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Training Novice Investors to Become More Expert: The Role of Information Accessing Strategy

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Considerable research has examined how securities information, once accessed, is cognitively processed to arrive at buy, sell or hold decisions. In contrast, this paper examines whether training novice investors to simply apply the information accessing strategies used by better-performing security analysts, prior to actual cognitive processing of the information, would improve their performance. We obtain performance differences by comparing trained subjects who used the recommended strategies with untrained subjects. Notably, these differences emerged even during a significant market downturn during the simulation. Implications of the findings and directions for future research are discussed.

The number of U.S. households owning stocks has doubled in the last decade (Foust, 1997), particularly due to the bullish U.S. stock market. A sizable number of the investors were new to stock market investing. One of the large discount brokerage houses reports that 50% of its recent new customers had never invested previously, compared to just 5% in 1987 (Himelstein, 1997). The ability of investors to easily access information and cheaply trade stocks on the Internet has further fueled the growth of investing in stocks. In less than eighteen months, the number of households trading online nearly tripled, to 6.3 million (Hansell, 1999).

Many novice investors are making decisions involving large amounts of money and carrying considerable levels of risk. How do they reach their investment decisions? Often, their decisions are based on limited amounts of information, even on only a single indicator such as past performance (i.e., recent stock price changes). These investors have been termed "naive retail trend chasers" (Sirri and Tufano, 1992). Perhaps because they have easy online access to great amounts of information, many of these online investors often feel overconfident and take greater risks (Hansell, 1999). In turn, such trading can lead to depressed earnings performance (Odean, 1999).

Investigating the psychology of stock market decision-making drew considerable impetus from studies of investment professionals by Clarkson [1962], Slovic [1969, 1972], and Slovic, Fleissner, and Bauman [1972]. Until recently, relatively little work focused on novice investors. But given the rapid growth in their numbers and their potential to impact the volatility of the market, their behavior is beginning to attract greater attention from decision theorists (see Thaler, 1993). We examine whether training novice stock market investors to use the information accessing strategies used by better-performing security analysts will improve their performance. Note that one would expect such improvements to be modest at best. After all, competence in this arena results from many factors, not simply learning to access certain types of information in certain amounts using certain sequences. Most important is what goes on after the information is accessed (i.e., how meaning is extracted from this information and how it is evaluated and integrated with other information). But given frequent trading and the amounts at stake, even slight improvements in one factor accounting for a small proportion of variance in performance could translate into substantial gains. Our research does *not* focus on how novice or experienced decision-makers determine what is relevant. Instead, we focus on the pre-evaluation strategies used for information accessing.

The expertise and decision-making literatures reviewed next provide a basis for our expectations regarding the potential impact of information acquisition

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training on decision-making performance among novice investors.

Improving Decision-Maker Performance

Understanding how individuals and groups reach decisions has been an important focus for psychology, management and marketing (see Hammond, McClelland and Mumpower, 1980, Stevenson, Busemeyer and Naylor, 1990 and Bettman, Johnson and Payne, 1991 for reviews). Research has examined the structure and process of decision-making, riskless versus risky choice and normative versus descriptive choice models. Research has also studied the effects of individual difference and situational variables on decision-making. But can such research findings be used to actually improve decision-maker performance? Specifically, can novice decision-makers be trained to become more expert decision-makers?

"Improving performance" implies that one has a criterion for what constitutes superior performance. Unfortunately, as Ericsson and Smith [1991] state:

> [Although] [r]esearch on expertise may be one of the most rapidly expanding areas in cognitive psychology and cognitive science [p. 1] … [t]here are few instances of real-life expertise in which superior performance can be demonstrated under relatively standard conditions [p. 14]. (See also Jacoby, 1977 and Kruglanski, 1989.)

Investment decision-making is a useful example because performance can be measured precisely.

Expertise can be defined as "knowledge about a particular domain, understanding of domain problems, and skill about solving some of these problems" (Hayes-Roth et al., 1983, p. 4). This paper focuses upon one skill (information accessing) that generally serves as a pre-requisite for "solving some of these problems." As Shanteau [1992b, p. 16] comments: "knowledge is a necessary, but not sufficient, condition for expertise." Certain skills are needed as well.

The Role of Information Acquisition in Complex Decision-Making

Complex decision-making consists of several stages. Often, not all the information necessary for solution resides in an individual's memory. Hence, the decision-maker must seek, then access information from the external environment. Although the number of stages and their labels may vary across theorists, most would agree that the decision-maker is first exposed to some or all of the (types of) information available in the external environment, then accesses (or acquires) some (but assuming an information-intensive environment, rarely all) of this information. After acquisition, and relying on previously learned and stored information, the decision-maker engages in interpretation, evaluation and integration of this newly accessed information, with the process eventually culminating in a decision.

