecting the strategies being formulated to as vigorous analytical evaluation as possible.

The multifaceted character of strategy was expressed in the three aspects of foresight, creative uniqueness, and sustainability. Each of these aspects of strategy was discussed and their necessity and contributions, as well as dangers, to successful strategies elaborated. It was emphasized that strategy cannot be standardized, expressed in recipes, or be formulated from tool boxes. Sound strategies must be powerful and unique and, at the same time, space- and time-specific taking competition and forthcoming events into account. This is why we strongly believe that a great amount of research is needed to advance and make relevant, useful, and practical the field of strategy. Equally important, we think that it is dysfunctional to assume that all strategies could be successful, in particular when they include direct competitors. Moreover, we must accept that the fruits of successful strategies will come in the long run. It may even be necessary "to lose a few battles to win the war."

Another consideration is that strategy cannot be conceived in its totality at one point in time. Instead it must evolve by making corrections, adjusting or even adapting to the changing environmental conditions as they unfold. Finally, it may indeed be necessary to abandon a long-held strategy and ignore even large sunk costs when it becomes obvious that it cannot succeed. This is why it is indispensable to make sure, as part of the strategic process, to collect feedback, at prespecified times, so that an evaluation of accomplishing the set strategy can be made (reference). Such feedback and evaluation can consequently be used to correct course, learn, or even abandon a given strategy if it becomes necessary.

Research on strategy must extend to both the intuitive and analytical aspects of our judgment as strategy is a high-level judgmental process whose soundness, overall effectiveness, and ultimate success depend upon the worthiness of such judgment. It is imperative to better understand the role and value of human judgment in high-level future-oriented decision-making like that involved while considering and developing business strategies.

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Table 1: Chess World Champions: 1886 to Today

Name	Becoming Champ: Year	Becoming Champ: Age	No. of Years as World Champion
W Steinitz	1886	50	12
E Lasker	1894	26	27
J P Capablanca	1921	33	6
A A Alekhine	1927	35	17
(Died Champion)		Lost the title between 1935 to 1937	
Vacant Title	1946-48	-	-
M Botvinnik	1948	37	13
		Lost the title between 1957-58 and 1960-61	
T Petrosian	1963	33	6
B Spassky	1969	32	3
B Fischer	1972	29	3
He relinquished the title			
A Karpov	1975	23	10
G Kasparov	1985-today	22	12+

Table 2 : List of Judgmental Biases, Their Description, and Ways to Avoid their Negative Impact

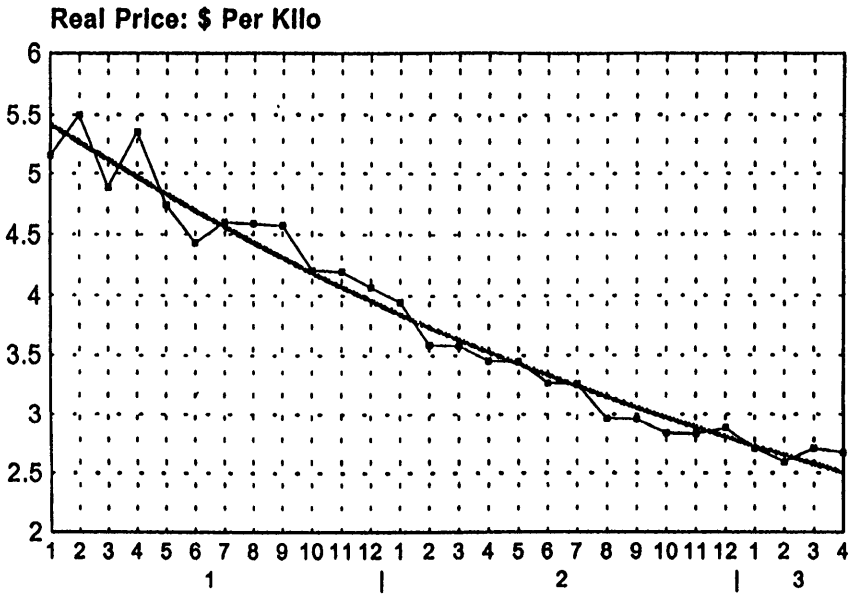
Type of Bias	*Description of Bias*	*Ways of Avoiding or Reducing the Negative Impact of Bias*
Inconsistency	Inability to apply the same decision criteria in similar situations	• Formalize the decision making process • Create decision making rules to be followed
Conservatism	Failure to change (or changing slowly) one's own mind in light of new information/evidence	• Monitor for changes in the environment and build procedures to take actions when such changes are identified
Recency	The most recent events dominate those in the less recent past, which are downgraded or ignored	• Realize that cycles exist and that not all ups or downs are permanent • Consider the fundamental factors that affect the event of interest
Availability	Reliance upon specific events easily recalled from memory, to the exclusion of other pertinent information	• Present complete information • Present information in a way that points out all sides of the situation being considered
Anchoring	Predictions are unduly influenced by initial information which is given more weight in the forecasting process	• Start with objective information (eg forecasts) • Ask people to discuss the types of changes that are possible; also ask the reasons when changes are being proposed
Illusory Correlations	Belief that patterns are evident and/or two variables are causally related when they are not	• Verify statistical significance of patterns • Model relationships, if possible, in terms of changes
Selective Perception	People tend to see problems in terms of their own background and experience	• Ask people with different backgrounds and experience to independently suggest solutions
Regression Effects	Persistent increases might be due to random reasons which, if true, would increase the chance of a decrease. Alternatively, persistent decreases might increase the chances of increases	• Explain that when errors are random the chances of a negative error increases when several positive ones have occurred
Attribution of success and failure	Success is attributed to one's skills while failure to bad luck, or someone else's error. This inhibits learning as it does not allow recognition of one's mistakes	• Do not punish mistakes, instead encourage people to accept their mistakes and make them public so they and others can learn to avoid similar mistakes in the future. (This is how Japanese companies deal with mistakes)
Optimism, wishful thinking	People's preferences for future outcomes affect their forecasts of such outcomes	• Have the forecasts made by a disinterested third party • Have more than one person independently make the forecasts
Searching for supportive evidence	People search for and remember information which is in accord with their beliefs and opinions	• Collect disconfirming evidence • Have someone play devil's advocate
Underestimating uncertainty	Excessive optimism, illusory correlation, and the need to reduce anxiety result in underestimating future uncertainty	• Estimate uncertainty objectively. Consider many possible future events by asking different people to come up with unpredictable situations/events

