

**Volume**

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# **THE BEHAVIOR ANALYST TODAY™**

*A Context for Science with a Commitment for Behavior Change*

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The Behavior Analyst Today has become, in our third year, a journal committed to increasing the communication between the sub disciplines within behavior analysis, such as behavioral assessment, work with various populations, basic and applied research. Through achieving this goal, we hope to see less fractionation and greater cohesion within the field. The Behavior Analyst Today strives to be a high quality journal, which also brings up to the minute information on current developments within the field to those who can benefit from those developments. Founded as a newsletter for master level practitioners in Pennsylvania and those represented in the clinical behavior analysis SIG at ABA and those who comprised the BA SIG at the Association for the Advancement of Behavior Therapy, BAT has evolved to being a primary form of communication between researchers and practitioners, as well as a primary form of communication for those outside behavior analysis. Thus the Behavior Analyst Today

will continue to publish original research, reviews of sub disciplines, theoretical and conceptual work, applied research, program descriptions, research in organizations and the community, clinical work, and curriculum developments. In short, we strive to publish all which is behavior analytic. Our vision is to become the voice of the behavioral community.

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#### **A Fond Farewell:**

The editors would like to say thank you to C. A. Thomas who has served this Journal as the layout editor of BAT and action editor of the Consulting Behavior Analyst for two years. C. A. is taking a sabbatical to further his education and expand his horizons. The Behavior Analyst Today 2 (4) was his final issue and so we say farewell, thank you and come back soon.

#### **PUBLISHER'S STATEMENT**

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The Behavior Analyst Today (BAT) is published by Joseph Cautilli. BAT is an online, electronic publication of general circulation to the scientific community. BAT's mission is to provide a concentrated behavior analytic voice among voices which are more cognitive and structural. BAT emphasizes functionalism and behavioral approaches to verbal behavior. Additionally, BAT hopes to highlight the importance of conducting research from a strong theoretical base, something that is sometimes lost in the ebb and flow of blind empiricism. BAT's areas of interest include, but are not limited to: Clinical Behavior Analysis, Behavior Models of Child Development, Community based behavioral analytic interventions, and Behavioral Philosophy. BAT is an independent publication and is in no way affiliated with any other publications whatsoever.

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THE BEHAVIOR ANALYST TODAY:  
ACHIEVING ITS MISSION BUT STILL A LONG WAY TO GO!

Joseph Cautilli & Beth Rosenwasser

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With the issue of BAT 2(4), we have successfully completed our second year. Publishing 3 (1), we begin our third year and indeed much has occurred to the world and our profession in that last year. Those of us who reside in the United States have witnessed a contested election, an ever broadening recession, and of course the vicious, unprovoked attack of September 11th. September 11th has bought what the U.S. president has termed a new normalcy to this country. It is one that many abroad have become accustomed to: the idea of living with ever tightening security and the realization that at any moment, our lives can be determined by total strangers.

On the issue of the recession, during this time it is critical for companies to increase productivity with fewer personnel than before. One way to accomplish this is through the use of performance pay systems. William Abernathy has provided us with a timely article on this subject matter and how to get started in the performance pay world.

Calls for homeland defense have led us to ask over and over again, "what is the role of behavior analysis in this new era?" To this question, behavior analysts have much to offer. Indeed, we are planning a future issue for the Behavior Analyst Today to be devoted to Behavior Analysis and homeland defense. From the socialization of individuals with conduct disorders to ensuring that the 20% of gifted children who underachieve, receive the skills necessary to maximize their potential, behavior analysis has a say about change and about tolerance. On the tolerance issue, Skinner, Cautilli and Hantula offer a functionalist perspective on Ebonics and place the perspective in light of the changing culture of language studies.

Even more locally in Pennsylvania, behavior analysis is still on the verge of adding

its knowledge to redesigning the overly costly mental health system. Still many would oppose suggestions from behavior analysts in spite of the state's acknowledged claim that it wants to shift from a focus on service to a focus on treatment. As surveys of psychotherapists have taught us, the percentage of patients who receive behavioral (and even cognitive) treatments for anxiety disorders has decreased (Goisman, Rogers, Stekettee, Warshaw, Cuneo, & Keller, 1993; Plante, Andersen, & Boccaccini, 1999) in spite of the U.S. Surgeon General's (1999) report. We can think of no other area in medicine where the nation's leading doctor issue a list of interventions that are efficacious for particular problems and have such a general disregard by the health community to implement such suggestions. The explanations for the reasons behind this vary but one of the leading reasons is that practitioners are not trained in these techniques (Committee on Accreditation, 2000). Another is that clinicians are biased against using such practices (Addis & Krasnow, 2000; Sanderson, 1995).

In Pennsylvania Best Practice Documents are listed on the Office of Medical Assistance and Substance Abuse Website, yet none of the documents list anything about functional assessment, contingency management or any of the other techniques that the Surgeon General has endorsed for the treatment of children. Part of this reason is that no one in Pennsylvania's Children and Adolescent Service System Provider Institute (CASSP Institute), the training wing for all mental health service providers, is certified in behavior analysis. They unfortunately see behavior analysis as only useful for developmental disabilities and have missed that the Surgeon General (1999, Chapter 3) has endorsed behavioral treatment techniques for childhood disorders as varied as anxiety (Goisman, Rogers, & Keller, 1999) and oppositional defiant disorder. Maybe readers

should stop by the website and let them know otherwise.

Behavior analysis has a place not only in the United States, but as the University re-opens in Kabul we need to think about what we could provide to the Afghan people. It seems to us that the country will be in sore need of Direct Instruction programs to help all its female students learn to read and write, many of whom have been out of school since the Taliban took control. In addition, a population, which has witnessed so much war in the past twenty-five years, could benefit from programs to help its people adjust from a life of war and killing to a life of peace. The time has come for behavior analysts to put what they know about developing cultural practices into effect. In addition, it is also a time for behavior analysts to begin to weld their methodologies with other disciplines to achieve a greater view of the scope/history of culture.

On the lighter side of overseas travel, in a piece vaguely reminiscent of a travel brochure, Erik Messick takes us on a tour of life in New Zealand and the state of behavior analysis in that country. This piece looks at some of the conditions in New Zealand that contributed to this American traveling there to study and work.

Radical behaviorism has never been satisfied with explanations of cultural practices, which fail to identify external correlates for the performance of an action. In this issue, Cautilli and Hantula take us into an exploration of interlocking patterns of conditional probability as we explore webs or matrices of reinforcement and their impact on peoples' lives. A focus on the greater ecology, which was originally developed by Warren (Rogers-Warren & Warren, 1977; Warren, 1988) in his eco-behavioral analysis served as an inspiration for much of this type of thought.

Behavior Analysis may be coming into vogue as theories of self shift. Before the enlightenment, people turned to "God" or Gods for answers to their problems and concerns (Jaynes, 1977). It was common in ancient times for people to report dialogues with "god," which

Jaynes viewed as conversations with one's fragmented self. With the exaltation of "man" came the search for his essence. This essence became known as the "self".

As life changed from the modern to the postmodern, realism came under attack. Postmodernism was first evident in the artistic community with the struggle to rid itself of the concept of the "artist as genius" capturing some essential characteristic of the world. High art became the point of contention and was eventually replaced by a search of personal meaning. In literature understanding of meaning of texts changed from its essential nature (its ability to capture truth) to a work that must be understood in its historical context (deconstruction / reconstruction). In politics many began to question if reality was the same for all. Multiculturalism (Hayes, 1991) and feminism emerged to question if the dominant society could really experience the world the same way as the non-dominant classes. "Man" was replaced by person in context. The self was seen as fragmented, rather than whole, a view of a dialogue in constant flux with endless daily re-creation.

If this holds to be the case, then the world is in greater need for a science of verbal behavior than ever before. Leigland (2001) has argued that it is time for behavior analysts to develop a science of verbal behavior. Mathew Normand in this issue describes the current research that is underway in that science. He highlights the importance of new methodologies such as protocol analysis in the continued development of data in that area.

We are pleased to bring you the first issue of the year 2002. We look forward to the next year of the Behavior Analyst Today.

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## FOCUSED VS. CONSOLIDATED MEASURES IN PERFORMANCE PAY SYSTEMS

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### Abstract

Two types of incentive pay plans both have long histories and have been widely adopted by business organizations. One type is the one-dimensional plan that includes sales commissions and production piece-rates. The second type is group plans that include profit sharing and gainsharing. Problems and issues are inherent in both approaches and are discussed. A solution to these problems is described that includes the use of the "Performance Matrix" and "Profit-indexed Performance Pay. An important issue in the design of performance pay systems is whether the payout measures should be focused (one-dimensional) or balanced (multi-dimensional) through consolidation. Examples of focused measures are sales commissions and piece-rate plans. Examples of consolidated measures are profit sharing and gain sharing.

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### PROBLEMS WITH INCENTIVE PLANS BASED ON FOCUSED MEASURES

Focused plans pay incentives on one performance measure. Sales commissions typically pay a percentage of revenue or gross profit above a threshold performance level. Similarly, piece rates pay per unit of production and, in some cases, include a threshold performance level. Early in my consulting career, I helped implement a number of sales commission and piece rate plans in banks. The piece rate plans were for tellers and back office clerical employees. The application of piece rates in a bank was, and is, novel. The results were consistently remarkable.

My first application was for 'proof operators' who encode checks and deposits. The baseline 'items per hour' was 950. We eliminated the operator's base wages and instead paid them per item processed. Errors were counted as multiple items and subtracted from the item count to produce a 'net item' count. The net item count increased to over 3100 items per hour, (a 326% gain) where it remained for some fourteen years. As a sidelight, turnover had been over 300% and dropped to zero.

Further, the supervisor volunteered to become an

#### Author's Note

For the past twenty years, Abernathy & Associates has specialized in assisting organizations in the design and administration of performance systems. Presently, we provide outsourced management for 26 organizations across the U.S. You can contact Dr. Abernathy at 901-763-2122 or e-mail [babernathy@abernathyassociates.com](mailto:babernathy@abernathyassociates.com).

operator again, and the operators then managed the department.

I repeated this success in several other banks, and with other clerical job positions. However, over time it became apparent that piece rate was a flawed plan. First, as the jobs I applied the plan to became more complex, it became evident that paying incentives on one measure often significantly reduced performance in other critical job results such as timeliness, accuracy or projects. Further, employees on a piece rate plan became quite uncooperative. Employees would come in early and take items from the in-basket to ensure they had plenty to do. Some employees hid items in their desks. As you would expect, employees were reluctant to train new employees, attend meetings, or help out in other areas. The Lincoln Electric Company is one of the best-known piece rate plans. When you enter the plant, there is a large sign posted that states, "no one can begin work before 8:00 A.M."

The problem of ignoring non-incented job responsibilities extends to sales commissions as well. I have been in hundreds of organizations over the past 25 years and consistently hear the same complaints about sales commission plans. Commissioned sales people become just as independent as do employees on a piece rate plan. They also steal sales leads from other sales people and invade each other's sales territories. Further, revenue-

based plans may encourage sales people to discount products and services, which has an adverse effect on the profit margin of the organization. They may sell to customers who can't pay, they make promises the operations group can't deliver, and they may be excessive in their travel and entertainment expenditures.

A larger issue, though, is that employees in these types of plans tend to focus on the specific performance pay measure and ignore their organization's overall mission. This is a two-pronged problem. It is quite possible for focused plans to award significant payouts to employees when the total organization is not profitable. I analyzed two large bank's commission sales plans in their branches and, in one case, found no relationship between the level of commissions and profitability. In the other case, I actually found a negative correlation between the amount of sales commissions and branch profitability. The result of this misalignment is an increase in payroll expense that quickly becomes unaffordable for the organization.