Ericsson and Smith [1991] conclude that few findings can be generalized across different domains of expertise, but they point to one major exception:

> There is now overwhelming empirical support for the theory of acquisition of skill with mechanisms akin to those originally proposed by Chase and Simon [1973, p. 32]. Chase and Simon [1973] argued that the main differences among masters, experts, and novices in a wide range of domains were related to their *immediate access* to relevant knowledge (p. 26).

This "relevant knowledge" may already exist in memory (thereby facilitating immediate access), or it may be available in the external environment. When the latter is true, Chase and Simon's argument suggests that the processes that occur *prior to* encoding, interpretation and evaluation also play an important role.

The notion of "prior to" is key to understanding this research. All would agree that how information becomes encoded, interpreted, evaluated and applied play important roles in determining decision quality. And with regard to information stored in memory, Fong, Krantz and Nisbett [1986], Jepson, Krantz and Nisbett [1993] and Nisbett et al. [1983] have shown that performance may be improved by training people to apply inferential rules to this information. But our research differs in that it explores whether performance may be improved simply by training people to apply rules for *accessing* information from the external environment *prior to* its incorporation in working and long-term memories. The question here is: Can the strategy used simply to access information, before it becomes invested with meaning by the decision-maker, exert an impact on decision-maker performance?

The sheer amount of information made available on the Internet may be why so many individual investors feel they can make investment decisions independently, rather than relying on the advice of a stockbroker. Given the myriad sources and kinds of information currently available, and the practical impossibility of accessing and processing all this information, it is important to determine how much information is needed, which information is most useful and what sequence of information acquisition is best.

Clearly, many factors contribute to expertise in complex endeavors. Individual differences (such as intelligence, judgment, personality, years of formal education or work experience) may make a difference, and the relevance and quality of the information that an individual possesses are also likely to affect decision quality. Indeed, knowledgeable decision-makers have been found to exhibit different information acquisition processes than less knowledgeable ones (Brucks, 1985; Jacoby et al.,1986; Perkins and Rao, 1990; Shanteau, 1992a). Not only is it impossible to access and process all the information available in the external environment, but some of it is likely to be irrelevant to the decision at hand (Nisbett, Zukier and Lemley, 1981; Trope and Bassok, 1983).

As we have stated, information acquisition may instill a sense of overconfidence that can reduce decision-maker effectiveness (Cantor and Kihlstrom, 1987). Accessing too much information can overload and hence degrade the individual's decision-making capabilities (Jacoby, 1977). Moreover, if the "wrong" information (that is, irrelevant, not discriminating, not predictive, etc.) is accessed, it may tie up valuable processing capacity. Or, if the right information is accessed, but in a less than optimal sequence, decision-making may likewise suffer (Jacoby et al., 1987).

Elstein, Shulman and Sprafka [1978] showed that medical decision-makers first retrieve a small set of information items from long-term memory to guide their search for additional information inputs in problem-solving. Experts, therefore, seem able to impose a structure on complex, ill-structured tasks and focus their attention on a smaller number of more diagnostic items of information (Jacoby et al, 1984, 1985, 1986, 1987; Spence and Brooks, 1997). Gaeth and Shanteau [1984] demonstrated that providing experienced decision-makers with simple training reduced their reliance on irrelevant information and improved decision accuracy. Providing training on the relative importance of information cues may therefore help novices organize their accessed information and develop efficient knowledge structures, or decision templates, similar to those used by experts (Chi, 1983; Means et al., 1993).

More specifically, in the field of investment, systematic differences (discussed in more detail next) have been found in the information accessing strategies used by better- versus poorer-performing security analysts (Jacoby et al., 1985). Can we improve the performance of novice investors simply by training them to use the information accessing strategies exhibited by these better-performing security analysts? We examine whether the strategies employed for accessing information, which clearly occur prior to its being comprehended and evaluated, affect decision quality and decision-maker performance. Clearly, information accessing strategy alone does not tap into all the relevant aspects of expertise. However, we hypothesize that novice investors trained to use the strategies of top-performing security analysts can outperform novices with no training.

It may seem unreasonable to believe that focusing on information accessing strategy alone could account for a proportion of the variance in decision-maker performance. However, in some decision-making domains, even slight improvements in performance can have great practical consequences. For example, slight improvements in investment performance can translate into huge differences in dollar profits or losses. And in the medical profession, slight differences in a physician's decision-making quality can have life and death consequences.

Below, we review previous research that has identified differences in information accessing strategies used by better- and poorer-performing security analysts. These findings were obtained using a direct behavioral procedure unlike any noted in recent reviews of methods used for capturing expert knowledge and information accessing policies (see Ericsson and Smith, 1991, pp. 18–25 and Olson and Biolsi, 1991). Compared to procedures noted in those reviews, which involve soliciting verbal reports or inferring underlying structures from ratings, the direct behavioral procedure we use here measures information accessing behavior online, as it occurs, without relying on either verbal reports or ratings.

