ELSEVIER

A LACK OF INSIGHT: DO VENTURE CAPITALISTS REALLY UNDERSTAND THEIR OWN DECISION PROCESS?

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EXECUTIVE SUMMARY

What decision criteria do venture capitalists (VCs) use to make their investment decisions? This question has received much attention within entrepreneurship literature (i.e., Wells 1974; Poindexter 1976; Tyebjee and Bruno 1984; MacMillan, Seigel, and Subba Narasimha 1985; MacMillan, Zeman, and Subba Narasimha 1987; Robinson 1987; Timmons et al. 1987; Sandberg, Schweiger, and Hofer 1988; Hall and Hofer 1993; Zacharakis and Meyer 1995) for a number of reasons. First, VC-backed ventures achieve a higher survival rate than non-VC-backed businesses (Kunkel and Hofer 1990; Sandberg 1986; Timmons 1994). Second, a better understanding of the decision process may lead to even better survival rates. Finally, entrepreneurs seeking venture funding benefit if they understand what factors are most important to the VC.

Although past research has greatly contributed to our understanding of the decision, it may be biased and somewhat misleading. The majority of past studies rely on post hoc methodologies (e.g., interviews and surveys) to capture the decision process. Post hoc methods assume that VCs can accurately relate their own decision processes, but studies from cognitive psychology suggest that people, in particular experts, are poor at introspecting. Introspection is subject to rationalization and post hoc recall biases.

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Using social judgment theory and the associated lens model as a framework, the current study investigates how well VCs introspect about their own decision process and, by extension, whether the past research efforts are biased.

The current research uses policy capturing, a real-time method common in cognitive psychology, to capture the VC's "actual theories in use" versus their "espoused theories" (Hitt and Tyler 1991). Policy capturing requires that VCs make a series of real-time decisions based on various information factors. Regression analysis of each VCs' decision captures how important each of the information factors is to her/his actual decision process. After the VCs make their decisions, they provided a weighting of how they believe they used the information factors. Comparing the captured decision policies to stated decision policies provides a measure of VC insight.

The findings suggest that VCs are not good at introspecting about their own decision process. Even within the confines of a controlled experiment, which greatly reduces the amount of information considered, VCs lacked strong understanding of how they made decisions. Most decision-makers would like to have all relevant information available for their decision. However, as more information becomes available, insight diminishes. Finally, this study finds that VCs are very consistent in their decision process, even though they do not necessarily understand how they make their decisions.

VCs face a plethora of information when making an investment decision (i.e., business plan, outside consultants, due diligence, etc.). It may be difficult for VCs to truly understand their intuitive decision process because of all the noise caused by this information overload. This lack of systematic understanding impedes learning. VCs cannot make accurate adjustments to their evaluation process if they do not truly understand it. Therefore, VCs may suffer from a systematic bias that impedes the performance of their investment portfolio. The methodology used in this experiment can be modified and used as a training tool for active VCs. In addition, the consistent nature of VC decision-making (even if they do not have a strong understanding of that process) is favorable to the development of decision aides. Decision aides can minimize the danger of salient information (e.g., the lead entrepreneur is a winner) clouding the VC's judgment.

Past research also needs to be interpreted in a new light. Although VCs undoubtedly use some of the information cited in past studies, the relative importance of that information needs to be reevaluated. VCs may not, for instance, rely most on the background of the entrepreneurial team. In addition, it is likely that the past studies provide more information factors than VCs actually use. People have a tendency to overstate the information they believe they relied upon and to use far less information (typically three to seven factors) to make a decision than they actually think they use. The methodology used in this experiment has the potential to identify the more relevant information factors cited in previous work.

Even though VCs are experts in the new venture funding realm, their decision process has room for improvement. Almost 40% of all backed ventures fail to provide a return to the VC. Considering the billions invested each year, a modest improvement in the failure rate can have a substantial impact on venture portfolio returns. That improvement starts by better understanding the decision process. This study is a step in that direction.

INTRODUCTION

New venture survival is tenuous at best, but those backed by venture capitalists (VCs) tend to achieve a higher survival rate than non-VC-backed businesses (Kunkel and Hofer 1990; Sandberg 1986; Timmons 1994). Thus, many researchers have investigated how VCs make their decisions (Wells 1974; Poindexter 1976; Tyebjee and Bruno 1984; MacMillan, Seigel, and Subba Narasimha 1985; MacMillan, Zeman, and Subba Narasimha 1987; Robinson 1987; Timmons et al. 1987; Sandberg, Schweiger, and Hofer 1988; Hall and Hofer 1993; Zacharakis and Meyer 1995). The underlying justification for these studies is that a better understanding of the VC process may lead to better decisions and thereby more successful ventures. However, the majority of these studies use post hoc methodologies, such as interviews and surveys, which may be subject to post hoc

rationalization and recall biases (Barr, Stimpert, and Huff 1992; Sandberg et al. 1988). Such biases likely inhibit how accurately people can introspect about their own thought processes (Fischhoff 1988). Experts who tend to rely on intuition more than non-experts (Simon and Chase 1973) are notoriously poor introspectors (Fischhoff 1988). VCs, experts in new venturing financing, also typically rely on intuition (Khan 1987; MacMillan et al. 1987).

Poor insight can be problematic because VCs—just as executives making important strategic decisions (Stahl and Zimmerer 1984)—need to communicate to other VCs and investors what decision criteria they are using so that the alliance of investors can comfortably commit money. For example, Steier and Greenwood's (1995) case study of a high-tech start-up found that a commitment by one VC led to three others joining the syndicate even though these three had each previously rejected the idea. As such, the funding relationship is a network of co-investors who must communicate effectively with each other and the entrepreneur. A lack of strong self insight hampers the lead VC's ability to effectively communicate.