When employees ignore the 'bigger picture', they may have an adverse effect on critical strategic or customer satisfaction objectives. I was asked to assist a large manufacturer to improve a piece-rate plan they had implemented some four years earlier. Employee productivity had increased significantly. However, the piece-rate plan was proving to be an obstacle to the plant management's desire to move toward 'just-in-time' inventory management. Despite numerous meetings and pronouncements, the piece-rate employees refused to reduce production during low sales cycles. The result was consistent high inventories that were expensive to maintain.

#### PROBLEMS WITH INCENTIVE PLANS BASED ON CONSOLIDATED MEASURES

One solution to the problems associated with focused plans is to pay incentives based on global financial measures. The two most common examples are profit sharing and gain

sharing. Profit sharing shares profits with employees after a threshold has been attained. Gainsharing shares expense savings based on an improvement in the ratio of expenses to volume compared to the previous year. The Brookings Institute examined the financial success of organizations that had implemented stock options, profit sharing, and gain sharing. (Binder, 1990). They concluded that implementing profit sharing, or employee stock options, had no significant impact on an organization's profitability. However, in some cases, gain sharing did have a positive effect on the organization's profitability.

There are several alternative explanations for these findings. Profit sharing is often distributed only once a year. Stock options have a direct financial effect on employees only when they are sold. However, many gain sharing plans also pay out on a delayed annual basis. One highly likely explanation for the poor results of these plans is that the profit, stock value, or gainshare measure is too removed from the direct control of employees to have a significant prompting or reinforcement effect on employees. As an extreme example, you could pay employees on gains in the nation's gross national product, but I doubt that this plan would have much impact on an employee's day-to-day behavior.

A problem with comprehensive measures, and especially profit sharing, is that the measure is made up of dozens of revenue and expense categories – some of which employees have no control over (rent, interest expense, depreciation, etc.). The number of variables contributing to profit makes the measure difficult to understand. Further, few organizations share this information with employees, making it next to impossible for them to determine how to improve profits. A second problem is that the payout requires performance improvements in a large and often disconnected group of people. The employee's personal control over the outcome is therefore severely diminished. To receive an incentive payment, the employee can only hope that all other employees are contributing.



## The Solutions

If we base performance pay on focused measures, employees become uncooperative, ignore non-incented performances, are unaligned with the organization's goals, and may receive significant payments when the company is not performing well. If we base performance pay on consolidated measures, we will likely fail to have any significant impact on employee performance. We will increase payroll expense with no concurrent improvement in profitability.

## The Performance Matrix

I wrestled with these issues for ten years before arriving at two solutions. The first innovation was the 'Performance Matrix' developed at the Oregon Productivity Center (Felix & Riggs, 1986). We had decided early on that one-dimensional performance measurement was problematic. When we began to use multiple measures, however, the issue became how to define their relative incentive payout values. For example, we could measure an employee's productivity and accuracy. But how would these be combined to arrive at an incentive payment? We tried assigning a specific dollar value to performance on each measure. This approach failed to 'balance' performance since the employee could simply focus on a preferred measure and receive a partial incentive payment.

We then converted performances to 'points', similar to the approach used in Skinner's *Walden Two* (1948). The points approach proved unworkable, as it was quite difficult to assess the relative point values of different performances. The performance matrix proved to be an excellent solution. The matrix converts each performance to a standard performance scale and then multiplies the standard scale value by a priority weighting. These weighed scale values are then summed to compute a 'performance index'. The original standard scales used by Felix and Riggs (1986) were discrete interval scales. This provided a 'look-up' capability relieving the employee from having to compute an answer. We have also used a continuous scale with the formula:  $\text{percent gain} = (\text{actual} - \text{base}) / (\text{goal} - \text{base})$ .

Typically, our scale end-points are -30% to 100%. The negative intervals subtract from the total index when performance falls below baseline levels. This ensures a mathematical balance among the measures.

Kaplan and Norton popularized the concept of the balanced scorecard in 1996. To link the scorecard to the organization's strategy they proposed a scorecard design method termed 'the method of cascading objectives'. An organizational strategic scorecard is first designed. Measures that drive the strategic scorecard measure are then developed for senior management, middle management, line management, and then workers. This design method ensures that each scorecard measure is aligned with the strategy. Unfortunately, Kaplan and Norton's balanced scorecard is not really mathematically balanced. The measures are not converted to a standard scale, priority weighted nor summed to compute a summary performance index.

We have applied the Performance Matrix to thousands of job positions and find it flexible enough to employ throughout any organization. If the matrices are designed using the cascading method, they generally will align with the organization's overall strategy. However, the matrix alone does not completely solve the problems of strategic alignment, employee cooperation, or incentive pay affordability. The typical matrix we assist in designing will have from two to seven performance measures. It is simply impractical to measure every aspect of an employee's contribution to strategy and profitability. In particular, the matrix fails to address one-time, novel behaviors or efforts an employee makes outside their assigned job position. Similar to commissions and piece rates, the employee may focus on the matrix to the detriment of other performances.

Second, the matrix will focus employees on specific performances and could undermine cooperation. Team matrix measures can alleviate this problem to some degree, but as you include larger numbers of employees in the measured results, the measure begins to lose

focus and performance improvement is reduced. Third, the matrix scores are not directly linked to actual profitability and therefore incentive payouts can occur even when they are unaffordable.

### **Profit-indexed Performance Pay**

In 1984, Martin L. Weitzman published *The Share Economy: Conquering Stagflation*. He proposed that organizations abandon the traditional wage and salary compensation system in favor of “profit-indexed pay”. Employees would receive no guaranteed pay, but rather share in the organization’s profits each pay period. As an economist, his primary concerns were full employment and the prevention of employee layoffs. He did not address either employee performance or pay equity among the employees within an organization.

I began implementing what I term ‘Profit-indexed Performance Pay’ in 1988. First, we use the cascading method to design performance matrices throughout the organization. Second, the performance pay opportunity is indexed to the organization’s profit. For example, the organization may produce enough profit to award an employee \$100 for the month. The employee’s performance index on the assigned matrix is 80%. The payment would be  $\$100 \times 80\% = \$80$ .

The employee can improve the level of performance pay earnings by increasing the performance index score, but also through any action that improves the profitability of the organization. In this way, novel initiatives, one-time contributions, and cooperation are recognized. I have described the proof operator piece rate system we implemented early in our work. After we began indexing performance pay to profitability, I was asked to design an incentive plan for proof operators in a bank in Hawaii. Rather than simply pay the operators a fixed amount per item, I indexed the incentive pay opportunity to a gainshare measure (there was no revenue stream in this operations area so a profit measure was unavailable). The gainshare measure was the ratio of payroll and

‘float’ expense to the item volume processed. In the employee orientation I explained that the value of improved processing rates would be determined by how much reduction in these two expenses occurred relative to the volume processed. To my surprise, the group’s first question was “What is float?”

“Float” is the interest expense incurred by the bank due to delays in crediting either deposits or checking withdrawals from other banks. Float expense for a large bank can be quite significant – a much greater expense than the operators’ pay. In a real sense, controlling float expense is the rationale for the operator’s job. Yet, these operators had no understanding of the concept (I later found out this was true in most banks). Once I explained the concept to the operators, and that it would affect their performance pay opportunity, they began to talk among themselves. They then asked, wouldn’t it make sense for our couriers to pick up the large dollar items early in the day to enable us to process them before day’s end? I said yes, and they spent the next hour devising a new courier pick-up schedule. The schedule was implemented and the reduction in float maximized the operator’s incentive opportunity every day. I am constantly amazed at how little faith management has in their employees’ ability to improve the financial performance of the organization.

Another advantage to profit indexing is that if there have been design errors or negotiated changes to the performance matrices, and they therefore don’t drive profitability, employees may well receive 100% of nothing since payments are indexed to profitability. This feature automatically regulates the alignment and validity of the measurement system. Finally, performance pay is always affordable, since payouts occur only when the specified profit levels have been attained.

The compromise is that as more measures are added, and opportunity is linked to profit, the employee’s control of the incentive payout is reduced. Even so, my analysis of performance matrices across twelve client organizations found an average 31% gain in

matrix measure performances (Abernathy, 2001). Employee control within this system can be enhanced by limiting the number of matrix measures and by funding the plan from 'controllable net income' rather than actual profit. I define controllable net income as revenues minus expenses that employees influence. Uncontrollable revenues and expenses are accounted for in the computation of the profit sharing threshold.

### Stakeholder Pay

Profit-indexed Performance Pay has proven to be a reliable alternative to commissions and piece rates, though it does not produce as high a level of performance improvement. This may, in part, be due to the fact that commissions and piece rates often have features other than the single measure payout scheme. In many cases, the base wage or salary is reduced or eliminated. When an employee is paid a market wage or salary, there is no necessity to attend to whatever performance pay system is implemented. This strategy also allows the organization to offer a much greater performance pay potential than the conventional modest incentive pay opportunity on top of a market-comparable base wage or salary. We have a few clients who have replaced annual base pay increases with increases in Profit-indexed Performance Pay earnings opportunity.

In these instances, the employee more closely shares the organization's rewards and risks. The results have been encouraging. One organization allows employees to volunteer each year for a base pay increase or a larger incentive pay opportunity increase. For the past three years, all employees have volunteered for the opportunity increase. Another company opened

a new plant and offered employees 90% of market wages in exchange for a profit-indexed performance pay opportunity of 60% above market. The financial plan was for the plant to break even in one year. In fact, the plant turned a profit in its third month of operation.

Two additional and significant benefits of Profit-indexed Performance Pay relate to the organization's societal responsibilities. As Weitzman (1984) pointed out, indexing pay to profits promotes full employment and reduces the need for layoffs when profits decline (Lincoln Electric offers lifetime employment). Further, profit-indexed pay enables unschooled workers to make a very good living despite their lack of marketability. Profit-indexed Performance Pay is a system that would serve well as an alternative to ineffective incentive pay schemes and ultimately as a replacement for the outdated wage and salary system.

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## A VERBAL ANALYSIS OF NONSTANDARD ENGLISH

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## Abstract

Linguistics has traditionally been a field dedicated to the study of the systematization of signs. This was the niche originally carved out by the French linguist de Saussure. Recent trends have questioned this narrow focus of the field. Arguments about the need to study language and thinking in context have existed since the days of Vico's extension of Descartes and were later highlighted in the Skinner and Chomsky debate. The argument for context-based analysis has resurfaced in current linguistic arguments, most notably in the subfield of sociolinguistics. With this increased focus on context, cross-fertilization between behavior analytic thinkers and those in linguistic fields previously denied to behavior analysts may now be open. Behavior analysis has much to offer the current field of sociolinguistics by providing a plausible micro-model of how political and economic factors select for various linguistic (i.e. autoclitic) forms such as dialect and accents. These autoclitic forms develop into overlearned patterns of responding and are not easy to extinguish. The early social conditions that select for the retention of such patterns are traceable from their form. This tracing tactic will be applied, using discourse analysis methodology, to identifying the functional and structural characteristics of Ebonics that qualify it as a distinct language and determine its value in the linguistic market.

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Linguistics was always the wrong field for verbal behavior, since it is a tradition that has always been married to "langue," a systematization of symbols (Irvine, 1989; Lee, 1984). Skinner (1957) staunchly opposed this tradition when he stated "no form of verbal behavior is significant apart from its controlling variables" (p. 331). Recently, the separation of signs and the material world has received a number of challenges within the field of linguistics (Irvine). Irvine champions a model of economic and political selection as the determinant of linguistic behavior. Irvine has urged linguists to move past the study of culturally determined signs and systems. This renewed interest in the study of social interaction by linguists increases prospects, severely limited after Chomsky's review (Place, 1983), for successful cross-fertilizations between the experimental analysis of verbal behavior and other areas in the study of language. A cross fertilization between Skinner's (1957) micro-model of verbal behavior and the more mainstream macro-models of sociolinguistics is presented and then applied to the current Ebonics debate.