To test our proposition, we conduct two studies comparing the performance of novices who received the information accessing training with the performance of a control group that received no training, and discuss the theoretical and practical significance of this research.

What Differentiates Better Performers?

Differentiating between better and poorer performers requires having a firm criterion of decision-making quality. However, this is not available in many real-world contexts, either because choice is based upon subjective ideals (as is the case with most consumer products) (see Jacoby, 1977), or because there are multiple objective criteria that do not correlate perfectly (e.g., is the firm's objective to increase sales, market share, profits or reputation/image, or to decrease overhead, taxes, and so on, or some combination?). Ericsson and Smith [1991, p. 9] note: "A critical issue in the expertise approach is *how to identify standardized tasks* that will allow the real-life outstanding performance to be reproduced in the laboratory. [The game of] chess provides such a domain."

In the domain of security analysis, maximizing return on investment (ROI) is the paramount objective criterion. The managers of mutual funds, for example, are routinely evaluated on the basis of their ability to consistently obtain high returns on their investment portfolios. Security analysis also satisfies the "stability constraint," which requires "a series of outstanding achievements under different circumstances" (Ericsson and Smith, 1991, p. 2). In the real world of security analysis, much of the data relating to each security (e.g., price per share, trading volume, etc.) tends to change daily, sometimes minute by minute, and decisions regarding a specific security are generally made over many points in time. Security analysis thus provides an opportunity to examine outstanding achievement under changing circumstances. Given such circumstances, coupled with an objective performance criterion, it is possible to compare the information acquisition strategies of better performers with those of poorer performers, thereby uncovering the relationship (if any) between these pre-decision information accessing processes and actual decision-maker performance.

One stream of prior work using real-world security analysts, upon which we base our current research, focuses on identifying the information accessing strategies that differentiated better-performing from poorer-performing analysts (Jacoby et al., 1984, 1985, 1986, 1987). The subjects in these studies were all practicing security analysts, and hence might all be considered "experts" (albeit of different competence and performance levels). In these studies, the real-world security analysts were asked to select, for each of four consecutive ninety-day periods, the one stock out of eight they judged would most appreciate in value over the next ninety days. They were allowed to access up to twenty-six types of fundamental factor information (information related to a firm's financial statements) for each of the eight stocks, whose actual names were unavailable to them.

The subjects were classified as better or poorer performers based on the cumulative net growth or decline in price of the stocks they selected. Systematic differences were found between better and poorer performers in regard to the *type* of information accessed (the content of the search), the *order* in which different items of information were accessed (the sequence of the search) and the *amount* of information accessed (the depth of the search). These findings are summarized below.

Content of Information Search

The proportion of accessing devoted to each factor was significantly different between the two groups for nineteen of the twenty-six fundamental factors (Jacoby et al., 1985). Both better- and poorer-performing analysts devoted nearly 50% of their total search to four types of information, but only one type was common to both groups (price/earnings ratio for the last twelve months). The three other types were: latest earnings trend, price last month and annual earnings per common share adjusted for all stock dividends and splits in the past four years.

Salthouse [1991, p. 293] writes: "it seems that a major limitation constraining the performance of novices is that they are unable to determine which pieces of information are relevant. …" Presumably, as we hypothesized, if novices are trained to pay attention to the types of information used by better-performing analysts, they should perform better. Demonstrating this would provide further support for earlier findings (Jacoby et al., 1985, 1987).

Sequence of Information Search

Better performers also differed dramatically from poorer performers in terms of the pattern of their information search. Better performers engaged in significantly greater amounts of "within-factor" search. Better performers generally selected one factor, such as earnings per share, and checked its value for all stocks of interest before moving on to the factor they next found of interest, such as long-term debt. Poorer performers tended to do more "within-stock" search. They tended to select one stock and check its value on all factors of interest, such as earnings per share, long-term debt, etc., forming an overall, holistic judgment of that particular stock before moving on to do the same for other stocks of interest. Using a procedure that overcomes the "representational adequacy" limitation of symbolic connectionist theories described by Holyoak [1991, p. 315], graphic representations of these dramatically different sequences are provided in Jacoby et al. [1987, Figures 2 and 3].

Amount of Information Search

The better-performing analysts in these studies tended to access more information overall than the poorer-performing analysts. Moreover, the better performers tended to maintain the same relatively high level of information search across all four periods of the task, while the poorer performers typically tapered off their search considerably after the first period. Note that these findings seem somewhat inconsistent with Johnson's [1988] finding that expert security analysts access less information than novice security analysts.

Study 1

Based on the results of these previous studies, Study 1 focused on 1) the content, and 2) the sequence of information search strategies exhibited by the better performers. (There was some concern that encouraging novices to acquire more information might overload their processing capabilities.) Providing they followed our instructions, we expected that novices trained to 1) devote most of their search to the four fundamental factors considered by the better-performing analysts, and 2) engage in "within-factor" as opposed to "within-stock" information accessing would outperform novices receiving no instruction.