At the end of Sandberg's (1986) book on new venture performance, he notes "there appears to have been no research that used a decision-making exercise rather than a survey to capture venture capitalists' real criteria and their associated weights" (1986, p. 152). Sandberg (1986) suggests that a policy capturing exercise—similar to one used by Stahl and Zimmerer (1984) to assess merger decisions—might find that VCs are also poor at understanding their own decision process. This study is a first attempt at answering Sandberg's call. The article proceeds as follows: first, the VC decision process is reviewed. Second, the article looks at how biases and heuristics hinder the decision. Next, social judgment theory and the associated lens model are used to provide a theoretical basis for exploring the decision. Then, a series of testable hypotheses is derived from the lens model. The subsequent section explains the policy capturing methodology and the associated experiment. Finally, results of the current study are presented followed by conclusions and implications.

VC DECISION-MAKING

VC firms are "those organizations whose predominant mission is to finance the founding or early growth of new companies that do not yet have access to the public securities market or to institutional lenders" (Gupta and Sapienza 1992, p. 349; Perez 1986; Pratt 1987). As such, Gupta and Sapienza (1992) suggest that VCs add value by:

1. bringing investors and entrepreneurs together in an efficient manner,
2. making better investment decisions than limited partners would make, and
3. providing nonfinancial assistance that in turn enhances survival.

All other things equal, a VC firm's performance is a function of how well it makes the investment decision and how effective its management advice and services are after the investment decision has been made. Therefore, improving the investment decision can improve the VC firm's performance.

VCs assess the probability of success or failure by evaluating information surrounding a venture. To receive funding, new ventures must pass an initial screening (typically a review of the business plan) followed by months of due diligence. A number of researchers have examined what information is critical to the VC's decision (see Ta-

ble 1). The information appears to fit four categories: (1) entrepreneur/team capabilities, (2) product/service attractiveness, (3) market/competitive conditions, and (4) potential returns if the venture is successful (Wells 1974; Poindexter 1976; Tyebjee and Bruno 1984; MacMillan et al. 1985, 1987; Robinson 1987; Timmons et al. 1987; Hall and Hofer 1993). Although insightful, these studies (except for Hall and Hofer's verbal protocol) likely suffer from introspection biases since they use ex post collection methods.

IMPEDIMENTS TO ACCURATE INTROSPECTION

Decision-makers are not perfectly rational, but are boundedly rational (Cyert and March 1963; Newell and Simon 1972; Simon 1955). It is impossible for decision-makers to fully evaluate all information. Moreover, salient factors within the information typically bias decision-makers (Fiske and Taylor 1991). For instance, the availability bias (Tversky and Kahneman 1974) encourages decision-makers to recall salient information from memory. If a venture under consideration has the same lead entrepreneur as a past successful investment, such available information may bias the VC to overlook other factors that suggest the current venture is likely to fail. For example, VCs may overlook underlying weaknesses in the market if they have lots of faith in the entrepreneur. As such, biases may change the relative importance and use of various information factors between venture proposals.

Biases not only inhibit decision-making, but they also likely impede the VC's ability to accurately report on her/his decision process. Instead of recalling the actual information that was used to make typical decisions, decision-makers likely fixate on one or two past successes (Dawes 1988; Dawes, Faust, and Meehl 1989) and recall information particular to those situations (Fiske and Taylor 1991). Likewise, VCs may fixate on the lead entrepreneur because of that individual's past record of success and because of that person's dynamic personality. As such, VCs often report entrepreneur characteristics as more important to the decision than they actually were (Hall and Hofer 1993). There are numerous other biases that cloud insight and by extension also impede optimal decision-making. Hogarth and Makridakis (1981) provide an excellent review for interested readers.

SOCIAL JUDGMENT THEORY

Social judgment theory (SJT) (Brunswik 1956) from cognitive psychology provides a framework for understanding the VC decision process, as well as a basis for removing post hoc biases. The underlying assumption in SJT is that decision-makers do not have access to "real" information, but instead perceive that information through proximal cues (Strong 1992). These cues quantitatively describe the relationship between an individual's judgment and the information used to make that judgment (Stewart 1988). Hence, SJT captures "theories in use" as opposed to "espoused theories" of action (Hitt and Tyler 1991). Within SJT, the lens model formally represents human judgments.

The lens model basically consists of two systems (cognitive and task) linked together by proximal information cues. The cues (see Figure 1) are the information factors that an individual considers when making a decision (represented by variables x_1 through x_4 that appear in the middle of Figure 1). The right side of the model represents the "cognitive" system. Cues are combined in some manner to make a judgment or

TABLE 1 Information Factors Used in VC Decision

Study	Wells (1974)	Poindexter (1976)	Tyebjee and Bruno (1984)	MacMillan et al. (1985)	MacMillan et al. (1987)	Robinson (1987)	Timmons et al. (1987)	Hall and Hofer (1993)
Method	Personal interviews	Questionnaire	Phone survey and questionnaire	Questionnaire	Questionnaire	Questionnaire	Unstructured interviews	Verbal protocol
Sample size	8	97	46 (Study 1) 41 (Study 2)	100	67	53	47	16
Entrepreneur/team characteristics:								
mgmt skill & experience	X	X	X	X	X	X	X	X
venture team				X	X	X		X
mgmt stake in firm		X	X					
personal motivation	X					X		
entr personality				X				
Product/service characteristics:								
product attributes	X		X	X	X			
product differentiation			X				X	
proprietary	X			X	X			
growth potential			X					
mkt acceptance				X			X	
prototype				X				
Market characteristics:								
mkt size	X		X				X	X
mkt growth	X		X	X		X	X	
barriers to entry			X				X	
competitive threat				X	X		X	
venture creates new mkt				X				
Financial characteristics:								
cash-out method	X		X					X
expected ROR		X	X	X			X	
expected risk		X						
percentage of equity		X						
investor provisions		X						
size of investment	X		X					
liquidity				X	X	X		
Other								
references	X					X		
venture development stage		X	X					
VC investment criteria								X