## HISTORICAL ACCOUNT OF LANGUAGE STUDIES

In the eighteenth century, Descartes questioned the nature of the universe by reducing it to the basics of what could be known from logic and introspection. This approach led to his famous dictum "Cogito ergo sum" (I think therefore I am). Through this rational line of reasoning and logic, Descartes argued, the world can be known. In 1704, Giambattista Vico extended Descartes's position by arguing that not only do objects not exist independently from thought, but that the nature of thought can only be elucidated by an examination of the evolution of language and social customs for the group (Vico, 1948).

Some two hundred years later, de Saussure distinguished between the rationalistic study of linguistic forms (i.e. the study of the historical cumulation of language) as synchrony and the study of language in context (i.e. the study of contemporary events) as diachrony (de Saussure, 1983). This view later evolved into its modern distinctions of *langue* (diachrony) and *parole* (synchrony). The rationalist line of

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<sup>1</sup>.The second author would like to thank Niyi Akinnaso, for his dedication and love of teaching. Without his guidance this paper could not be written.

Descartes continued to study “langue” or language. In this tradition, language is studied as passive, receptive, collective, and homogeneous. De Saussure carved this out as the niche area for the field of linguistics and modern linguistics continues in this tradition. The emphasis is primarily on what make language a unique system and separates it from other sign systems. In sharp contrast, the alternative tradition continued to study “parole” or speech. Parole is active, executive, individual, and heterogeneous. Indeed by de Saussure’s account parole was to be considered a branch of a much larger field called “semiology” or semiotics. Semiology was the study of social behavior.

By the 1940's & 1950's, the two traditions appeared to be antagonistic to each other. The leading figure in the study of parole was Benjamin Whorf. Whorf (1950) studied the interaction between what is said and what is thought. He and his mentor Edward Sapir observed how the usage of tense in the English language allowed for the segmentation of time into tense. This distinction does not exist in the language of the Hopi Indians and thus allows for a more subjective interpretation of language. On a more individual level, the study of parole was carried out by many American behaviorists (Kantor, 1922, 1936; Mead, 1922; Skinner, 1945, 1957). Some behaviorists continued to study language structure (Esper, 1918, 1925, 1933, 1966, 1968, 1973)<sup>2</sup>, while others began to merge language in the functionalist tradition (Kantor, 1922; Skinner, 1945, 1957). By the late 1950's a considerable amount of behavioral research (e.g., Flanagan, Goldiamond, & Azrin, 1958; Hargreaves & Starkweather, 1959; Holland, 1958; Lindsley, 1959; Osgood & Walker, 1959; Quay, 1959; Staats, 1957a, 1957b; Staats & Staats, 1957, 1959; Staats, Staats, & Biggs, 1958; Verplank, 1955) and theorizing had been conducted in the area of verbal behavior. Skinner’s *Verbal Behavior*

(1957) represented an attempt to construct a process taxonomy of verbal behavior to organize this information. Skinner’s program was based on a merger of his laboratory research, his own studies of verbal behavior (i.e., Skinner, 1936, 1939, 1942a, 1942b), and his lab informed observations of his daughters’ learning of verbal behavior.

In 1945, Skinner argued that psychological terms needed to be deconstructed and understood in their historical contexts. Skinner (1957) had developed an ingenious way of observing function in behavior by dividing the context into long term motivational variables (e.g., third variables), antecedents and consequences and observing regular patterns in the observation over time. Awareness of context in particular social context is highlighted in Skinner’s definition of “verbal behavior.” He refers to verbal behavior as “reinforced through the mediation of others” (p. 4). Thus for Skinner (1957) speech was bound by context and the unique combination of historical elements for the context for the speaker. Consistent with Vico, Skinner (1989) asserted “Etymology is the archaeology of thought” (p. 13). Consistent with de Saussure’s view that parole was a branch of semiology, Skinner (1953) defines verbal behavior as a “sort of social behavior”(p. 307) and in 1957, Skinner defined verbal behavior as behavior “reinforced through the mediation of other persons...” (p.2). Thus behaviorism may be considered to have continued in the tradition of studying parole.

At the end of the 1950's and in the early 1960's, Chomsky, in an effort to return to rationalism, drove diachrony and synchrony into the person. Redefining the two as competence (diachrony) and performance (synchrony), he staunchly argued against Skinner’s (1957) account in an effort to demonstrate that performance / parole is not the critical feature of what needed to be studied and indeed may be impossible to study (Chomsky, 1959, 1963). By 1963, Chomsky had *attacked* all parole positions, including socio-linguistics and behavioral linguistics. For Chomsky (1980) parole events alone could not induce grammar. Grammar’s origins were locked in the human

<sup>2</sup>. Esper’s work continues in behavior analysis today. It combined with the functionalist tradition through the work of Wetherby (see Wetherby, 1978; Wetherby & Striefel, 1978) and currently is represented in the work on recombinative generalization (see Goldstein, 1983, 1985, 1993).

“mind,” which contained a specialized “language organ.” He focused on the universal features of grammar to indicate the “natural tendencies” of grammar (Pateman, 1989 p 46-49). Chomsky (1980) concluded that logic was innate, preceded language, and was not linked to it. For Chomsky, the apparent “universality” of grammar demonstrated this.

Despite Chomsky’s fame, psycholinguist’s investigators, from the sixties, have failed to show the “psychological reality” of deep structures and grammatical transformations. By the 1970’s many former Chomskians were concluding that children do not operate with the formal apparatus of Transformational Grammar (Bowerman, 1973; Braine 1976; Brown, 1973). The field of linguistics and psycholinguistics was changing. Palmer (1986) sums it up:

*Chomsky has been able to formulate precisely his theoretical ideas because they have remained abstract, but useful theories cannot remain abstract forever. If there is no way to use them to predict, control, or describe actual events, then they are empty. (p.56)*

Detailed criticisms attacked the notion that a child’s syntactic and semantics resemble adults’ (cf., Bowerman, 1973; Braine, 1976; Edwards, 1978; Howe, 1976; Salzinger, 1975, 1979). These authors argue that no evidence exists to support the claim that children operate with adult-like categories or rules in formulating early sentences and thus these categories should not be posited. Finally, Chomsky’s (1995) book *Minimalist Program* represents a significant departure from government binding theory (Chomsky’s theory of grammatical transformations) and Chomsky appears to be taking a position closer to current trends in cognitive psychology.

In *Rules and Representation*, Chomsky (1980) tries to determine “parts of an innate endowment that defines the human essence.” To do this Chomsky leaves the behavioral realm of analysis, retreating into the world of the idealized speaker and listener (Palmer & Donohoe, 1992). For Chomsky the relationship

between words and the world is intrinsic, fixed, and determined. Language as an individual process emerges. It is seen as neither incremental nor adaptive. Chomsky’s view is a dramatic departure from current theories of evolution (Palmer, 1986; Palmer & Donohoe). Also, unlike in the ethologically studied fixed action patterns, the relationship between environmental input that triggers grammatical output is arbitrary (Palmer). Palmer further goes on to state:

*Languages vary from culture to culture and within a language there is no relationship between the sound of the utterance and its grammatical structure. Clearly there is no physical property of the stimulus that suffices to identify its part of speech. Nothing about the word ‘house’ enables us to conclude that it is a noun, or that it might be a ‘subject’. (pp. 54-55)*

Verbal behavior maintains its correspondence with environmental events through the practices of a verbal community (Catania, 1992; Skinner, 1957) or in sociolinguist terms a speech community (Gumperz, 1968). The verbal community is that portion of our culture, or social environment, that formulates and preserves the language symbols<sup>3</sup> that the culture uses to express abstract thinking and to transmit its cultural practices to the next generation (Ruiz, 1995). Gumperz (1972) identified the goal of the speech community to develop shared use of language use. However, this is not a conscious process or social contract. Indeed, one can argue that language will be prone to some variation, which is selected by its consequences in the speech community (Skinner, 1981, 1986).

Contrary to the Chomskian view that language variation is “free,” its variations are systematic and regular (Labov, 1973a). Thus

<sup>3</sup>. Symbols are arbitrary stimuli that are trained by the verbal community in correspondence with the object or event with which they are associated. These symbols are significant when they are used by more than one person, such as the elements of language (Mead, 1922).

even as verbal behavior biologically evolved, the speech community or the verbal community continues to evolve also (Skinner, 1981, 1986). Understanding this marks the study of language change beginning with the study of existing variable forms in a speech community (Labov, 1973a).

Gumperz (1972) identified three key concepts of a speech community: (1) people who meet regularly (2) who have a shared mode of communication (3) and a shared mode of interpretation. The earliest speech community can be considered the family. It is through contact with this speech community that we are trained to speak and acquire “knowledge” (Hart & Risely, 1995; Ruiz, 1995; Wittgstein, 1953, 1969). Wittgstein (1969) while in discussing language games stated that all children are “trained” into language “games.” He further went on to say:

*“I am using the word ‘trained’ in a way strictly analogous to that in which we talk of an animal being trained to do certain things”*  
(p.77)

Speech is trained for its functional properties. Skinner pointed out that verbal behavior greatly aided the amount of aid that one person could render to another (Skinner, 1986). How does verbal behavior relate to language? Catania (1992) defines language as the “features of verbal behavior shared by the members of a verbal community, including their vocabulary and grammar.” (Glossary)

#### **An Integrative Behavior Analytic and Sociolinguistic Account of Ebonics**

So what from a functionalist perspective constitutes a language? Spoken language has both a functional and a structural component (Skinner’s concept of autoclitics, 1957). More than one person must be trained to recognize a particular utterance and responded to it (Mead, 1922). In this sense, a recognized speech community must exist. The second necessary feature is that two people from the same verbal community must be specifically trained to mediate reinforcement for each other’s

utterances (Skinner, 1957). Third, the speaker and the listener must have a majority of shared tacts, mands, autoclitics, and intraverbals.

Is there an identified Ebonics speech community? The answer to this appears to be yes. In Philadelphia alone there appears to be a community that ranges in what has been commonly called the North Philadelphia area. Members of this community show great linguistic variety but a predominance of Linguistic “structures” fit the patterns commonly known as Ebonics (Labov, 1973c). Labov (1973c) was able to identify Black English vernacular had regular Grammatik patterns. He was also able to trace the roots of many of these patterns to Southern English.

Is there ground to support that Ebonics or any verbal behavior results from training? While the consequences of verbal behavior are subtle and probably not explicitly arranged (Catania, 1992), contingencies (Hart & Risely, 1995; Moerk, 1978, 1983, 1990; Whitehurst & Valdez-Menchaca, 1988) and modeling (Hart & Risley; Moerk, 1977, 1983, 1990) or echoic behavior (Skinner, 1957) play an indispensable role in a child’s acquisition of language. In a re-analysis of Brown’s (1973) data, Moerk (1983) discovered that mothers correct and expand their infants’ grammatical statements approximately 50 times / hour. Also, Moerk (1983) discovered children experience every major sentence type about 100,000 times / month. Moerk (1990) also demonstrated that parents expand, acknowledge, and provide corrective feedback and elaborate their children’s statements with enough frequency to account for language acquisition. Indeed, Hart and Risely in their ethnographic study reporting the data obtained from 42 families discovered that factors such as socio-economic status, parents educational level, race and parent child social interaction; social interaction is the most robust predictor of adult IQ. Even when they partial out the effects of the other variables this factor accounts for a sizable amount of the variance in IQ scores. By observing society at natural “cleavages” such as class, race, and educational level much can be learned about society (Ben-Rafael, 1994). It is through the interaction between parents and

child that culture is transmitted (Hart & Risley). Thus analysis of the speech community and its effects on the speaker are critical to any account. We set out to perform such an analysis in the area of Ebonics.