Table 3: Conventional Wisdom, Empirical Findings, and Ways to Avoid Negative Consequences

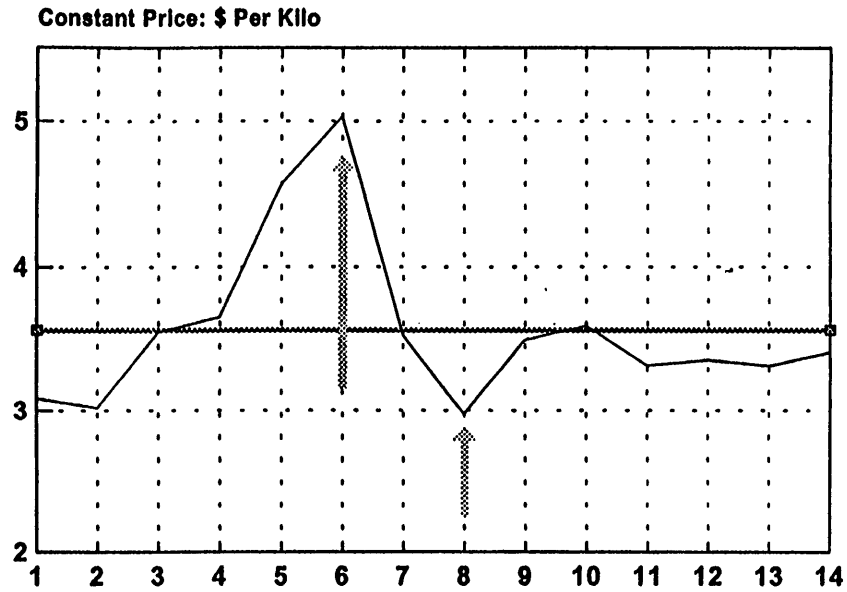
Conventional Wisdom	*Empirical Findings*	*Ways to Avoid Negative Consequences*
– The more information we have, the more accurate the decision	The amount of information does not improve the accuracy of decisions, instead it increases our confidence that our decision will be correct	• We must make sure that our sources of information are *not* redundant (that is come from similar sources)
– We can distinguish between useful and irrelevant information	Irrelevant information can be the cause of reducing the accuracy of our decisions	• All information must be checked for its accuracy and relevance, even when coming from "reputable" sources
– The more confident we are about the correctness of our decision the more accurate our decision will be	There is *no* relationship between how confident one is and how accurate his or her decision is	• Weigh equally the information provided by various people/sources
– We can decide rationally when it is time to quit	We feel we have invested too much to quit, although the investment is a sunk cost	• Accept sunk costs and introduce objective procedures to end a project, even if large investments have been made, when the chances of success become small
– Monetary rewards and punishments contribute to better performance	Human behavior is too complex to be motivated by monetary factors only	• Introduce a variety of rewards that recognize human aspirations and the need for self-esteem
– We can assess our chances of succeeding or failing reasonably well	We are overly optimistic and tend to downgrade or ignore problems and difficulties	• Provide assessment of the chances of succeeding by a third, objective, party. If the assessment is negative accept it even if large sunk costs are involved
– Experience and/or expertise improve the accuracy of decisions	In many repetitive, routine decisions, experience and/or expertise do *not* contribute more value to future-oriented decisions	• We need a minimum level of experience and/or expertise but we do not need the best guru or the highest paid consultant
– We really know what we want, and our preferences are stable	Slight differences in a situation can change our preferences (most people, for instance, prefer a half-full to a half-empty glass of water)	• Always look at preferences from at least two points of view and make sure that they do not change when, for instance, we see a glass as half empty or alternatively as half full