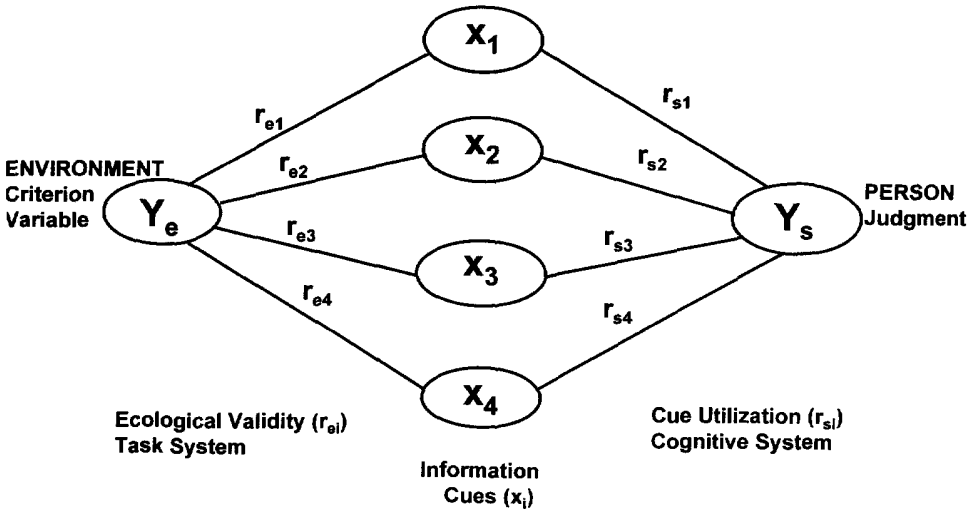

FIGURE 1 Lens model.

decision (Y_s); Y_s captures the expert's judgment policy. In other words, Y_s represents the judge's perception leading to the decision. The correlation of cues to the individual's judgment is represented by r_{si}. The larger the standardized r_{si} (assuming orthogonal cues), the more heavily the decision-maker relies on that cue to make the decision (Stewart 1988).

The "task" system is on the left side of Figure 1. The criterion variable is the actual outcome (Y_e). Each of the cues also correlates (r_{ei}) to the actual outcome. Thus, r_{ei} defines the relationship between the cues and the reality based condition of interest to the decision maker. Just as r_{si} indicates the relative importance of each cue to the decision maker, r_{ei} indicates which cues have the greatest predictive value to the actual outcome. Hammond (1975, p. 73) sums up the lens model as follows:

> Judgment is a cognitive process similar to inductive inference, in which the person draws a conclusion, or an inference, Y_s, about something Y_e, which he cannot see (or otherwise directly perceive). In other words, judgments are made from palpable events and circumstances.

An example may better clarify the use of lens models. The lens model can depict a VC examining a new venture. The VC makes a judgment [(Y_s) invest or not] of the venture's potential [(Y_e) success or failure] based upon a number of information factors [(x_k) e.g., strong team, proprietary protection, etc.]. The VC is not directly observing the venture's ultimate outcome, but instead inferring the venture's potential based upon a number of observable current conditions ($x_1 \ldots x_4$). This brief example illustrates that judges make decisions about potential outcomes that they cannot directly perceive by using a series of information factors (cues) that they can observe. The lens model provides a basis for a series of testable hypotheses.

Information inundates VCs considering new venture proposals. For example, there is information about the entrepreneur (e.g., entrepreneur's industry and start-up experience), the market (e.g., size and growth), and the product/service (e.g., proprietary protection). Not only is there a lot of available information, but much of it is subjective.

For example, VCs often discuss the "chemistry" between themselves and the entrepreneur. The deal often falls through if the chemistry is not right. Such intuitive, or "gut feel" (Khan 1987; MacMillan et al. 1987), decision-making is difficult to quantify or objectively analyze. The added complexity from subjective information further clouds the decision-making process and invites the decision-maker toward more biases. Due to the complexity of the decision and the VCs' intuitive approach, VCs may have a difficult time introspecting about their decision process (Fischhoff 1988). In other words, VCs do not have a comprehensive understanding of how they make the decision.

H1: VCs do not accurately introspect about their decision criteria.

Although decision-makers believe they thoroughly consider all relevant information, most typically rely on only three to seven factors or cues (Stewart 1988). Moreover, people are apt to report using far more information than they actually use (Slovic and Lichtenstein 1971). Thus, as more information becomes available to a particular decision, the VC's ability to introspect about that decision process diminishes.

H2: More information decreases the VC's introspection accuracy about her/his decision process.

Likewise, the type of information available to inform the decision also impacts the VC's ability to accurately introspect. To this point, the hypotheses derive from the cognitive side (right side of Figure 1) of the lens model—factors the VC feels most comfortable using to make the decision. However, information cues on the task side (left side of Figure 1) represent the optimal set of decision cues. These real performance cues best discriminate between eventual outcomes and are statistically derived based on past, actual ventures. Nevertheless, the optimal set of cues may not fit the VC's intuitive understanding of what to consider in the VC decision. The optimal cues may not be in the form or experience with which the VC is familiar or comfortable. Since intuition interferes with introspection, using the optimal cues may increase the VC's understanding of her/his decision process and yield more accurate insight. In other words, the unfamiliarity with the nature of each optimal factor may cause the VC to consciously examine each factor independent of the other factors. As such, VCs who use optimal information cues in a controlled experiment should introspect better than those who use only intuitive cues.

H3: Using optimal information factors increases the VC's introspection accuracy about her/his decision process.