Method of Study 1

Subjects. The participants were seventy-two undergraduates, male and female, from an undergraduate marketing class who received partial course credit for participating. All were approximately 19 years old and almost none had prior experience investing in stocks.

Information environment. Bernstein [1975] found that much of the total variation in a particular firm's stock price can be attributed to factors unique to the company. Such company-unique factors are often divided into those involving the company's financial statements (termed "fundamental factors") and those involving non-financial matters, such as changes in its management or whether its labor force is about to negotiate a new contract. Prior research indicates that general market and industrywide factors (e.g., deregulation of an industry) account for perhaps 40% to 50% of the changes in a stock's price, fundamental factors account for approximately 30% to 35% of the variance and other company-unique variables (e.g., changes in leadership) account for 20% to 25% of the variance (Bernstein, 1975; Blume, 1971; Hagaman and Jensen, 1977, p. 64; Tersine and Celec, 1976, p. 32). In this study, subjects were presented with actual fundamental factor information (e.g., earnings per share, long-term debt, etc.), while holding all other factors constant. Note that restricting attention to fundamental factors further limits our expectations of finding substantial effects.

For each test period, the subjects could access 184 separate items of information—twenty-three fundamental factors for each of the eight companies. The twenty-three fundamental factors were chosen after both a review of the literature and consultation with knowledgeable colleagues,[1] and include many of the fundamental factors typically considered by security analysts (see the Appendix). This type of information is also commonly available at Internet-based trading sites.

To eliminate variation in cross-industry factors, all stocks were drawn from the same industry (retailing). To eliminate the possibility that subjects might be familiar with the fundamental factor data, these data were taken from 1969 and 1970. To avoid participants relying on information that might previously have been stored in memory, and perhaps nullifying the effects of training, the letters J, K, L, M, P, Q, R and S were substituted for the actual firm names. (The firms actually involved were Lane Bryant, Gimbels, Hughes and Hatcher, R.H. Macy, J.C. Penney, Sears Roebuck and Co., F.W. Woolworth and Zayres.) The data regarding each of these companies were obtained from the October 1969, January 1970, April 1970 and July 1970 issues of the "Monthly Stock Digest," published by Data Digests. Test quarters 1, 2 and 4 reflected a relatively stable to "bullish" market, and quarter 3 reflected a "bearish" market during which all eight stocks decreased in value. Since some have suggested that most people can perform well in a bullish market, a more stringent test of expertise would be the ability to make profitable investments during a bearish market.

Procedure. Subjects were tested individually using an IBM-compatible PC to better simulate an online trading environment. Both trained and non-trained subjects completed a practice exercise that familiarized them with how the computer program operated. After completing the practice task, subjects were asked to select the stock in each period that they thought would make the greatest amount of money over the next ninety days (i.e., quarter). They were also told that, prior to making their choice, they could access any or all of twenty-three types of fundamental factor information for each of the eight stocks.

The fundamental factors and stocks were presented on screen as a 184-cell matrix consisting of eight columns (the eight stocks) and twenty-three rows (the twenty-three fundamental factors). Using a matrix format favored neither a within-factor nor within-stock accessing strategy. To access a particular item of information, subjects moved the cursor to that cell and hit return, revealing the contents of that cell, and creating a sequential record of their accessing behavior. Subjects could access as much or as little of this information as they wanted and in any order they wanted, but they could access information only for that quarter. After a decision had been reached for one quarter, the computer automatically updated the fundamental factor information for all eight stocks to reflect where these values stood ninety days hence.

Each non-trained subject then began the task of selecting the stock he or she thought would most increase in value over the next ninety days. Trained subjects were given additional instructions on how to use the information accessing strategies used by top-performing security analysts. Specifically, trained subjects read a passage and were also told that the real-world security analysts who made the most money on this particular task had concentrated most of their information accessing on four types of information (latest earnings trend, price/earnings ratio for the last twelve months, price last month and annual earnings per common

Table 1a. *Study 1: Content of Information Search: Number of Acquisitions by Information Type*

	4 Types Preferred by Experts				Remaining 19 Types			
	T*	**NT**	**t_{67}**	**p-value**	**T**	**NT**	**t_{67}**	**p-value**
P1	12.7	8.3	1.97	0.027	30.1	28.6	0.27	ns
P2	7.2	3.5	2.26	0.014	13.0	15.3	–0.84	ns
P3	4.5	3.6	0.75	ns	11.9	12.9	–0.38	ns
P4	4.6	4.3	0.27	ns	11.8	10.6	0.53	ns
Total	29.0	19.6	1.85	0.034	66.2	66.9	–0.07	ns

Note: T = trained; NT = non-trained.
Value n = 39 (excluding two trained subjects who did not follow both of the instructions).

share adjusted for all stock dividends and splits in the past four years).[2] Trained subjects were also shown diagrams of within-stock and within-factor information search patterns (see Jacoby et al., 1987, Figures 2 and 3) and told that the expert analysts tended to use a within-factor strategy (selecting one factor and checking its value on all stocks of interest before moving on to the next factor of interest). The training, therefore, focused on imparting to novices the content and sequence of information accessing behavior typically exhibited by the better-performing security analysts (Jacoby et al., 1985, 1987).