### **Integrating Behavior Analysis and Sociolinguistics**

Since different speech communities maintain subtle variations in verbal behavior, the use of various forms of verbal behavior such as pronoun use during interactions (Brown & Gilman, 1960) and accents (Gumperz, 1964; Labov, 1973a, 1973b) can be used to identify people of particular verbal communities and often lead to biases or social evaluation against individuals of that community. For example, Brown and Gilman focused on the study of the pronoun system in those Indo-European languages which have two forms of “you,” summarily referred to as T and V. Their data show that mutual T (tu, du, ty) and mutual V (vios, usted, vous, Sie, uy) came to mark equality, emphasizing either solidarity and familiarity (T) or unfamiliarity (V), while the asymmetrical use of V to superior and T to inferior came to mark a difference in power. These areas would be considered autoclitics in Skinner’s (1957) system and would of course be subject to the ontogenic selection process of reinforcement by the speech community. Over time this process would lead to bias (see Baum, 1974, 1979 for how such biases develop in response patterns) in autoclitic use. From a verbal behavior perspective, Kohlenberg and Tsai (1991) show how this preference over extended periods of time could become part of a larger functional unit, such as what is commonly called “self” or what sociolinguists identify as part of the individual and group identity (Ben-Rafael, 1994). This allows subtle aspects of language structure to be important for a correlation with social structure (Labov, 1973a). This appears obvious since social structures are nothing more than the collection of individual behavior (Skinner, 1971, 1981). However, the occurrence of this phenomena is important because linguistic structures and function can be correlated with social structure and function (Gumperz, 1972; Labov, 1973a; Skinner, 1957, 1971; Ulman, 1985) and language change can be

viewed as an extension of social change (Akinaso, 1997). Two researchers identified with this type of analysis are Gumperz (1972) and Labov (1973a, 1973b).

Gumperz (1972) and Labov (1973a, 1973b) both engaged in the study of “verbal repertoires;” however, with different analytic styles. Gumperz’s (1972) interest was linguistic practices as a whole and thus observed the phenomena at a different scale of analysis than Labov (1973a, 1973b). Due to this difference in scales, Gumperz was able to focus his studies on linguistic use and not on linguistic choice. This also produced the effect of viewing language as relatively crystallized.

Labov (1973a, 1973b) was interested and focused on language change in progress. In the chapter titled “The Social Motivation of a Sound Change,” he explored the community of Martha’s Vineyard. He noted that centralized diphthongs are not salient in the “conscious” of the Vineyard speakers. In the Ryleian sense while they knew “how” to speak in the local accent, there was no knowing “that” they spoke with an accent (Ryle, 1949). Thus the effects of the speech community are evident as prolonged exposure to reinforcement contingencies resulting in a pattern that some might refer to as “engrained” in the person and less prone to a conscious choice on the part of the speaker. This means that such patterns are excellent variables to study speech. Labov discovered that higher, more constricted variants were characteristic of up-island, “native” speakers, while the lower, “more open variants” were portrayed by the down-island speakers under mainland influence (Labov, 1973b).

From this study, Labov (1973b) was able to summarize the intersection between social and linguistic structure as follows: (1) he contrasted the language differences between islanders, representing contrast between two standard dialects (2) features were viewed as exaggerated signs of “social” identity (3) under increased selection pressure caused by hypercorrection lead to a generalization of the features (4) new group norms are established as the process levels off and (5) new norms are



adopted by succeeding groups for whom the original group now becomes the reference group. Labov (1973b) reported the need for a mechanism by which such structures enter into this correlation. Skinner's theoretical functionalist account (1957, 1981) provides the answer to this question or at the very least is a viable model for examination.

In another related study Labov (1973a) used micro-ethnography in a rapid and anonymous observation to analyze the pronunciation of the presence or absence of the constant (r) in postvocalic positions. It was discovered that (r) can serve as a differentiator of all levels of New York City speech and that the rapid and anonymous methods used in the study were valid for the study of this type of phenomena. While many sources of error are inherent in the method, it was discovered that the highest status group showed an inverse correlation of (r - 1) with age while the lowest status group showed the reverse correlation. It was argued that it takes 10 to 20 years to "reach maximum sensitivity to hierarchical organization of formal language in" (p.65) a given speech community. The importance of Labov's work is that not only do we see variation, but also through the application of a vigorous methodology we are able to study the nature of the change.

### **Ebonics and the Autoclitic**

Labov (1973c) attempted to understand regular patterns in the structure of Ebonics. He demonstrated that Ebonics is a highly structured "dialect." He compared the following four patterns: (1) In English verbal communities, negation is ordered with an indefinite before a verb (2) in various white verbal communities, negation combines with all other indefinites (3) in various white verbal communities, negation may appear in the preverbal position in the same clause (For example from Labov's work, "Nobody doesn't know nothing); (4) in various black verbal communities, negation is obligatory to all indefinites within the clause; (5) in various black verbal communities, negation may be added to the preverbal position. Thus all English verbal communities have selected for verbal

behavior which is categorized by negation being placed near indefinite subject, and differ with respects to negation is distributed to other indefinites in the preverbal position. He further demonstrated that speaker of the same community are able to respond to this coherent system of communication. Some may question if discourse analysis is an appropriate ABA procedure. While the verbal interactions between two speakers can aid in determining functional relations, this account is troubled by the loss of other contextual and paralinguistic factors (e.g., facial expressions, body posture, etc.).

### **A DISCOURSE ANALYSIS**

To identify if Ebonics can be categorized as a language from a functionalist perspective, we conducted a discourse analysis using Skinner's (1957) classification system. This analysis involved an entire episode of communication.

### **Data**

The context in which the communication episode occurred was in a local high school. Two African American students were engaged in a dialogue. The session was recorded on audio-tape.

### **Method**

The research method, discourse analysis, proceeded in four steps. These included: (1) ethnographic description of the social context of the interaction in terms of sequence of events, histories, and people involved; (2) sampling of the full set of conversations; though sampling of the conversations the episodes that "will help generate to the fullest extent...theoretical categories" of theoretical interest (Stubbs, 1983 p. 231) in this case examples of (a) trained mediation of others or what Hymes (1972) called communicative competence, (b) an identified verbal community (c) tacting- the use of a verbal discriminative response in the presence of the object (d) manding- a verbal response that identifies its reinforcement and is only reinforced through the specific

reinforcement (e) intraverbals- a verbal response that is occasioned by verbal stimuli, in which the relation between the stimulus and the response is arbitrary with its establishment grounded in the practices of the verbal community (f) descriptive autoclitics- the discrimination of one's own behavior, (g) relational autoclitics- grammar and syntax, (h) Self editing- the sharpening or revoking of a response by the speaker; (3) transcription of the interaction; (4) systematic coding of the transcript to determine if criterion for verbal behavior have been met.

### Data analysis and interpretation

Speaker A "Did you see the wart?"

Speaker B "Nah"

Speaker A is manding to Speaker B. The specific reinforcement for the mand is informational (Foxall, 1990) in nature to provide relevant tacts and interverbal as to whether she was at a particular event. Speaker B uses the qualifying autoclitic "nah" or "no." Speaker B has thus stated that she cannot provide informational reinforcement (add her own interverbal chains) to speaker A's request. Speaker A then begins to verbalize her own tacts of the event.

Speaker A "Oh, my God your should have seen the puss and mace. As soon as puss came out there. He lifting his arms going crazy. He like..." *schreeching sound, laugh.* Speaker B: I wish I be seeing that. I be like my baby. What's up, nigger, nigger what's up?

Speaker A is tacting the event and providing descriptive autoclitics. In Skinner's (1957) verbal behavior he discusses the process of "recalling" past tacts and whether or not it is best to interpret such behavior as tacting (p.142). Indeed Catania (1992) refers to such behavior as naming. Naming is a higher ordered class of behavior which integrates both speaker and listener behavior. However, for our purposes we will classify such behavior as tacting. Speaker B is engage in autoclitic behavior of describing what her response might be under similar stimulus situations. The tone of the conversation

as well as the specific autoclitic sequences convey that the speaker would react to the event with excitement and arousal.

Speaker A: Then, uhm mace came out and started snaking, sliding, and hustling. Almost the end he be snaking. He hot. I was like yeah.

Speaker B: Wait, did he take off his boxers or stuff like that...

Again here the speaker is engaged in tacting; however, this is an impure tact for the speaker B's previous reaction is obviously important to what is said. Thus this situation is similar to Skinner's discussion of the troubadour. Speaker B's verbal behavior is occasion setting for the informational reinforcement that the speaker would find most gratifying.

Speaker A: Nah uh.

Speaker B "Did he take off his pants?"

Again here speaker B continues to mand for the intraverbal chains that she would find most gratifying to hear, thus serving to B as informational reinforcement (Foxall, 1990).

Speaker A: Nothing like that...But you remember when they played the powerhouse, they dropped their drawers. (Scream). I saw something out the hole. It's the shadow of his hand. But I think its the....yeah.

Speaker B: Wooh, try to hold it in....

Speaker A: I been did that...

Speaker B is emitting the rule as a tact (Baum, 1995) for speaker A to not get too excited or to exercise "self-control." Speaker A replies with the autoclitics that she is already rule following (possibly by self-generation).

Speaker B: Well let me tell you there are some jealous boys and girls in this world....

Speaker A: There is some.... My bad.  
My bad. What's up?

Speaker B: Let me tell you about this  
player.....Chang, check this out that boy is a  
freak.....

Speaker A uses a qualifying  
autoclitic/self editing. In this sequence speaker  
A is rejecting her own intrusion and interruption  
of speaker B. The relation then is to  
acknowledge this is a mistake (to self-edit). "My  
bad" stands as the discriminative stimuli that this  
is the case. Thus the speaker is revoking her  
previous intrusion. Speaker B responded with a  
very long story and thus was able to recognize  
the discriminative stimuli to speak.

## Results

It appears from the above that both  
speakers have been trained to serve as listeners  
to each other's verbal behavior. There appears to  
be a continued and on-going stream of social  
behavior through verbal interaction. Both  
speakers readily engage in complex verbal  
behavior such as discriminating their own  
behavior, editing their own behavior, providing  
reinforcement to each other's verbal behavior,  
and the tacting of environmental events.

## Discussion

Applying this analysis to the current  
Ebonics debate, it lends support to the theory  
that Ebonics constitutes a "language." Ebonics  
meets all the functional requirements of a  
language, (1) participants in this study were able  
to reinforce each other's conversations with  
attention, recognized /expanded intraverbal  
chains (Foxall's informational reinforcement)  
and encouragers. Thus, it appears that Ebonics is  
verbal behavior for it is "behavior reinforced  
through the mediation of others" (p. 2), "where  
the 'listener' must be responding in ways which  
have been conditioned precisely in order to  
reinforce the behavior of the speaker" (p. 225)  
(2) it has an identified verbal/speech community  
(3) children who speak Ebonics are able to self  
edit, tact, mand, form intraverbal chains, and (4)

finally using Labov's analysis are able to form  
autoclitics (Labov, 1973c).