If VCs do not have a clear understanding of their intuitive decision process, an interesting question may be whether they are even consistent in applying that process. In other words, does the inherent complexity, or the many potential biases, or the intuitive nature of most VC decision-making negatively affect the VC's consistency in applying her/his decision process? Although decision-making consistency may vary over time (Brehmer and Brehmer 1988), it is likely that VC decision-making is relatively consistent in the short run. In other words, the VC is likely to judge investments in relatively the same manner from one week to the next. However, if that VC's decisions are compared from one year to the next, consistency might be altered because new criteria are used to judge venture potential. If the decision process is inconsistent in the short run, such inconsistency would impede systematic attempts to understand that process. Moreover, it is important that key decision-makers be able to accurately communicate their

decision criteria so that others involved in the decision process can concur and validate that decision (Stahl and Zimmerer 1984). Just as lack of insight deters successful communication, inconsistent decision processes would also hamper communication. If, however, lack of insight does not result in inconsistent decision-making, then the decision process can be studied and hopefully improved. In their study of 42 executives making merger and acquisition decisions, Stahl and Zimmerer (1984) found that the executives are internally consistent ($R^2 = 0.8$), even though they lack insight into their decision process. Likewise, VCs are likely internally consistent.

H4: VCs are consistent in applying their decision policies.

METHODOLOGY

The hypotheses propose that VCs do not have a strong understanding of their decision process. Therefore, the current design captures each VC's actual decision process and then compares it to the VC's stated decision process (how VCs believe they make decisions). The VCs receive several pieces of information about 50 potential investments. The exercise requests that the participants evaluate the ventures as they would during the initial screening stage of an actual decision and judge whether the venture will likely succeed or fail. Regression analysis of the VC's 50 decisions captures the actual decision policy. In addition, the VCs provide a weighting scheme of how they believe they used the information by splitting 100 points among each presented information factor. The VC's weighting scheme can be formulated into a regression equation of the VC's believed or stated decision policy. Comparing the VC's actual decision policy and stated decision policy gives an indication of his/her self insight. The following paragraphs further detail the methodology.

Decision Experiment

The experiment is administered on a notebook PC brought to the VC's office; such convenience likely increases participation. Unlike the majority of past research that uses ex post interviews, the policy capturing methodology elicits the VC's decision policy real time. The experiment does not rely on the VC's conscious efforts to accurately introspect. As such, this methodology eliminates the threat of recall and rationalization biases (Barr et al. 1992; Sandberg et al. 1988). Additionally, policy capturing experiments enable greater control and are conducive to quantitative statistical tests (i.e., regression and ANOVA).

Sample

The sample for this experiment is 53 practicing VCs from two entrepreneurial "hotbeds," (1) the Colorado Front Range (primarily the Denver/Boulder metro area) and (2) the Silicon Valley in California. Two of the 53 participants were removed (one because the PC crashed during the exercise and the other because he did not wish to con-

TABLE 2 VC Demographics

Variable	Description	Range	Mean	SD
VC Firm Demographics:				
Stage of investment	Percentage:			
	Seed	0–100	21.6	21.214
	Start-up	0–100	35.7	21.926
	Early growth	0–60	22.8	15.324
	Expansion	0–60	18.5	17.809
	Decline	0–40	1.5	6.136
Size of VC firm	Dollars under investmant control (in millions)	1–2000	202.9	316.196
Age of firm	Years since founding	1–32	14.0	7.890
Number of associates	FT equivalents actively involved in venture funding decisions	1–35	5.4	5.033
Industry requirements	Percentage of portfolio in high technology versus low technology	0–100	81.4	24.977
Geographic focus	State (1) Regional (2) National (3) International (4) None (5)	1–4	2.4	.753
Average funding per venture	Dollar amount (in thousands)	50–50,000	3304.6	7031.198
Type of VC firm	Independent/private, bank affiliated, corporation affiliated, non-affiliated SBIC	All independent		
Average number of investors per venture	0, 1–3, 4–5, >5	0–>5	2.5	1.525
Individual VC Demographics:				
Age	Measured in years	29–72	46.5	10.366
Gender		50 males 3 females		
Education level	Years of education with a high school graduate = 12; 4 yr college degree = 16, etc., College, Gradute, etc.	14–22	17.8	.977
Education type (number of VCs with degree in field)	Business	44		
	Engineering	23		
	Liberal Arts	17		
	Science	8		
Tenure with firm	Number of years with current firm	1–25	8.7	6.104
Other VC experience	Years	0–19	2.3	4.239
Other relevant experience	Number of years working (including years as VC)	5–49	22.5	10.341

tinue past the first few decisions). Table 2 further delineates the demographics of the sample.

Procedure

The experiment follows a two-step creation process: (1) identify information cues that are valuable to the investment decision and (2) create decision cases for the VC to judge. The number of cases and cues is interrelated (Stewart 1988). The more cases each participant completes, the higher the validity of that person's judgment policy. Unfortunately, too many cases may tire the judge and limit participation. Stewart (1988) suggests that 35 cases is typically sufficient to accurately capture the subject's decision policy. Another rule of thumb is to have a minimum of five cases for every cue that is being tested (Stewart 1991).

A policy capturing exercise that uses all the identified information factors from previous research (see Table 1—approximately 25 cues in aggregate form) would be untenable. To achieve an appropriate case-to-cue ratio, the VCs would have to evaluate over 100 cases (5 cases/cue * 25 cues = 125). Evaluating 100 cases would increase the required time to complete the exercise and might tire each participant thereby reducing the experiment's validity. Additionally, such an increased time requirement might discourage VCs from participating in the exercise altogether. Furthermore, several of the identified cues are probably highly correlated with each other. High multicollinearity adversely affects policy capturing methodology (Stewart 1988). Finally, most people, including experts, typically use only three to seven information cues (Stewart 1988), so a smaller set of cues is valid. For the above reasons, the number of cues used in the exercise in a subset of all possible cues.

In order to use a manageable set of cues, cue frequency across studies and reported importance within each study are used as a criterion for a particular cue's inclusion in the experiment. Additionally, cues that are highly correlated with other cues are removed (Lewis, Patton, and Green 1988), retaining the cue that is deemed most important in the literature. A consulting expert VC also verified that the retained cue was more important. Although the list is not exhaustive, it is more probable that the identified cues in this study include unimportant factors rather than exclude important factors, because experts typically identify far more cues than they actually use (Stewart 1988).