Results of Study 1

Depth of search. Trained subjects were given no instructions on how much information to acquire. Not surprisingly, trained and non-trained subjects, all of whom had little or no personal experience in selecting securities, did not differ in the total amount of information accessed ($M_{trained}$ = 95.3 versus $M_{non\text{-}trained}$ = 86.5, t_{67} = 0.77, ns).

Content of search. Recall that the trained subjects were told at the outset that experts concentrated their attention on four types of information. As shown in Table 1a, trained subjects accessed these four types of information significantly more often than non-trained subjects (the number of times these four items were accessed: $M_{trained}$ = 29.0 versus $M_{non\text{-}trained}$ = 19.6, t_{67} =1.85, $p < 0.05$). However, when examined on a period-by-period basis, significant differences emerged only in the first and second periods of the simulation (P1: $M_{trained}$ = 12.7 versus $M_{non\text{-}trained}$ = 8.3, t_{67} = 1.97, $p < 0.05$; P2: $M_{trained}$ = 7.2 versus $M_{non\text{-}trained}$ = 3.5, t_{67} = 2.26, $p < 0.05$). This difference was no longer evident in the third and fourth periods (P3: $M_{trained}$ = 4.5 versus $M_{non\text{-}trained}$ = 3.6, t_{67} = 0.75, ns; P4: $M_{trained}$ = 4.6 versus $M_{non\text{-}trained}$ = 4.3, t_{67} = 0.27, ns). For Study 1, the impact of training, in terms of information content, lasted for only the first two of the four decision periods.

Sequence of search. Each time a subject accessed an item of information, the computer captured the type of transition made. Four basic types of transition were possible: accessing information for the same stock and same fundamental factor (Type 1); accessing different fundamental factor information for the same stock (Type 2); accessing the same fundamental factor information for a different stock (Type 3); or accessing different fundamental information for a different stock (Type 4).[3] The percentage of Type 1 and Type 4 transitions were similar for both trained and non-trained subjects, as expected. It was hypothesized that the trained subjects would engage in a greater proportion of Type 3 transitions than the non-trained subjects, but the results did not support this. Trained subjects devoted 71% of their search to Type 3 transitions, which is not significantly different from the proportion for non-trained subjects (66%) [t_{67} = 0.96, ns; see Table 1)]. Therefore,

Table 1b. *Study 1: Sequence of Information Search: Proportion of Transitions Devoted to Accessing Types*

Transition Type:	**T**	**NT**	**t_{67}**	**p-value**
Type 1	6	5	0.61	ns
Type 2	13	20	–1.27	ns
Type 3	71	66	0.96	ns
Type 4	10	9	0.73	ns
Total (%)	100	100		

Note: T = trained; NT = non-trained.
Value n = 39 (excluding two trained subjects who did not follow both of the instructions).

Table 1c. *Study 1: Performance: Cumulative Value of Investment as a Percent of Initial Value*

	T	**NT**	**t_{67}**	**p-value**
Period 1	94.45	94.32	0.14	ns
Period 2	94.50	92.91	0.97	ns
Period 3	65.99	63.93	0.46	ns
Period 4	74.00	71.83	0.42	ns

Note: T = trained; NT = non-trained.
Value n = 39 (excluding two trained subjects who did not follow both of the instructions).

the training regarding accessing sequence was not evidenced in any of the four periods in this study.

Overall performance. The performance criterion was based on the increase or decrease in price per share of each stock calculated cumulatively for each of the test periods. Not surprisingly, there were no significant differences between the performance of trained and non-trained subjects either overall or on a period-by-period basis (see Table 1c). While almost all lost money (as did fifteen of seventeen financial security analysts in Jacoby et al. [1985] that used the same information environment), by the end of the exercise, the trained subjects had kept 74.0% of their initial investment intact, compared to 71.8% achieved by the non-trained subjects, a non-statistically significant difference ($t_{67} = 0.42$, ns).

Discussion of Study 1

The findings from Study 1 suggest that differences in accessing strategy either did not take or wore off too soon to have any noticeable impact on investment performance. The failure of trained respondents to outperform the untrained respondents might have been due to the fact that they were "too novice," i.e., they lacked the ability to sufficiently understand and use the relatively technical fundamental factor information made available to them. Because they were participating to fulfill a course requirement, they may also have lacked adequate motivation.

These considerations led to the following hypothesis: Some threshold levels of knowledge, capability and motivation are likely to be a prerequisite for information accessing training to exert an effect on investment behavior and performance. A second study using MBA students and including a performance-based financial incentive was conducted to test this hypothesis.