Figure 1

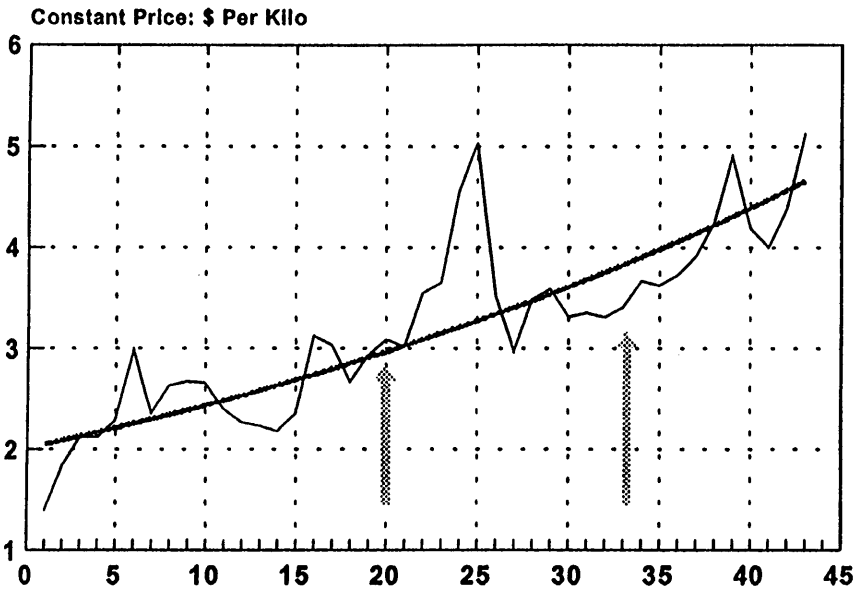
(a) REAL 1997 MONTHLY COPPER PRICES



(b) REAL 1997 YEARLY COPPER PRICES



(c) REAL 1997 YEARLY COPPER PRICES



(d) REAL COPPER PRICES IN CONSTANT 1997 DOLLARS

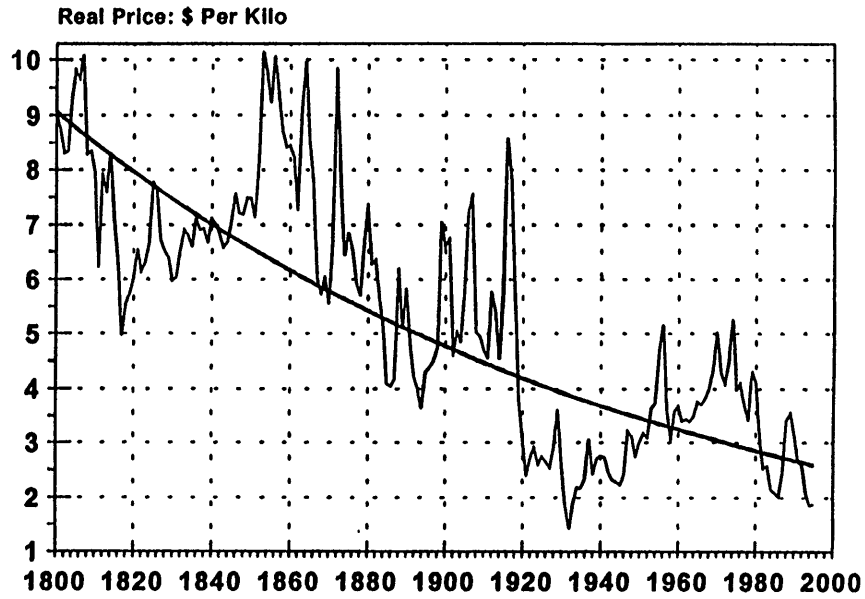


Figure 4: Factors that Facilitate Creativity

1. Thinking in abstractions, conceiving ideas in images
2. Examining all (or as many as possible) combinations of basic ideas and/or existing products/services
3. Avoiding stereotypes
4. Searching outside one's area of business or field of study for fresh ways of looking at old things
5. Questioning assumptions
6. Rejecting conventional wisdom
7. Disliking to:
    a) Be supervised or told what to do
    b) Be criticized or told to hurry up
    c) Be promised rewards for accelerating current progress