Decision cases are created once the pertinent cues have been identified. Cooperative VCs outside the study's sample (primarily VCs based in Chicago and the East Coast) provided actual cases. Robert Keeley provided additional cases based upon one of his previous studies (Roure and Keeley 1990). A stipulation for using the cases was that the entrepreneur, venture, and any associated firms or individuals remain unidentified. Such a provision does not impede this study in any way. Identifying the venture or entrepreneur might bias the participants' decisions. For example, the knowledge that an entrepreneur has achieved substantial success in the past might lead the subjects to view that particular case favorably. Products also are not identified, because many of the actual cases included products identified with unique firms. Moreover, identifying the product might also narrow the available sample size. A VC may be hesitant to make a decision about a biotechnology firm if (s)he specializes in computer disk storage. For the same reasons, financial cues are not included in this experiment. Different VCs use different hurdle rates.

Value ranges given to each cue allow it to be compared across cases (Stewart 1988). Concrete values are used (e.g., market size) for cue values when possible, but purely representative distributions are appropriate for subjective cues (Stewart 1988). A uniform coding system allows consistent coding across the business plans used in building the experiment.

The lead researcher pulled information factors from the business plans. Although there is a potential threat that the information included in the plan is inaccurate (which would carry over into the experiment), Roure and Keeley (1990) find that VCs rarely need to make "intense" corrections. Thus, it is reasonable to assume that the business plans are accurate. To insure interjudge reliability, a colleague also coded all appropriate cues. The lead researcher provided the second coder with the entire list and description of the information factors of interest. He then coded two business plans. Overall interjudge reliability equates to 87.5%. Berelson (1952) reports that interjudge

TABLE 3 MANOVA Results between Actual and Generated Cases

Variable	Cochran's C		Bartlett-Box F
Market familiarity	p = 0.173		p = 0.182
Leadership ability	p = 0.813		p = 0.817
Start-up record	p = 0.154		p = 0.152
Team completeness	p = 0.854		p = 0.857
Proprietary protection	p = 0.945		p = 0.946
Product superiority	p = 0.817		p = 0.821
Time to development	p = 0.762		p = 0.774
Market size	p = 0.123		p = 0.142
Market growth	p = 0.813		p = 0.817
Direct competitors	p = 0.369		p = 0.382
Competitor strength	p = 0.274		p = 0.287
Buyer's concentration	p = 0.499		p = 0.509
Multivariate tests of significance	Pillais	0.731	
	Hotellings	0.731	
	Wilks	0.731	
Multivariate tests of homogeneity	Box's M	0.367	
	Wilks	0.353	

reliability typically ranges from 66 to 95%. As such, the coding is deemed fairly accurate.

A technique to further decrease multicollinearity while maintaining strong external validity is to combine actual and statistically derived cases. A random case generator from Policy PC software package (Stewart 1991) creates a manageable number of statistically derived cases. MANOVA verifies that the statistical cases are from the same population as the actual cases (see Table 3). The independent variables have equal variance between real and generated cases and the multivariate means are equivalent. Furthermore, a consulting expert VC identifies those cases that are not feasible (i.e., combination of cue values that rarely occurs in reality). Unfeasible cases are dropped from the sample of potential candidates.

The final design allows the VCs to use four to eight cues (depending upon the treatment) and judge 50 cases. The independent variables are the decision cues available within each treatment. The dependent variable is the VCs' assessment of how likely the venture is to succeed as measured on a 7- point Likert scale anchored by 1 (highly likely to fail) and 7 (highly likely to succeed). The participants are divided into three groups (see Table 4). Group one uses the information cues associated with a base cognitive model as derived from literature (see Table 4). The cues are from studies (primarily Tyebjee and Bruno 1984; MacMillan et al. 1985, 1987; Robinson 1987; Timmons et al. 1987) that rely on post hoc methods. Thus, these studies basically rely on introspection by the VC as to what are the most important decision factors. Group two uses more cues than either the first or third groups to assess whether more information changes the decision process (see Table 4). Specifically, group 2 cues include the five used by group 1 VCs plus three more commonly cited from the literature. Groups 1 and 2 use cues corresponding to the cognitive side of the lens model (see Figure 1). Group 3 uses the information factors that best distinguish between successful and failed new ventures; these cues correspond to the task side of the lens model (see Figure 1). The current study uses task cues derived by Roure and Keeley (1990). The regression equation for each of the three possible treatments is as follows:

TABLE 4 Experiment Treatment Variables

Base Cognitive Cues (Treatment 1)	Additional Cognitive Cues (Treatment 2)	Task Cues (Treatment 3)
1. Market familiarity—average number of years of experience in market/industry for team	Same five cues as base cognitive cues treatment plus:	1. Completeness of team—percentage of key positions which were filled at the time of the first major (over $300,000) outside funding
2. Leadership ability—average number of years of management experience for team	6. Relevant track record–number of past start-up experiences for team	2. Product superiority—how product compares to existing products
3. Proprietary protection—level of protection provided because product/service or process to deliver product/service is unique and difficult to imitate	7. Competitors—number of direct competitors	3. Time to development—number of months from initiation of development to the initial sale as forecast in business plan
4. Market size—market revenues for most current year	8. Competitor strength—five point scale from high strength (large relative market share) to low (numerous small market share competitors)	4. Buyers concentration—measures the number of potential customers in the target market during the first two years of sales
5. Market growth—% over last several years		

Base Cognitive Cues Model

$$Y = a + b_1\,(\text{mktfam}) + b_2\,(\text{lead}) + b_3\,(\text{proprietary}) + b_4\,(\text{mktsize}) + b_5\,(\text{mktgrw})$$

Additional Cognitive Cues Model

$$Y = a + b_1\,(\text{mktfam}) + b_2\,(\text{lead}) + b_3\,(\text{proprietary}) + b_4\,(\text{mktsize}) + b_5\,(\text{mktgrw}) + b_6\,(\text{start-up}) + b_7\,(\text{competitor}) + b_8\,(\text{strength})$$

Task Cues Model

$$Y = a + b_1\,(\text{complete}) + b_2\,(\text{product}) + b_3\,(\text{devtime}) + b_4\,(\text{buyer})$$

RESULTS

The policy capturing experiment provides many interesting insights. In general, VCs have a difficult time introspecting about their decision process. As such, past research needs to be cautiously interpreted. The following paragraphs further explore the results.