## EBONICS IN THE CURRENT LINGUISTIC MARKET: STUDYING THE VERBAL COMMUNITY

Behavior analysis has a long history of  
trying to understand behavior in its historical  
context. To do this a clear theory needs to exist  
linking the micro-model of behavior analysis to  
the more macro- culture; however, at this point  
no clear social theory has emerged among  
behavior analysts. Several have been suggested  
including Marxist theory (Ulman, 1985, 1995),  
Skinner's cultural analysis (Skinner, 1971, 1981)  
and cultural materialism (Glenn, 1988).

Linguistic styles shaped and maintained  
by the verbal community primarily the family;  
however, from the earliest days of schooling,  
linguistic styles are normed and determined by  
the discourse of the teacher (Bourdieu, 1982).  
This means that linguistic variation is selected  
against. Each language variant that remains has  
its own social value and can be readily used to  
distinguish "parlure bourgeoisie" from the  
"parlure vulgaire." Given this is the case,  
linguistic variables can be viewed as economic  
exchanges in which speech acts are not only  
understood but shows signs of authority and  
become representations of power (Bourdieu,  
1990). Bourdieu's (1990) concept of the  
symbolic domination can be viewed as the  
relation between speech habits and the market  
on which they are offered as products. For  
example, a person with various sound accents  
may be judged negatively once outside his / her  
initial verbal community. From this systems of  
specific punishments develop of sanctions and  
censorship, placing tension to retain the  
"legitimate language." For example, a writer  
who sends a manuscript that does not meet the  
transcription requirements to a journal may not  
have his/her manuscript published. Symbolic  
domination holds the political economy (Marx,  
1977) will function in a way to stratify society  
with some language varieties conferring more  
prestige than others (Akinnsaso, 1997). An  
example of this would be when a Boston or  
Midwest accent is preferred to a Southern

accent. Symbolic violence occurs when the language becomes more entrenched in the community or receives greater prestige in the community and former members of the old language begin to speak the new language and oppress those of the old culture who do not use the language (Akinaso). When verbal communities that support different speech forms live near one another avoidance behavior may be more prevalent (Key, 1949). In these areas greater attempts maybe made to restrict speech forms through increased use of aversive control or legal rule creation (Black & Black, 1973; Schoenberger & Segal, 1971; Tatalovich, 1995). In such cases the less economically prestigious speech form is selected against, however, points of counter control (Skinner, 1971) can be observed.

### **The Role of BA in the Market**

Skinner's (1957) approach has received critiques within the field of behavior analysis (e.g., Hayes, 1994; Place, 1983), and a period of "drought" in research in verbal behavior (Eshleman, 1991, p. 66) did occur. However, a "systematic increase in behavior analytic research in verbal behavior" (Drash & Tudor, 1991 p. 49) might lead to "too much verbal behavior research for one person to get a handle on!" (Eshleman, p. 77). The communities that could profit from its application still often find behavioral technology produced from the studying of verbal behavior offensive. In sociolinguistics, while Labov (1973c) often attacked behavioral programs for suggesting that Ebonics was not a language, he conceded the need for children to learn to speak in the Standard English form. This had the effect of keeping valuable behavioral technology from adequately reaching consumers.

Technology such as Direct Instruction (DI), the Morningside Model of Generative Instruction, and behavior analysis, function to teach children to use more marketable forms of the language. To this end they are highly successful. For example, Meyer (1984) reviewing the Project Follow Through data found that one of the groups exposed to DI for one Head Start year, 34% were accepted into

college as compared to the matched school in which only 17% went to college. The Morningside model has been demonstrated to help children gain at least two grade levels per school year (Johnson & Layng, 1992). Behavior analytic programs such as Excell have demonstrated the ability to help a significant number of minority students succeed at the university level (Brigham, Moseley, Sneed, & Fisher, 1994). Indeed, behavior analytic models have emerged as the dominant models of language intervention (Goldstein & Hockenberger, 1991). These positions represent a non-coercive alternative to traditional teacher that are clearly documented to help children to become versed in the dominant linguistic form. However, as a micro-model it is important that these approaches always remain vigilant to the fact that these children have already acquired the skills (echoic behavior, tacting, manding, autocitics, and intraverbals) of a language. It is only through this effort that they will not subtly subvert the community from which the child comes and also not deliver undue aversive instruction to the child.

### **SUMMARY**

To summarize, the speech community trains us in the way we speak. This training leads to various but subtle differences in speech because no two verbal communities select for exactly the same patterns. Since this is the case, studying accents can be an excellent way to determine differences in speech communities such as those from higher or lower socio-economic status, age, racial background, and other ways that society stratifies people. Two researchers who have studied this extensively are John Gumperz and William Labov. Gumperz focused on language as a whole within the community, while Labov focused on the scale of the individual. Methodological advances by Labov allowed him to study language change in process. This is very important in the study of the evolution of speech communities and the history of sound forms. Both researchers were able to demonstrate that language is affected by the speech community to which you belong; however, for Gumperz this is a more crystallized view of language than Labov's fluidity. It is

clear from these works that Ebonics constitutes a language spoken by the African American community. This language is not highly rated on the current linguistic market and thus children need to be taught to use more marketable forms. Behavior analysis and hybrid programs such as Direct Instruction are extremely successful at doing this in a non-coercive fashion. However, BA must always remain vigilant that the programs do not subvert the fact these verbal communities already possess language.

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## STUDYING, RESEARCHING, AND APPLYING BEHAVIOR ANALYSIS IN NEW ZEALAND

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### Abstract

This paper is intended to show that New Zealand is a viable place to study, research, and apply behavior analysis. The author presents his personal accounts of moving from the United States to New Zealand and presents some statistics and summary information about the country. Similarities and differences with respect to behavior analysis are discussed and reasons for these differences are proposed. The author concludes that increased academic freedom, the presence of behavior-analytic expertise, the availability of behavior-analytic work, and the subtle cultural differences contribute make New Zealand a unique and appropriate choice for a prospective or an active American behavior analyst.

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It was winter, 1999 when I decided to leave my behavior specialist job in Philadelphia to pursue a master's degree in behavior analysis at the University of Waikato in New Zealand. Why go all the way to New Zealand to get what so many United States Universities offer? Before coming to New Zealand I really didn't have an answer to this question. I did know that reinforcers probably increase behavior even on the other side of the world, that New Zealand was a beautiful natural marvel, that the trout are huge, and that things were relatively inexpensive. Furthermore, people at several universities in New Zealand publish behavior analytic papers frequently, and the two New Zealanders who I met at an Association for Behavior Analysis conference were laid-back, approachable, and just as behavior-analytic as any other behavior analyst I had met. Something in the above made me decide to go. The remainder of this paper attempts to answer the above question and to disseminate some information about studying and applying behavior analysis in New Zealand.

### FACTS ABOUT THE COUNTRY

The plane ride from the United States to New Zealand is indeed a long one. It spans several time zones that, in the end, results in over 12 hours of plane ride that arrives in Auckland about two calendar days after departing the United States. Needless to say, the resulting jetlag is memorable, especially if the trek began on the East Coast of the States. The trip becomes worth its trouble when the tired

passenger is greeted by the green rolling hills of New Zealand around Manukau Harbor with the city of Auckland spreading across the background.

Contrary to the belief of some Americans, New Zealand is not part of Australia (nor were prisoners of the British mainland sent here) and there is no trans-Tasman-Sea suspension bridge linking the shopping district of Auckland with the shopping district of Melbourne. Rather, New Zealand is located about 1,600 kilometers (1000 miles) east of Australia and consists of the North and South Islands along with hundreds of smaller islands scattered along its coasts. The terrain varies considerably from black beaches to white beaches to thermal areas to rolling hills to snow-capped mountains and volcanoes. The country is roughly the same size as the United Kingdom or Japan and has a population of just over 3.5 million people. About 1 million of those people live in Auckland (cf., Philadelphia's 1.5 million people). This small population results in 14 people per square kilometer compared to the United Kingdom's 240 or Japan's 332 (these statistics and subsequent statistics are from the New Zealand Immigration Service, 1999). Of this population, about 75% are of European descent about 15% are New Zealand Maori, the indigenous people of the country. The combination of the diverse landscape and the small population make New Zealand an extraordinary place to enjoy the outdoors.



Being in the Southern Hemisphere means different stars, different sun and moon orientation, counterclockwise water spirals, and reversed seasons. Auckland is located at 36 degrees south latitude making it slightly closer to the equator than San Francisco or Washington D. C. Going south, then, results in colder weather while the opposite occurs when going north. The weather differs slightly between islands and across the several types of geography, but overall New Zealand's weather never gets too hot, too cold, too wet, or too dry. In Hamilton, where I live, the summer temperatures range from 45 to 82 degrees Fahrenheit and the winter temperatures range from 33 to 61 degrees Fahrenheit. There are about 6.5 rainy days per month in the summer and about 14.2 per month in the winter. When people ask me what the weather is like in New Zealand, I say, "it's nice," and when asked for more detail, I say, "'cold' and 'hot' are associated with less extreme temperatures down here."

Also describable as, "it's nice," is the exchange rate. Currently, a U. S. dollar will buy over two New Zealand dollars. A simple formula for putting cost in perspective is to take the price of the product in New Zealand dollars and divide it in half to get the approximate price in U. S. dollars. The result is quite astonishing for most products and services. For example, an inexpensive car that runs fine can be bought for about \$250 (all prices quoted are in U. S. dollars). One-month of rent in a 3 bedroom house in Hamilton costs about \$350; one night in a motel, about \$30; a quality dinner for two, about \$20; a meal at McDonald's, about \$2; a can of Coke, \$0.45. Hence, the current exchange rate makes time in New Zealand affordable to people earning U. S. dollars.

New Zealand wages range from \$3 per hour (minimum wage) to about \$4 for service and sales workers to about \$6 for trades workers and higher for professionals, including behavior analysts. In U. S. dollars these wages seem low, but the socio-economic statuses of New Zealand workers are similar to the socio-economic statuses of Americans working similar jobs in the United States. Overall, the labor force is

about 7.7% unemployed and the government supports low-income individuals with the dole (i.e., welfare).

A variety of industries are supported in New Zealand including forestry, horticulture, and tourism. The largest industry, though, is probably agriculture and anything related (e.g., there are about 47.4 million sheep in the country; approximately 13 times more sheep than people). It is difficult to travel for more than 20 minutes in New Zealand without seeing cows, sheep, chickens, and farmland. This industry has created a niche for scientists researching animal behavior, welfare, biology, genetics, and other animal-related sciences. AgResearch is a large organization in New Zealand that supports many scientists in agriculture-related endeavors and shares the Animal Behaviour and Welfare Research Centre (ABWRC) with the psychology department at the University of Waikato in Hamilton. It is in this building where I do my research for my Ph.D.

#### TERTIARY STUDY IN NEW ZEALAND

The Ph.D. program in which I am enrolled is a full-time research program in behavior analysis in the psychology department at the University of Waikato. New Zealand uses a system similar to the British system of education, which deviates from the United States system. At the tertiary level, students spend three years on a bachelor's degree or four years on an honors degree. Advanced degrees require one or two years for a master of arts or science degree, and about three years on a Ph.D. (or about one year for a master of philosophy—a degree between a master's degree and a Ph.D.). Furthermore, Ph.D. students are not required to do courses as partial fulfillment to their degree, only a dissertation (or thesis, as it is called in New Zealand). Without scrutiny it appears as though this system neglects important content material that should be learned during a Ph.D. However, this is not the case. While completing undergraduate, honors, and master's degrees, students take courses that are specific to their field of study. This structure differs from most American colleges and universities in that it

promotes more concentrated study vs. an American liberal-arts-type program. Consequently, by the time a New Zealander reaches doctoral study, much of the important content in the field has already been learned through the required courses.