Study 2

Method of Study 2

Subjects. The subjects in Study 2 were forty-one MBA students. All had spent a minimum of five post-baccalaureate years in the workforce prior to returning to school. To encourage participation and simulate "consequentiality" (see Janis and Mann, 1977) in the task motivation, there were two incentives: $10 for participating plus a chance to win an additional $75 prize based on superior performance.[4] These volunteers were assigned randomly to the trained ($n = 20$) or non-trained ($n = 21$) groups.

Procedure. The procedure in Study 2 was similar to that in Study 1. In this study, however, the fundamental factors and stock information were presented as randomized menu lists, rather than as a structured matrix. This new format was intended to discourage systematic processing strategies, such as a tendency to search by factor rather than by stock, which may have resulted from the matrix information format used in the first study.

Results of Study 2

As before, analyses were conducted to answer two questions: Can novices be trained to access information more like experts? If so, does this affect the quality of their decision-making?

Depth of search. Trained subjects were given no instructions on how much information to access. As before, trained and non-trained subjects did not differ in the total amount of information accessed ($M_{trained} = 154.9$ versus $M_{non\text{-}trained} = 137.8$, $t_{39} = 1.03$, ns).

Content of search. Trained subjects accessed the four types of information favored by experts significantly more than the non-trained subjects both overall ($M_{trained} = 78.2$ versus $M_{non\text{-}trained} = 48.7$, $t_{37} = 3.75$, $p < .001$) and on a period-by-period basis (P1: $M_{trained} = 26.8$ versus $M_{non\text{-}trained} = 19.5$, $t_{37} = 2.62$, $p < .05$; P2: $M_{trained} = 20.3$ versus $M_{non\text{-}trained} = 10.3$, $t_{37} = 4.27$, $p < .001$; P3: $M_{trained} = 16.3$ versus $M_{non\text{-}trained} = 10.0$, $t_{39} = 2.21$, $p < 0.05$; P4: $M_{trained} = 14.8$ versus $M_{non\text{-}trained} = 8.9$, $t_{37} = 2.54$, $p < .05$; see Table 2(a)].

Sequence of search. As described previously, professional security analysts employing a "within-security" or Type 2 transition search pattern typically exhibited poorer performance, while better performers typically exhibited a "within-factor" or Type 3 transition pattern. Informed of this difference, the trained subjects were expected to engage in more Type 3 transitions than the non-trained subjects. This expectation was not supported. Both trained and non-trained subjects engaged in about the same proportions of Type 2 (17.1% versus 14.5%) and Type 3 (67.8% versus 69.2%) searches. This result mirrors the finding from Study 1, and we therefore concluded that the fixed matrix format of information had no impact on the search sequence. In both studies, trained and non-trained subjects engaged predominantly in within-factor searches, the type typically exhibited by better-performing security analysts.

Table 2a. *Study 2: Content of Information Search: Number of Acquisitions by Information Type*

	4 Types Preferred by Experts				Remaining 19 Types			
	T	NT	t_{39}	p value	T	NT	t_{39}	p-value
P1	24.2	19.5	1.50	0.072	31.4	46.5	–1.96	0.029
P2	18.5	10.3	3.26	0.002	20.4	15.5	1.37	0.088
P3	15.0	10.1	1.74	0.045	16.1	13.3	0.97	ns
P4	14.2	8.9	2.33	0.013	15.3	13.8	0.58	ns
Total	71.9	48.7	2.71	0.005	82.9	89.1	–0.48	ns

Note: T = trained; NT = non-trained.
Value n = 39 (excluding two trained subjects who did not follow both of the instructions).

Overall performance. The hypothesis of better performance of the trained subjects was contingent upon their adhering to instructions. Examination of each subject's information accessing behavior revealed that two of the twenty "trained" subjects ignored their training and followed neither the content nor sequence instructions. As they no longer qualified, these two subjects were removed from the data set before comparing the investment performance of the trained versus the non-trained subjects.

The ROI was calculated within and across all four test periods. As shown in Table 2, the trained subjects directionally outperformed the non-trained subjects (ending performance: $M_{trained}$ = 77.9% versus $M_{non\text{-}trained}$ = 68.0%, t_{37} = 1.53, $p < 0.07$, one-tailed; see Table 2c). Interestingly, driving this result is the difference in performance between the two groups during a significant market downturn, that is, during Period 3, when all stocks declined in value (P3: $M_{trained}$ = 70.1% versus $M_{non\text{-}trained}$ = 61.6%, t_{37} =1.47, $p < 0.10$, one-tailed). As we have noted, some researchers consider superior performance during a falling market to be a more stringent test of expertise than superior performance during a rising market.