All 51 VCs demonstrate statistically significant policy equations at the 0.01 level or better. Adjusted R-squares vary from 0.35 to 0.85 for the VCs' policy equations. Table 5 details how important each information cue is to the VC decision for both her/his actual and stated decision policies. The next section discusses these results further as they relate to each of the hypotheses.

Hypothesis 1, which suggests that VCs do not understand their decision process, receives mixed support (see Table 5—Treatment 1). By visually examining the weights and respective ranks for each cue, it appears that VCs in Treatment 1 have a strong understanding of their decision process. The rank order is generally the same, although two factors (proprietary protection and market growth) are reversed between the actual

TABLE 5 Comparison of Actual Decision Policy with Stated Decision Policy

	Actual Decision Policy			Stated Decision Policy		
Cues	Mean	SD	Rank	Mean	SD	Rank
Cognitive cues (Treatment 1):						
Entr/Team						
Mkt familiar	0.3562	0.1361	1	22.80	6.420	1
Leadership	0.2954	0.1314	3	19.50	6.917	3
Product						
Proprietary	0.3488	0.1460	2	18.95	6.395	4
Market						
Size	0.1556	0.1277	5	17.90	6.711	5
Growth	0.2875	0.1853	4	20.85	7.150	2
Additional cognitive cues (Treatment 2):						
Entr/Team						
Mkt familiar	0.2145	0.1297	5	14.12	5.988	4
Leadership	0.1786	0.1557	7	16.71	6.789	1
Start-ups	0.0897	0.0615	8	8.29	5.181	8
Product						
Proprietary	0.1989	0.1665	6	10.71	5.861	5
Market						
Size	0.2632	0.1504	3	15.29	6.371	3
Growth	0.2221	0.1467	4	15.53	4.976	2
Competitors	0.3133	0.0898	1	9.47	3.676	7
Strength	0.3037	0.1389	2	9.88	4.973	6
Task cues (Treatment 3):						
Entr/Team						
Complete	0.2320	0.1139	2	19.91	15.667	2
Product						
Superior	0.8071	0.0820	1	46.14	18.949	1
Dev time	0.2038	0.1413	3	18.86	10.045	3
Market						
Concentrate	0.1456	0.1264	4	15.07	9.385	4

decision policy and the stated decision policy. However, studying whether the actual decision policy or the stated decision policy explains more variance of the VC's actual decision is a more rigorous test of VC insight (Summers, Taliaferro, and Fletcher, 1970—see Table 6). Within Treatment 1, the actual decision policy explains 13% more of the variance than the stated decision policy. This difference means that the actual decision policy captures the VC's true decision policy better than the VC does. In other words, VC understanding is not perfect. Nonetheless, the strong rank order correlation between the actual and stated decision policies suggests relatively good insight.

Hypothesis 2, which suggests that more information decreases VC understanding, receives support. A comparison of each VC's actual decision policy with her/his stated decision policy (see Table 5—Treatment 2) indicates that understanding may be low. The rank order between the actual and stated decision policies is very different. VCs are relying heavily on number of competitors and competitor strength (actual decision policy), yet they don't believe that to be the case (number of competitors and competitor strength rank as the sixth and seventh most important out of the eight factors presented in the VC's stated decision policy). VCs in Treatment 2 also believe that they are using leadership much more so than they are (ranked as most important in stated decision policy but is actually seventh out of eight in actual decision policy). Perhaps even more

TABLE 6 Median Variance Explained of Actual Decision by Actual Decision Policy (ADP) and Stated Decision Policy (SDP)

Cognitive Cues (Treatment 1)			Additional Cognitive Cues (Treatment 2)			Task Cues (Treatment 3)		
Median r^2 for ADP	Median r^2 for SDP	Change in explained variance	Median r^2 for ADP	Median r^2 for SDP	Change in explained variance	Median r^2 for ADP	Median r^2 for SDP	Change in explained variance
0.5937	0.4630	0.1307	0.5869	0.3359	0.2510	0.7107	0.5190	0.1917

striking is that the VCs within Treatment 2 seem to understand their actual decision policy even less than their peers within Treatment 1. In Treatment 2, the VCs' stated decision policy explains 25% less variance than their actual decision policy [versus only a 13% drop in Treatment 1 (see Table 6)]. More information greatly diminishes VC understanding of their actual decision policy.

Hypothesis 3, which suggests that VCs using an optimal set of information factors can better introspect about their decision policy than those using an intuitive set of cues, receives conditional support. Although the rank order between the actual and stated decision policies is identical, the order of magnitude on the most important factor is quite different (see Table 5—Treatment 3). In the stated decision policy, VCs typically rate product superiority 2.3 to 3 times more importantly than the other factors. However, in their actual decision policy, product superiority is 3.5 to 5.5 times more important than the other factors. Within Treatment 3, the decrease in explained variance is 19%, which is also greater than the decrease in Treatment 1 (see Table 6). However, VC understanding is greater than those VCs in Treatment 2 (19% versus 25%). Thus, VCs are more aware of their thought process using optimal cues conditioned upon the number of intuitive cues they use. Since VCs typically rely on far more than the four to eight cues provided in this experiment—whereas optimal models rarely exceed three to seven cues (Stewart 1988)—VCs using optimal cues should have better understanding.