The absence of course requirements allows students to more freely engage in other academic and research activities. Generally, the biggest difference between undertaking a Ph.D. in New Zealand vs. the United States is this academic freedom. Several students teach at the University and others, myself included, are able to do some applied behavior analysis in the community along with our Ph.D. work at the ABWRC. So, most of my time is spent at the ABWRC with occasional consulting, teaching, and applied work in autism.

#### BEHAVIOR ANALYSIS AT THE UNIVERSITY OF WAIKATO

The ABWRC is home to about 10 staff from AgResearch, university students and staff who are currently undertaking behavior-analytic research (usually about 4 to 6 Ph.D. students, about 4 masters students, and occasionally an undergraduate or honors student), and a full-time laboratory technician. Behavior analysts, Mary Foster, Bill Temple, and Cath Sumpter are lecturers at the university and supervise the university work that is undertaken at the laboratory. The ABWRC is also home to over 100 hens, 30 brushtail possums, 2 horses, 5 stoats, lots of cows, and a cat. Over the past 25 years the ABWRC has also been home to sheep and goats. Currently, most of the work that comes from the university part of the ABWRC is done with hens and brushtail possums and is related to behavioral economics, psychophysics, animal welfare, matching, and delayed matching to sample.

The hen lab is a cooperative lab, meaning that each member who is working with hens runs all of the hen experiments once per week instead of running only their own experiment daily. So, for six hours of running all experiments on a single day, each lab member gets six or seven days of data. The

possum lab is similar, but fewer members work with possums so those members run the possum experiments more often. This organization allows members to become familiar with each other's work and it also frees a considerable amount of time.

Behavior analysis is limited to three courses at the University of Waikato. Behavior analysis that is not covered in the above courses makes its appearance in psychology courses such as research methods and general and experimental psychology. The clinical psychology program is based on cognitive and behavioral therapy and none of the current students are behavior analysts. There are about four students doing applied-behavior-analytic-type research throughout the department, but applied behavior analysis is not a mainstream topic of study at the University of Waikato. Because many of the local professionals were trained locally, traces of behavior analysis can be found but practitioners are usually not behavior analysts, per se. Such traces include positive parenting practice, positive behavior support, the Center for Autism Research and Development program, and precision teaching.

#### BEHAVIOR ANALYSIS AROUND THE COUNTRY

Although New Zealand has such a small population, behavior analysts can be found all across the nation's universities. These include (from north to south) the University of Auckland (Auckland), the University of Waikato (Hamilton), Massey University (Palmerston North), Victoria University (Wellington), the University of Canterbury (Christchurch), and the University of Otago (Dunedin). It is tempting to make the claim that New Zealand has more behavior analysts per capita than any other country in the world.

As at the University of Waikato, most of the behavior analysts in other parts of the country are basic researchers and only a few do applied work or a bit of both. The lack of applied behavior analysis was apparent at the annual New Zealand Behaviour Analysis Symposium, a two-day conference usually

occurring in August. There were 32 presentations at the 2000 conference and only 4 involved humans (and only 1 of those involved applied work).

This low number of applied behavior analysts means that it may be difficult to find academic or practical support in the area and that the terms, methods, and history of behavior analysis may be quite distant to many people. It also means that there is a lot of room for applied behavior analysts who don't mind the challenge of applying and disseminating the science with little support. However, being a small country with a different culture, few people, and few applied behavior analysts makes for some substantial differences in applying and disseminating behavior analysis as compared to the United States.

#### THE EFFECT OF NEW ZEALAND ON APPLYING BEHAVIOR ANALYSIS

Subtle differences in New Zealand's culture change the way behavior analysis should be applied (as one would expect when transcending cultures). When Americans ask me what New Zealanders are like, I ask them to envisage a continuum of "personality" that is bound by Americans on one end and the British on the other. New Zealanders are somewhere around the British end being more subtle and conservative and less competitive and overt than your average east-coast American. So, for a Philadelphia-raised person like myself the move was difficult. Before going to New Zealand someone else's silence, lower-volume speaking, or slow speaking during a conversation meant that it was definitely my turn to talk; being loud was always better than being quiet; using the horn was a necessary part of driving; and being brutally honest was usually appreciated. But the rules are different in New Zealand and must change somewhere in the Pacific Ocean between Los Angeles and Auckland. Needless to say, to maintain myself as a salient reinforcer my more American behaviors are sometime attenuated.

Another cultural difference that affects the application of behavior analysis is the Treaty of Waitangi. The Treaty is the agreement

between the British Crown and the indigenous Maori people that made New Zealand a British colony in 1840. Many issues involving colonization, land ownership, equality, and others continue to be debated with respect to the Treaty of Waitangi. In some ways, the issues seem to parallel the issues that have plagued relations between Native Americans and European Americans. However, New Zealanders see the Maori culture more as a part of New Zealand than distinct from it (there are no reservations for Maori and the culture is an integral part of schooling). Because aspects of the Treaty specify how the Maori culture should be preserved, it is a document that is important for the applied behavior analyst.

The sparse population has some important implications on education, psychological services, and other areas that are of interest to applied behavior analysts. First, inclusive education is sometimes more of a necessity than a choice because in small towns and rural areas there are simply not enough children with a particular need to support a specialized school. Second, and for similar reasons, families in these areas are likely to have a difficult time finding services. I used to drive for an hour and a half to get to a client because no closer services were available. And third, problems associated with population density (e.g., violence) are encountered less frequently.

The apparent sparseness of behavior analysts also impacts education, psychological services, and other areas. Psychologists must be registered in New Zealand and certified behavior analysts are not yet recognized as specialists. The small number of applied behavior analysts and the non-recognition of behavior analyst certification give the impression that applied behavior analysis is somehow less trustworthy than it really is. At the individual level, though, the New Zealanders who have been my students, consultees, or audience for paper presentations have been generally agreeable with the content.

Following a presentation that I gave on autism and behavior analysis to about 50 parents, teachers, and professionals, 16 members of the audience sent back feedback forms. A

parent corroborated my thoughts on the sparseness of applied behavior analysts and wrote, "I've never really heard anyone talk on behaviour analysis before so I have huge gaps in knowledge on this topic." A pragmatic parent wrote, "I think that behaviour analysis is a huge chunk in the jigsaw puzzle of autism. I tend to look at most approaches and take out what works. Not all approaches work but I'm still learning and open to information." A parent with a two-year-old child who was recently diagnosed with autism wrote, "I have yet to set up any type of intervention programme for my son. But, it gave me great guidelines, encouragement, and belief that we can be involved and set targets for our children and ourselves."

But you can't please everybody. After the same presentation a professional indicated that the presentation was, "Heavily behaviourist...the sort of stuff New Zealand did in the 70s...we've moved on since then." I can only wonder what was so bad about the 70's! And sometimes you can be happy that at least most of your point made it through. A teacher wrote, "We have since reworded objectives in our IEP. However, I still believe you can have well written objectives and they cannot be used when the reality of the classroom hits."

Generally, the same criticisms and praises of behavior analysis occur in New Zealand as they do in the United States. Although it is unlikely that many parents, teachers, and professionals may regularly encounter behavior analysis proper, the majority of respondents in this audience seemed to like the material. When asked, "will you use behavioural objectives now?" 12 of 16 respondents said definitely. For the question, "about how much of the discussion did you agree with?" 8 of 16 said over 80% and 4 said 60%.

#### WHY GO TO NEW ZEALAND?

So back to the original question: why go to New Zealand to do behavior analysis? I remain in New Zealand for the same reasons as when I first came to New Zealand. Recall that I

did know that reinforcers probably increase behavior even on the other side of the world. I was right. Some evidence for this fact is that some children with autism with whom I've been working have developed part-time American accents! So, behavior analysis even works all the way across the world and a foreigner behavior analyst can be an effective practitioner once cultural differences are overcome.

I said that New Zealand was a beautiful natural marvel. I continue to concur with this point when I go to the beaches, parks, and mountains and encourage anyone to take one or two months to see the North and South Islands. Julie Vargas and William Baum gave rave reviews of New Zealand when they independently spent some time seeing the countryside last year. Some behavior analysts from the University of Waikato showed each of them some thermal areas, parks, gardens, and a glowworm cave, amongst other things.

I also said that people at several universities in New Zealand continue to do sophisticated basic research and to publish behavior analytic papers; they still do. These behavior analysts and their students are a tightly woven crew; most are aware of each other and each other's work. As described earlier, this group meets yearly at the New Zealand Behaviour Analysis Symposium conference and its members are approachable, knowledgeable, supportive, and good-humored. These qualities make the conference an excellent place for new students to practice their presentation skills and for more experienced students and professionals to attain up-to-date feedback on their work.

Another comment that I made was that the trout are huge. After plenty of fishing experience I add that it is not possible to put a line in the water without catching a fish in New Zealand's waters. This rich variable-interval schedule brings the fisherman to coasts of islands and to rocks off of the mainland where mussels and oysters can be picked ad lib. As with any outdoor activity in New Zealand, one is constantly reminded that the country is New Zealand when so few people abound, when the bottom of the ocean can be seen, and when only

a few homes and industry-related buildings dot the landscape.

Now that I earn New Zealand dollars, it is no longer the case that things are as “inexpensive” as they were when I arrived with U. S. dollars. In order for a foreigner to be financially secured in New Zealand, the first step is to acquire the appropriate paperwork. Student permits are granted to foreign students; holders of these permits are allowed to work a maximum of 15 hrs per week. Work permits are granted to certain successful foreign job applicants and restrict the type, hours, and duration of work. Resident permits are granted to foreigners who fit the government’s current specifications for residency (such as age, work experience, education, and others). These remove most of the restrictions on work, allow government subsidies for university tuition, allow coverage under the nation’s health system, and make the holders eligible for New Zealand scholarships. So, after an intensive bit of paperwork, a New Zealand resident has most of the same rights as a New Zealand citizen. Once the paperwork is completed, working, getting paid, and getting taxed is similar to the process in the United States.

Finally, I said that the two New Zealanders who I met at an Association for Behavior Analysis conference were laid back, approachable, and just as behavior-analytic as any other behavior analyst. After being in New Zealand for over a year and a half, I’ve found that there are good reasons why New Zealanders are laid-back. Generally, there is not much red tape in all aspects of New Zealand life. Car insurance is not mandatory; there is less signing and asking for permission in administrative matters; there are fewer forms, disclaimers, warning signs, and other hurdles for most endeavors. Additionally, lawsuits are rarely heard of. The first time I heard the word, “sue,”

mentioned was on the radio about a year ago. The announcer was describing the attempt of an American man to sue the city of Hamilton. Apparently, the city’s slogan, “Hamilton...where it’s happening,” misled the man somehow and he saw it fit to be compensated. He didn’t get very far. It’s likely that the virtual non-existence of suing contributes to the laid back atmosphere in New Zealand because it decreases the reasons for directing blame or taking advantage of small accidents. Consequently, though, it makes it difficult for those individuals who are more justified in pursuing a lawsuit.

### CONCLUSION

The personal account outlined above shows that undertaking study or work in behavior analysis in New Zealand is a viable option for American students and behavior analysts. Once half of the world is traversed, one finds that the technology and quality of behavior analysis is up to par with the rest of the world, especially with respect to basic research. Although applied behavior analysts are less frequent than their basic-research counterparts, applied behavior analysis has found its way into some of the methods and language of local practitioners from different schools of thought. This low number of applied behavior analysts means that there are many opportunities to apply and disseminate behavior analysis in New Zealand, especially in areas such as autism. Overall, the freedom, expertise, and opportunity down here combined with all of the cultural differences are salient reasons for spending time doing behavior analysis in New Zealand.