Figure 2
Tree Without Decomposition

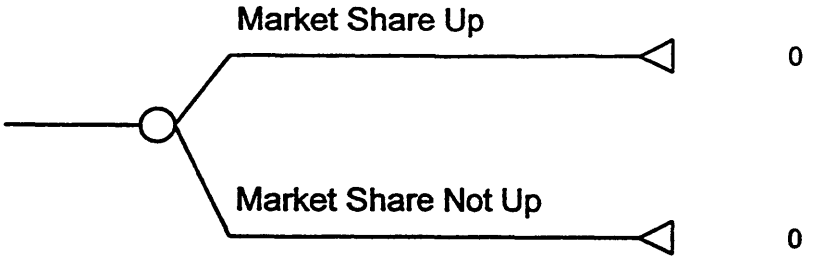
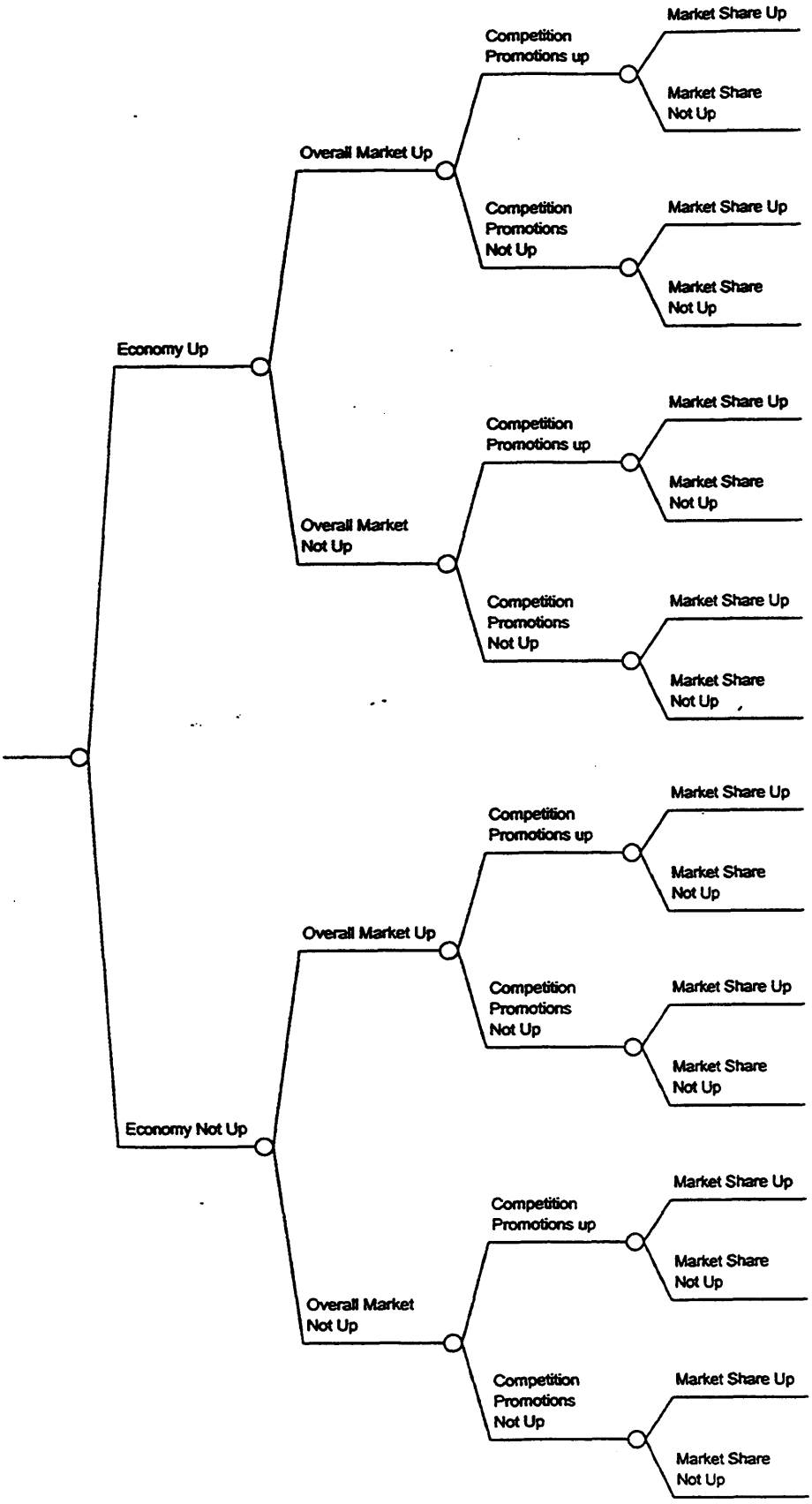



Figure 3
Tree With Decomposition