Table 2b. *Study 2: Sequence of Information Search: Proportion of Transitions Devoted to Accessing Types*

Transition Type	T	NT	t_{37}	p-value
Type 1	1.0	1.2	–0.56	ns
Type 2	18.7	14.5	0.68	ns
Type 3	65.7	69.2	–0.46	ns
Type 4	14.6	15.1	–0.22	ns
Total (%)	100.0	100.0		

Note: T = trained; NT = non-trained.
Value n = 39 (excluding two trained subjects who did not follow both of the instructions).

Table 2c. *Study 2: Performance: Cumulative Value of Investment as a Percent of Initial*

	T	NT	t_{37}	p-value
P1	94.97	94.53	0.38	ns
P2	96.82	95.98	0.34	ns
P3	70.12	61.62	1.47	0.075
P4	77.86	68.03	1.53	0.066

Note: T = trained; NT = non-trained.
Value n = 39 (excluding two trained subjects who did not follow both of the instructions).

We estimate the average age of the participants in Study 2 to be 30. Some of these students had worked in the financial industry, and may have acquired better information accessing skills than others. As we could not control for these pre-existing differences, we relied on random assignment to counterbalance them. However, examination of the subjects randomly assigned to the "non-trained" group revealed that a few engaged in "within-factor" search and concentrated their search on some factors that were the focus of the instructions given to the "trained" subjects. When one non-trained subject who engaged in within-factor search and also focused on the same types of information as the trained subjects was removed from the analysis, trained subjects were found to perform significantly better than non-trained subjects (P3: $M_{trained}$ = 70.1% versus $M_{non\text{-}trained}$ = 60.1%, t_{36} = 1.75, $p < 0.05$; P4: $M_{trained}$ = 77.9% versus $M_{non\text{-}trained}$ = 66.5%, t_{36} = 1.78, $p < 0.05$).

General Discussion

This research suggests that it may be possible to train novice stock market investors to use information accessing strategies exhibited by better-performing financial analysts. The data also suggest that this type of training can lead to improvements in their decision-making performance.

When the performance of the subjects in the "trained" group who followed the training instructions was compared with all the subjects in the "non-trained" group, the findings were directionally significant (at $p <$ 0.07 ca.). When we removed the one "non-trained" respondent who performed as if he had been trained, we found that subjects in the "trained" group who followed the training instructions performed significantly better (at $p < 0.05$) than those in the "non-trained" group.

Despite the small number of subjects (approximately twenty each in both the test and control groups), two other factors suggest the findings are more substantial than they appear. First, consider that the subjects were working with partial (i.e., only fundamental factor) information regarding each of the securities. Remember that fundamental factor information has been found to account for only 30% to 35% of the variation in stock prices. Furthermore, the twenty-three fundamental factors to which our subjects had access represent less than 10% of the nearly 300 types of fundamental factor information available. Demonstrating performance effects under such circumstances, when only a small proportion of the variance has been captured, is meaningful.

Second, decision-making regarding stock market securities is generally acknowledged to be a complex, multifaceted task. One facet of this task—the cognitive processing of information *after* it has been accessed—can be expected to exert a relatively large impact on performance. By comparison, the information accessing strategy employed *prior to* comprehending and interpreting the acquired information can be expected to exert a relatively minor impact. To see that this is true, consider the implications for the value of the cognitive processing component if we showed that information acquisition strategy accounted for 80% or even 50% of the variation in performance.

For these reasons, training in information acquisition strategy can only be expected to exert a modest impact on performance, as we found. Expecting anything more would be unreasonable.

Our findings complement the research of others studying expert decision-making. For example, while it has been shown that people can be trained to apply inferential rules for *processing* information in a way that makes them better decision-makers, our work suggests that simply training people to apply certain rules for *accessing* information may also make them better decision-makers. The present findings also complement the work of Gaeth and Shanteau [1984], who found that training judges to reduce the use of irrelevant information improved decision-making performance.

Our results emphasize another point: There is likely to be an interaction between training, *per se*, and the ability to comprehend and profit from training. For information accessing training to be effective, it needs to be coupled with the motivation and the ability to comprehend the significance of the information accessed. As Study 1 demonstrates, if the individuals being trained do not understand the significance of the information being accessed, such training will not be maintained very long, nor will it lead to improved performance. It is possible, however, that simpler training strategies, such as pointing out to online investors the counterproductive tendencies of trading too often and holding securities for too short a time period (Odean, 1999) may be effective and simpler for novice investors to implement.

The methodology used here provides an unobtrusive means of collecting information on the amount, content and sequence of information access. Compared to other methods of collecting process data, it offers some advantages, such as not having to 1) infer the process used from the outcome, or 2) collect concurrent or retrospective verbal protocol data from subjects who often do not know or cannot verbalize the process underlying their decisions (Nisbett and Wilson, 1977). Our research represents only a start in examining how decision quality in complex decision-making tasks can be improved. Further research using different subjects with varying amounts of prior knowledge and different decision tasks is needed before drawing conclusions about the effectiveness of process training.