Hypothesis 4, which suggests that VCs are consistent in applying their decision policies even if they do not consciously understand that policy, receives support. Multiple R from the regression analysis of each individual gauges consistency (see Table 7). It appears that VCs across treatments are very consistent in applying their actual decision policies. The very high Multiple R within Treatment 3 is likely a function of the overwhelming reliance on the product superiority cue. A series of repeated cases also tests consistency (see Table 7). VC assessments within +/- 1 of their initial success assessment on the Likert Scale are considered consistent. As Table 7 illustrates, VCs are consistent on approximately four out of five repeated cases on average. These results suggest that VCs are very consistent in applying their actual decision policies.

TABLE 7 VC Consistency of Applying Actual Decision Policy

	Base Cognitive Cues (Treatment 1)	Additional Cognitive Cues (Treatment 2)	Task Cues (Treatment 3)
Multiple R	0.7876	0.7876	0.8639
Portion of unreliable responses on repeated cases	1.1/5	1.3/5	1.1/5

INTERPRETING RESULTS OF POLICY-CAPTURING EXPERIMENTS

Although policy capturing allows real-time, unbiased capture of VC decisions, it does have some limitations. As with any experiment, reductionism is an issue. The subjects participate in a decision situation that does not perfectly mirror the "real-life" decision. Such "paper tests" affect the external validity of many lens model experiments (Brehmer and Brehmer 1988; Strong 1992). Nevertheless, policy-capturing experiments are a valid method for deriving what information decision-makers actually use (Stewart 1993). Although such "paper" experiments have been criticized, Brown (1972) finds that under even the most contrived cases, the decisions reflect actual decisions. Moreover, since the VC decision has a large "paper" component in the real world (i.e., much of the VC's information comes from business plans), correlation between the experimental task and the "real-world" decision should be even higher.

The experiment also forces VCs to make decisions based upon the presented cues. In reality, VCs would (1) have access to a multitude of possible information cues and (2) use interactive due diligence and other methods to clarify and assess reliability of chosen cues. The experiment, for example, gives participants the relative strength of competition on a 5-point scale. This cue is a distillation of several information points within the business plan. Whereas VCs would normally distill and evaluate these elements for themselves, the experiment does it for the VCs. As such, the assigned value for competitor strength (and other subjective cues) possibly differs from the value VCs would assign. Furthermore, the participating VCs are not privy to these other information factors. Thus, they may be less confident in assessing the impact of competition than might otherwise be the case. In an actual evaluation of a business plan, VCs could use other elements to hedge their assessment of competition thereby increasing their confidence in how to interpret competition. For example, a VC might judge competition to be a critical decision criterion because (s)he sees that (1) there are numerous competitors, (2) some of the competitors are very large, (3) the competitors are known to fiercely retaliate against new entrants, etc. The fact that the experiment presents a combined subjective cue impedes such adjustments and may lead to a systematic over/under weighting of subjective cues.[1] Nonetheless, insight is likely greater in this controlled exercise than it is in the information-laden, noise-filled actual decision environment precisely because of all the noise surrounding each criterion.

The experiment also eliminates the interactive due diligence that typifies the decision. A common theme in the follow-up interviews is that VCs like to reserve final judgment until they have a chance to meet with the lead entrepreneur. In essence, meeting with the entrepreneur adds more data points. As such, the real-life decision has far more informational noise than the experiment. As the results suggest, more information impedes insight. In the experiment, the VCs had at most eight cues. It is easy to imagine how hundreds of cues would further confuse understanding.

The fact that VCs had to use the cues given within the experiment and that there was not an opportunity for interactive due diligence somewhat diminishes the study's external validity (as is often the case in controlled experiments). However, considering these results in conjunction with the results gleaned from verbal protocols (Hall and Hofer 1993; Sandberg et al. 1988; Zacharakis and Meyer 1995) add a deep richness to

[1] Thanks to a reviewer for highlighting this potential experimental bias.

previous survey results. Specifically, verbal protocols provide a sense of (1) how VCs read and assimilate information from a business plan, (2) why they use certain information to make a decision, and (3) how they use that information. Interpreting the results of the current study in light of past verbal protocol studies gives researchers a sense of how VCs pull together information to derive subjective assessments (i.e., competitor strength). Whereas verbal protocols provide a first glimpse at self insight, policy capturing allows a more rigorous and controlled examination of self insight in that the experiment captures the VC's actual and stated policies.

DISCUSSION

This study suggests that VCs do not have a strong grasp on their decision-making process, especially as the decision becomes information laden. Thus, past studies that provide a laundry list of factors may be biased in that they list a multitude of factors that have a relatively small influence on the decision. Slovic and Lichtenstein (1971) assert, for most decisions, that three information cues typically account for 80% of the variance; one cue often explains 40% of the variance. The multitude of available information factors surrounding the actual investment decision likely hinders VC decision-making. Nisbett and Wilson (1977) suggest that poor insight is a function of "ease of access"; people cannot easily access that part of the brain dealing with multiple criteria processing. As such, post hoc studies may not provide as much prescriptive value as they could because they hide the most important factors with others that create noise. Previous ex post studies might mislead not only VCs, but entrepreneurs as well.

Understanding decision criteria are not only important for VCs, but also important for entrepreneurs seeking venture capital. Using criteria identified in previous ex post studies to prepare for the solicitation of venture backing might be a mistake. For example, many of the ex post survey studies (Wells 1974; Poindexter 1976; Tyebjee and Bruno 1984; MacMillan et al. 1985, 1987) would lead entrepreneurs to believe that personal and team characteristics are the most important criteria, but this study coincides with Hall and Hofer (1993) in that the entrepreneur factor does not appear that important. Market characteristics might be better determinants of who gets funding and who does not. Thus, entrepreneurs that spend most of their time and effort presenting the team, while neglecting other factors, may not obtain funding.