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## INTERLOCKING PATTERNS OF CONDITIONAL PROBABILITY: THE REINFORCEMENT MATRIX

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### Abstract

To further integrated behavioral and ecobehavioral models, we introduce the idea of the reinforcement matrix. We define the reinforcement matrix as relatively stable patterns of interlocking contingencies. We can conceptualize this matrix at the ontological level, consisting of varying reinforcement density of dynamic interaction. These interactions occur between interlocking elements of the social and nonsocial environment. Multiple layers of interlocking patterns increase stability and resistance of the ecology to change. These multiple environmental influences act on the organism and lead to gradual shifts in behavior over time. These behavioral shifts are economical in nature based on fluctuations in reinforcement rates, amount of reinforcement, movement toward least effort, and decreasing delay and uncertainty. While relatively stable, the entire process drifts slowly overtime. We identify and discussed factors that lead to this drift. The role of metacontingencies, which can lead to rapid shifts or even disturbances in the matrix are discussed. We make suggestions for the study of communities and the development of technology.

“The experimental analysis of behavior is a rigorous, extensive, and rapidly advancing branch of biology.” (Skinner, 1974, p.255)

Behavior is the locus of the interaction between organism and environment (Baum, 1994; Hineline, 1992; Skinner, 1981). Through this interaction behavior is selected ontogenetically by environmental consequences (Campbell, 1956; Kimble, 1961; Skinner, 1953, 1981), which correlate with the occurrence of the behavior over time (Baum, 1973). Thus the nature of reinforcement is primarily to serve the organism as a feedback system (Baum, 1973; Hineline & Wanchissen, 1989; Timerlake, 1993, 1995). In this view, variation of behavior is a natural occurrence. Variations that lead to less effort, increased reinforcement density (i.e., higher pay off or higher amount), or decreased aversive stimulation to which the organism is susceptible are selected for continuation in similar contexts (Herrnstein, 1970; Rachlin, Logue, Gibbon, & Frankel, 1986). For “organism-based theories” (Hineline) this process is called “adaptation.”<sup>4</sup> Variations that

correlate with the opposite of the above are selected against recurrence. Also, in novel situations component repertoires can be rapidly integrated in a process called contingency adduction (Andronis, 1983). In this process behavioral classes combine, the product of which then undergoes the selection process (Andronis; Johnson & Layng, 1992; Layng & Andronis, 1984). Moment to moment attempts to maximize the “adaptive” factors may not lead to maximization over time. We call this process melioration (Herrnstein, 1990).

Due to stable environmental elements, relatively stable patterns of interaction form. For example, John Gottman in studying couples discovered that non-distressed couples had a positive to a negative interaction ratio of 5:1 (Gottman, 1993; 1996). In this view we say that the environment-organism- environment system “closed-looped” (Hineline & Wanchissen, 1989) with contexts of high probability of reinforcement increasing the likelihood of responding (stimulus control). As expected, stimulus control degrades at different rates depending on the species (Balda & Kamil, 1989;

<sup>4</sup>. This view of adaptation avoids the teology that is often spawned in a naive view of adaptation is sponsored by several of the teologically oriented ethologists and cognitivists. Adaptation in the should run may be harmful

or nonadaptive in the long run (Ghiselin, 1981; Skinner, 1969)

Krebs, Healy, & Shettleworth, 1990). Interconnecting patterns of stable probability of reinforcement may lead relatively to stable patterns of interaction over time and even the development of bias (Herrnstein, 1990; McDowell, 1989; Snyder & Patterson, 1995). Bias in responding may develop after prolonged exposure to nonequivalent reinforcer parameters (McDowell; Noll, 1995). This is similar to an idea called homeostasis in organism-based theories. Shifts in stable reinforcement effects can have profound effects not just on the target but on all connected to the pattern. Since behavior is selected in the past, biases established may persist and create new problems in the system.

This paper discusses the advantage of the matrix metaphor in conceptualizing and building behavioral technology and furthering its distribution. In this view, we see reinforcement as occurring in interlocking patterns of conditional probability. These shifting probabilities are linked in an interconnected system. This view may have particular benefit for integrating behavioral and ecobehavioral models. Subtle shifts in the stability of reinforcement over time may produce changes in emotional by products (Hineline, 1997, personal communication; Skinner, 1972) for all organisms involved. Thus we review factors that lead to both gradual and extreme changes in the reinforcement matrix. Finally we discuss the limitations of the matrix notion.

#### WHAT IS BEHAVIORAL ECOLOGY?

Ernst Mayr (1991) pointed out that an evolutionary perspective can readily answer all ecological questions. He provides the following examples:

*"...the ecologist asks to what extent an ecosystem is the result of such evolutionary forces as competition and predation? By what kind of selection pressures is the partitioning of resources controlled?" (p.154)*

A sub-branch of ecology is behavioral ecology. Behavioral ecology is a combination of

ecology and ethology (Crawford, 1996). Its origins are primarily in the "...biological sciences and it refer traditionally to the study of relationships between living things and their habitats and the formalization of the natural rules by which those interactions are governed" (Willems, 1977 p. 41). Behavioral ecology has much in common with behavior analysis. For example both are interested in the direct study of behavior, the allocation of behavior over time (Barker, 1963; Dubos, 1965; Field, Tonnuau, Ahearn, & Hineline, 1997), the function of behavior (Axelrod, 1987; Skinner, 1953, 1957; Wicker, 1972; Willems, 1977). Both view phenomena as nonreductionistic and molar (Hineline, 1992; Skinner, 1953; Willems, 1977). However, behavioral ecology has remained largely interested in naturalistic observation (Krebs & Davies, 1984). When studies are conducted behavioral ecologists believe in only controlling enough of the context necessary to answer questions "clearly" (Barker, 1965, 1969; Brandt, 1972; Chapanis, 1967; Gump & Kounin, 1959-1960; Menzel, 1969; Willem, 1965, 1969). This lack of intense control of the subject matter has left them focused on large scale processes (Crawford). Furthermore, behavioral ecologists are left without the benefit of inferred and well-tested concepts like reinforcement (see Sells, 1966 for issues around problems with encoding the environment).

In behavior analysis, the inferred process of reinforcement led to studies of schedules (Ferster & Skinner; 1957; Skinner, 1969) and eventually to the integration of schedule data into the matching law, as the basic model of choice (Herrnstein, 1990). The issue that remained was how to code reinforcement in the natural environment (Watson, 1979). They made a single hypothesis here: common cultural experience would determine positive and negative valences (Buehler, Patterson, & Furniss, 1966; Gottman & Roy, 1990; Hoffman, Fagot, Reid, & Patterson, 1987; Snyder & Patterson, 1986). Thus behavioral ecology, with its macrolevel naturalistic focus and behavior analysis with its individual and precision methods from the lab, began integration in the 1970's (for early attempts see Rogers-Warren &

Warren, 1977) continuing today (Lutzer & Campbell, 1994; Schroeder, 1990).

### Why Develop a Matrix Concept

Applied behavior analysis has a primary focus on shifting behavior in context. This behavior change can be very beneficial to the survival possibilities, health status, or reproductive success of the organism. Behavior analysis's success is drawn from its ability to break down the context into antecedents and consequences over time. By doing this behavior analysts can determine the function of that behavior (Axelrod, 1987) and generate treatment options (Axelrod, Spreat, Berry, & Moyer, 1993). This has led to the unparalleled applied success (Timberlake & Farmer-Dougan, 1991) and production of technology that is "par excellence" (Willems, 1974b, p.151). However, behavior analysts are less apt at predicting the changes in the larger environment after they have set up the behavior change program (Cautilli, Rosenwasser, & Skinner, 1996). By not being aware of the shifting patterns of reinforcement that result as a byproduct of our intervention we often miss "other effects" (Willem, 1973a, 1973b, 1974a, 1977). These "other effects" may be positive (McDowell, 1981; Sajwai, Twardosz & Burke, 1972) or negative (Kazdin, 1982; Knoll, 1995). According to Kazdin new negative behaviors are often a case of "symptom substitution." Also "other effects" may slow the adoption of behavioral technology or lead to unanticipated discontinuation of successful programs (Cautilli et al.). If behavior analysts focused on the reinforcement matrix, they will be better able to analyze a broader range of possible outcomes from the cascade of changes that might take place with shifts in metacontingencies to the subtle drifts that over time might become problematic.

A second reason for focusing on a matrix concept is that it might lead to better indirect services. For example, Bergan and Kratochwill (1990) view behavioral consultation as an indirect service model. In this model the consultant works with the consultee to change the behavior of the client. This has led some to

question the utility of such a model in the treatment of children and call to return to a more direct model of service delivery (Witt, Gresham, & Noell, 1996). While not wishing to enter this debate and recognizing that important deficits do exist in the current consultation model, it is important to note that indirect models can be developed to have powerful effects. For example, it is common practice in third world countries to reduce the cases of malaria by introducing fish into local rivers. These fish eat the larvae of the mosquitoes that carry malaria from animal to animal.

### FACTORS THAT LEAD TO SUBTLE CHANGE

#### Behavioral Momentum

Kounin (1970) observed relationships between teacher behavior and student behavior. He discovered that independent of the types of management techniques employed by teachers, student's behavior problems were fewer in classes where teachers could establish a flow. Teachers established this flow by giving continuous "signals to attend." The teachers ignored minor disruptions or used non-disruptive techniques of disciplining students such as eye stares. Kounin called this ability to establish flow "momentum." Mace et al. (1988) linked reinforcement rates to increased flow of behavior. As a process, behavioral momentum shifts the availability of environmental contingencies, making the interactional reinforcement the highest density.

#### Behavioral Contrast

Historically behavioral ecologists have had an interest in how animals allocate time between environments (Sells, 1966). A method that explains these phenomena at least in part is that of behavioral contrast. Given two contexts A and B, if the reinforcement density in context A begins to dwindle, the organism spends not just less time in context A but also more time in context B. This ratio shift in density and subsequent shifts in allocation of time represents behavioral contrast (Hantula & Crowell, 1994b). Contrast exemplifies the interconnected patterns of response choice. It also shows how, over time, minor drifts in reinforcement density can



have profound changes in behavior. For example, if a person is dating two significant others and after awhile one person becomes less “fun” to be around, they will spend less time with that person. However, they will also spend more time with the person who had not changed (Hantula, 1997, personal communication). This can have profound ecological effects on the second relationship due to increased time allotment. Hursh (1984) does not see this relationship as a rational process but an economical one.

### **Reinforcement Erosion**

Jacobson and colleagues introduced the concept of reinforcement erosion (Jacobson & Christensen, 1996; Jacobson & Margolin, 1979). Reinforcement erosion builds on the organismic concept of habituation. Reinforcement erosion is considered a natural process where reinforcers gradually lose their effectiveness over time (Jacobson & Christensen). For example, a couple’s sexual routine may become less fun over time.

### **Aging**

The biological interactions with environmental contingencies change with age (Skinner, 1987a). As sensory systems become dull, less stimulation occurs, reactions slow and weaken (Skinner, 1987a). All these contribute to old preferences changing and new ones emerging. These shifts lead to other shifts in the context. For example with age, older people tend to withdrawal from the center of society and thus the experiences that they have learned are less likely to be turned into instructions.

### **Differential Effectiveness of Behaviors Within a Class**

A rat in an operant chamber can press a lever with either his or her head or paw to obtain reinforcement; however, paw use can produce quicker rates of responding. Thus, we see a gradual shift from head use to paw. Thus while topography of behavior moves to least effort, certain responses will undoubtedly have differential effects on the environment. This differential effect can produce gradual changes

in the matrix of reinforcement. In the applied world we use this natural process to “shape” responses. This parallel’s what organismic theorists call “zones of proximal development.” (Vygotsky, 1978). In zones of proximal development, the organism is seen as adapting by moving from what can be done independently to what can be done with assistance. Shifts are made gradually starting with what can be performed.