Our findings, if confirmed, however, have important managerial implications for interactive stock trading sites such as E-Trade, Ameritrade, Schwab and Datek. By providing novice investors with such easily communicated and easy to implement training, brokerages that have attracted large numbers of novice investors may be able to increase their business.

Future Research

One interesting question is whether content or sequence or some other processing characteristic explains most of the variance in performance. In both our studies, trained and non-trained subjects devoted a higher percentage of information accessing to within-factor search, making it difficult to contrast the effects of within-stock versus within-factor accessing on performance. In our studies, within-factor search seemed to be the default strategy regardless of whether information was presented in matrix form (Study 1) or in menu form (Study 2). Subjects in these studies may have found the sequence training more difficult to comprehend or apply than the more straightforward training regarding content. Future research could deliberately train subjects to perform within-stock searches to better understand how the sequence in which information is accessed affects decision quality. We suspect that within-factor accessing will be best for most complex tasks.

We were able to train subjects to access the content accessed by better-performing financial analysts. Although content is unique across different decision-making tasks, the approach employed in the earlier studies can be used to identify the content considered relevant by better performers in other domains, and then used to train novices in those domains. Of course, such an approach is likely to work best where an accepted criterion of decision-making quality is available (see Kruglanski, 1989).

An earlier finding (Jacoby et al., 1985) suggesting that there may be multiple routes to naturally occurring expertise is also in need of further examination. Not all the better-performing analysts in these earlier studies accessed precisely the same information, or did so in the same sequence. These better-performing analysts concentrated approximately half their search on the same four types of factors, thereby leaving another 50% for individual differences in information acquisition. Thus, when trying to capture the information accessing policies of experts, one needs to identify what is common overlap, recognizing that there will be unique variance as well. In this regard, Salthouse [1991, p. 289] comments:

> The issue of generalizability across experts should be examined because a question of considerable theoretical interest is whether there are multiple routes to naturally occurring expertise or whether all experts in a given domain necessarily achieve their expertise in the same manner. If the former is true, then one might expect experts to be less similar to one another than novices to each other, whereas if the latter is the case, then individual variability might be expected to decrease as the level of competence increases.

The findings from Study 2 suggest that the degree to which novices are able to rely upon their information accessing training may be moderated by the degree of task difficulty for the decision-maker. This is also an interesting notion that warrants further investigation. A future study could be conducted using three different "market conditions": an improving stock market, a declining stock market and a steady stock market, to see whether trained subjects rely more on their training or whether their training aids their performance to a greater degree under periods of more stressful decision-making.

Another area for future research concerns the potential impact of investor overconfidence on learned investment strategies. It is possible that the reason subjects in Study 1 abandoned their learned accessing strategies after the early periods of the simulation is because they felt overconfident in their performance ability. It would be interesting to test this notion in a future study. Most importantly, work is needed to ascertain the degree to which these findings carry over into other expert decision-making domains.

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Notes

1. A professor and two Ph.D. students in the Department of Finance at New York University assisted in developing this factor list. The list was also reviewed post hoc by a professor of finance at Columbia University. All agreed that, except for beta, a measure of risk increasingly relied upon by investors, the list contained what were generally considered to be the most important factors. Beta was excluded only because it came into use after 1970 and so did not appear in the "Monthly Stock Digest," our information source. To accommodate for differences in monitor capabilities between the initial studies with the security analysts and the present study, the three factors least accessed in the first study were removed from the present study.
2. Note that the use of these four types of information does not guarantee such behavior is normatively optimal for all financial investment decisions. Rather, it reflects the actual behavior of superior performing analysts in the same decision context. The primary purpose of this paper is not to suggest exactly which information accessing strategies should be used to enhance performance, but to examine whether this training is effective.
3. For a more detailed description of transition types and analyses, see Jacoby et al. [1976] and Jacoby et al. [1987].
4. Actually, two separate $75 prizes were awarded: one to the best performer in the trained group and the other to the best performer in the non-trained group, so as not to handicap the latter's chances of winning a prize.

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Appendix. *23 Types of Fundamental Factor Information Available for Accessing*

% net price change (last nine months)
Price range last ten years: high/low
Price range current year: high/low
Price last month
Ratio price to last twelve months of earnings
Yield in indicated twelve months of dividend
Number of institutions holding a position
Number of shares held by institutions
Interim earnings last reported $/common share at most recent report
Interim earnings previous year $/common share
Last earnings trend (up–down or no change)
Earnings per common stock twelve months ending next to last reporting quarter
Earnings per common stock at twelve months ending the last reported quarter
Annual earnings $/common share adjusted for dividends and splits in past four years
Last dividend trend (up–down or no change)
Cash dividend per common share at last year or indicated annual rate
Dividend ($) per common share last interim
Cash and equivalents
Total current assets
Total current liabilities
Long-term debt
Number of common shares
% price change last three months