Information necessary to the decision is not of equal importance. George Doriot, a pioneer in the VC industry, notes that "a grade-A man with a grade-B idea is better than a grade-B man with a grade-A idea" (as cited in Sandberg 1986). It is evident from this quote that VCs do not view all cues as equally important; they do not receive equal consideration. Notwithstanding the VC's ex post assessment that the entrepreneur is the most important consideration (Wells 1974; Poindexter 1976, Tyebjee and Bruno 1984; MacMillan et al. 1985, 1987), this study derives the actual importance of each presented cue in the VC's decision process. Although the VCs do not have complete freedom in choosing which information cues they wish to use within the experiment, the relative importance of each cue is interesting. Specifically, each VCs' actual decision policy, as represented by a standardized regression equation, indicates how much weight the respective VC places on each information cue.

Table 5 presents the frequency, by experiment treatment, with which each factor is most influential, second most influential, etc., to the VC's decision. Within Treatment 1, proprietary protection is most important, closely followed by entrepreneur/team

characteristics (see Table 5). Market factors (market size and market growth) are the least important. Within Treatment 2, market factors (especially competition cues) are the most important with market familiarity and product factors following (see Table 5). Finally, VCs in Treatment 3 exclusively view product superiority as the most important factor. Buyer concentration (a market factor) is least important. In summary, the type of information available influences the VC's decision process. When certain information is available, it causes VCs to shift their attention (i.e., the addition of competitor information in the additional cues treatment causes the focus to shift to market factors from entrepreneur/team factors). In addition, more information seems to shift the importance from the entrepreneur to the market. Such a finding suggests that the entrepreneur is critical when the VC does not have much information about the market. However, if the VC is confident in the market, the entrepreneur is not too important. Such a finding is congruent with those of other real time experiments (Hall and Hofer 1993; Zacharakis and Meyer 1995). Thus, the current results point to biases in post hoc studies that suggest entrepreneur characteristics are typically most critical to the investment decision. It appears that additional policy capturing experiments might provide further identification of the more important information factors. Considering the lack of VC insight, the policy capturing methodology holds much promise for prescriptive advice to VCs (and by extension, to entrepreneurs).

Implications for VCs are numerous. First, VCs may want to re-examine the importance of the entrepreneur. Since the current study and Hall and Hofer's (1993) study suggest that entrepreneur factors are not as important as believed, relying on meetings with the entrepreneur to judge the entrepreneur's capabilities could be dangerous. Trivial factors (i.e., height, appearance, etc.) might bias the VC. The entrepreneur's perceived personality might generate more weight than is appropriate. "I stopped the deal because I did not think we would work well together" or vice versa. Judging entrepreneurs on how well their personality fits with the VC's personality opens a cauldron of potential mistakes. How well can a person get to know an individual in one or even 10 meetings? For example, people place inordinate importance on personal appearance when conducting job interviews (Borman 1991). Likewise, attractive entrepreneurs may be more likely to receive financing. However, the link between appearance and entrepreneurial qualifications is dubious, at best. First impression biases impact hiring decisions, yet do not correlate very strongly with ultimate success (Borman 1991). Thus, it may be wise to screen the potential entrepreneur on her/his paper record. This is not to say that once a venture passes the screening stage that the VC and entrepreneur should not meet. Post-screening meetings enhance venture success by clarifying expectations and jointly evaluating entrepreneur/team capabilities.[2] The VC and entrepreneur can then take remedial action to improve the probability of a successful launch.

Second, VCs face a plethora of information when making an investment decision (i.e., business plan, outside consultants, due diligence, etc.). The noise caused by this information overload may impede insight into the intuitive decision process. This lack of systematic understanding hinders learning. VCs cannot make accurate adjustments to their evaluation process if they do not truly understand it. Therefore, VCs may suffer from a systematic bias that impedes the performance of their investment portfolio. The methodology used in this experiment can be modified and used as a training tool for active VCs. In addition, since VC decision-making is very consistent (even if they do

[2]Thanks to a reviewer for suggesting the article clarify between pre- and post-screening meetings.

not have a strong understanding of that process), decision aides can be developed to minimize the danger of salient information (e.g., the lead entrepreneur is a winner) clouding the VC's judgment. Unlike the current study, policy capturing can be customized toward an individual VC or a VC firm; policy capturing can include financial and product factors that were removed from this study. Thus, VC firms can use this methodology to aid individual VCs by helping them understand and improve their decisions.

Third, the study implies that formalizing VC intuition may help them improve their decisions because it allows corrective action. One simple method of formalizing intuition is to use a checklist, or scorecard, of how ventures measure on key criteria. Only 24% of the participating VCs queried in follow-up interviews use some sort of factor checklist. Checklists provide a basis for VCs within the firm to evaluate the lead VCs analysis and, by extension, examine whether certain salient factors are creating a bias. Over time as certain funded ventures succeed and others fail, checklists allow VCs to assess the validity of their decision criteria and make corrections. In fact, several of those VCs that use a checklist did so after they made an investment decision. In other words, the VC made the decision on an intuitive basis and then, after funding the firm, the VC went back and completed the checklist. Such a history of investment decisions allows VCs to learn what works and what does not. It is much more difficult to discern the critical factors if the VC never formalizes the decision process, especially considering post hoc recall and rationalization biases.

Finally, this study demonstrates the strong theoretical basis that SJT and the lens model provide to the VC decision. Although many of the early studies focus on decision criteria, few tie it to a theoretical framework. In fact, Tyebjee and Bruno (1984) acknowledge a lack of theory behind their work. SJT provides that basis not only for the current study, but also for previous studies.

If VCs do not have a strong understanding of their decision process, they cannot systematically work to improve it. Forty percent of VC investments (Ruhnka, Feldman, and Dean 1992) fail to provide a satisfactory return, even though VCs are experts. The value of this study and policy capturing is that it may better identify the important factors for both VCs and entrepreneurs. This study will, hopefully, encourage VCs to step back and reevaluate their decision-making. Moreover, the results of such techniques can be used to build decision aides that can further improve VC decision-making (Zacharakis 1995). Any improvement in understanding (which ultimately leads to improved decision-making) can have a huge economic impact for both the VC community and their funded ventures.

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