### **Instructional Effects**

Behavioral ecology and behavior analysis share many common elements in their study of communication. Both models began as heavily speaker focused (Krebs & Dawkins, 1978; Skinner, 1957) and only later became more focused on the receiver (Baum, 1995; Cerutti, 1989; Endler, 1993; Hayes & Hayes, 1989; Guilford & Dawkins, 1991; Krebs & Dawkins, 1984; Skinner, 1966b). Also both models focus on functional aspects of communication (Buehler & Richmond, 1963; Dawkins & Krebs, 1978; Krebs & Dawkins, 1984; Salzinger, 1979; Skinner, 1957). However, behavioral ecology has failed to move past single utterances and displays (see Kuczaj & Kirkpatrick, 1993 for review).

We can view communication in terms of reinforcement (Baum, 1995; Buehler & Richmond, 1963; Ervin-Tripps, 1972; Skinner, 1957). From this perspective on phenomena of interest is the movement of rule or instruction between speaker and listener (Baum, 1995; Cerutti, 1989; Hayes & Hayes, 1989) and compliance to those rules (Carpenter, Tomassello, & Savage-Rumbaugh, 1995; Cautilli & Hantula, 2001). Instructional effects can change the reinforcing nature of events (Rakos, 1992). Hayes and Hayes (1989) argued that we follow rules for their functional utility. Baum (1995) showed how this utility leads to increased reproductive success, health status, and/or fitness. Instruction can heighten sensitivity or lead to a relative insensitivity by opening the listener to collateral contingencies that are social (Cerutti). In other words instruction serves as a discriminative signal that other contingencies are present in the matrix at a

given point. These other contingencies that arise from the verbal community, lead to the development of culture (Skinner, 1957, 1987b). For example Carpenter and colleagues (1995) compared the social interactions and imitative behavior of children, chimpanzees raised by other chimps, and chimpanzees raised by humans. They discovered that chimps raised by humans were closer to human children in imitation and compliance than they were to wild chimps. They suggested that human like sociocultural activity is a critical feature in human cognitive development. These factors were at least partially recognized early in sociolinguistics as they tried to integrate Skinner's (1957) concepts into mainstream language studies (see Ervin-Tripps).

The verbal specialist can use instruction to manipulate the behavior of the listener (Dawkins & Krebs, 1978) through autoclitics (Skinner, 1957) and deception (Cautilli & Hantula, 2001). For example, stories are verbal behavior with autoclitics designed to increase the probability that instructions will be replicated and followed. All language is learned in compliance contexts (Cautilli & Hantula; Tomasello, Strosberg, & Akhtar, 1996). Second, we train children from childhood to discriminate the instructions in a story. This occurs in school when children read and are asked to identify the "main idea" of a paragraph or when parents ask children for the "moral" of a story.

This view can explain an apparent phenomenon often evoked by organism-based theorists: human can see into the future and adapt to situations before they arise. They need not evoke this form of ontogenetic teleology to account for these phenomena. A more accurate way to view the situation is that humans discriminate processes in the present and tact rules to those processes. For example, I may save money for retirement because I have seen my father grow older and others in my life grow older and I can generate the rule that some day I will grow old. Notice that the rule functions in the present and does not actually represent the future: illness, accident or war can cut my life short and I may never reach retirement age. Also ecological factors might invade here such as the

banks going bankrupt and I will never collect on my retirement fund. Similar arguments to move away from teleological cognitive explanations and return to selection explanations have occurred in biology (Ghiselin, 1969, 1974, 1981). The trick at the ontological level is to be able to discriminate the key environmental predictors and to create accurate verbal rules. This is also the way that science proceeds (Skinner, 1990).

Even complex verbal behavior like scientific progression can be viewed as the product of variation and selection. This view was stated in the evolutionary model of Popper (1975). In this view science serves as adaptive behavioral learning. It adapts through two processes: "instruction" and "selection" (Popper, p. 73). Scientific theories serve as "structures" transmitted by instruction during social tradition and imitation. If mutation occurs, new instructions arise from within the organism (from the history in behavior analytic terms). These new rules are exposed to certain pressures, challenges, or problems. In response variation to traditional instructions are produced by methods that are "at least partly random" (p.73). It continues to be important to note as Guerin (1992) did that what might be thought to be a tact may just as well be an intraverbal, under the control of social reinforcement and not under stimulus control of the experimental context.

Bias may also enter verbal behavior (Dishion, Spracklen, Andrews, & Patterson, 1996). For example, Dishion and colleagues discovered that deviant peer groups were more likely to reinforce rule-breaking talk. Over time this pattern is prognostic of escalation in offenses. This establishes rule-breaking talk as adaptive in the peer group, serving to stabilize relationships. Some branches of psychology try to capitalize on biases that develop in speech. The major assumption underlying protective testing is that the use of vague stimuli that can have multiple interpretations will encourage the emission of responses that the interviewee would not share in direct questioning (Chandler, 1990). In behavior analytic terms ambiguous stimuli will lead to the production of verbal

behavior of a generalized response class of tacted verbal rules. As Skinner (1936) noted repeating themes in protective instruments might fit into this category. However, it is equally plausible that the verbal response class that might be emitted might be a mand to the clinician such as "I need help" or "I am ill." This was the case in the early studies conducted on suicide notes (Osgood & Walker, 1959). Osgood and Walker compared study suicide notes with fakes. The frequency and intensity of mands were robust predictors of attempters vs. completers and real notes from fake. Also it is equally possible that responses on a protective test could serve as intraverbals under control of prompts and restricted social reinforcement from the experimenter or clinician. Indeed this last is not just restricted to a protective test but is also problematic for ethnographers and legal experts studying eye witness testimony (Loftus & Palmer, 1974; Loftus & Zanni, 1975). Putting these factors aside however, a picture of personality as biased patterns of verbal responding begins to emerge, which is consistent with Kohlenberg and Tsai (1991) and Millon (1986, 1996).

#### FACTORS THAT LEAD TO MORE PROFOUND CHANGE

##### **Metacontingencies**

One basic goal of behavioral ecology is to attempt to understand how well defined differences in niche or habitat affect social organization (Gould, 1982). Organizing human habitats to ensure the survival of those communities has a long standing interest for behavior analysts (Skinner, 1971, 1974, 1986). There is growing interest in this area from behavior analysts (Foxall, 1990, 1994; Glenn, 1988; Glenn & Madden, 1995), who have sought integration with other materialist perspectives. This materialistic view may not be limited to humans (see McGrew, 1992). Many "unique" aspects of the human appear in chimpanzees, such as tool use and cooperative hunting (Gould; McGrew). For example, gang like behavior is common in chimpanzees. Some of the favorite targets of chimps' hunts are juvenile baboons. Examining the hunting pattern we see that it can

begin with a chimp wandering into a group of baboons. Silently, other male chimps descend from the trees and meander toward the same general spot. Suddenly they all close in on one baboon and in an instant the hunt is over. The chimps divide the spoils and the screaming baboons soon calm (Teleki, 1973).

To integrate behavior analysis and cultural materialism, Glenn (1988) developed the concept of the metacontingency. Metacontingencies are contingencies that affect the group (Glenn, 1988, 1991). These contingencies may overwhelm individual contingencies. An example of a metacontingency occurs in the baboon. Ecological stress constrains both group size and social activity (Dunbar, 1992). Dunbar showed that increased ecological stress led to greater risk of fragmentation. This shows how metacontingencies can lead to drastic changes in the reinforcement matrix. In humans, changes in the infrastructure lead to higher rates of spousal abuse, depression, and teen pregnancy (see Biglan, Lewis, & Hops, 1990 for review). We will discuss three sources of metavariation in the matrix: technological innovation, introduction of new organisms, and increases or decreases in delay.

##### **Technological Innovation**

One metacontingency that needs to receive more study is the role of technology. Technology changes society both directly and indirectly. Directly, there is a need to study the interaction between person and technology. Kipnis (1997) explored the relationship as society progress through agricultural, mechanistic and finally automated phases. The person-technology relationship has replaced the person-person relationship in growing areas of the workforce and it is expected that this trend will continue. Skinner (1984) identified that the increased use of technology may remove people from contact with the natural reinforcers in their environment. This might lead to increased alienation or split between person and nature (Du Nann Winter, 1996). Indirectly, technology changes society by changing language. Skinner (1957) alluded to the fact that language grows

through metaphors. Technology changes and replaces the metaphors of the community (Postman, 1993). For example, the brain went through metaphors of aqueducts, telegraphs, serial computer, and currently parallel distributive processor. Each metaphor brought a host of changes in basic interpretation of action and led to some understanding and some limitations in understanding.

### Introduction of New Organisms

Barker (1968, 1969, 1987) did not see the introduction of new organisms as a problem. He assumed that the system's setting events would use punishment methods like deviation countering (e.g., reprimands) and vetoing (exclusion, social shunning) to bring the new members into line (Barker, 1969; Wicker, 1972). Thus their organisms over time would "fit together comfortably" (Wicker, 1979, p. 10). This might hold for social systems where all members share a relatively common learning history; however as Foxall (1994) pointed out this would not hold for people exposed to other social histories. These different histories might be biased to resist such measures and lead to changes in the system. Thus, the migration of other people or organisms into a particular habitat can lead to drastic changes.

### The Introduction or Removal of Delay

The introduction or removal of delay may have profound effects on changing the biases in a given habitat (Kirby & Herrnstein, 1995). Often this is a byproduct of the creation of technology but not necessarily so. It can also occur as a byproduct of customer innovation or other marketing forces or shifting legal rules. A current example would be the flow of information and the changing nature of "informational reinforcement" (Foxall, 1994), that has occurred in cultures that exist on the Internet. The movement to such technology has profoundly decreased the time to receive products. Since information (rules) can radically change the reinforcing properties of material reinforcement (Rakos, 1992), societies are now dealing with a commodity that by its very nature is constantly shifting with nearly infinite forms

(verbal behavior). Thus many societies are experiencing drastic restructuring of how we conduct business.

### LIMITATIONS OF THE MODEL OF INTERLOCKING CONTINGENCIES AND AREAS OF FUTURE WORK

History effects while often alluded to in behavior analysis are now being created directly (Field et. al, 1997; Goltz, 1992, 1993; Hantula, 1992; Hantula & Crowell, 1994a). So is the case with patterns of interlocking contingencies. Ferster & Skinner (1957) used yoked schedules to study variables that operate within schedules. This method proved useful in studying inter-response times and the probability of reinforcement (Anger, 1956; Kruch & Platt, 1976) and to study response rates in VR versus VI schedules (Zuriff, 1970). These procedures might be modifiable to test stability patterns of interlocking reinforcement schedules. We may understand in this fashion, dismantle, and then synthesize many societal events.

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## VERBAL BEHAVIOR: HISTORY AND FUTURE

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## Abstract

Since the publication of B. F. Skinner's *Verbal Behavior* (1957), interest in a behavioral approach to the study of language has grown. Skinner laid an impressive framework for the interpretation of many language-related phenomena that were traditionally left to linguists and philosophers. What Skinner lacked was any sound empirical data to support his analyses. Recently, behavior analysts have suggested that, despite much promise, there is a scarcity of research derived from Skinner's *Verbal Behavior*. However, in the years since the publication of *Verbal Behavior*, the amount of verbal behavior research published in peer-reviewed journals and presented at professional conferences has increased. Moreover, technology derived from a behavioral analysis of language has been put to great use in a variety of clinical settings. The future of verbal behavior research and theory seems promising, especially as behavior analysts move toward incorporating into the behavioral arsenal relevant methodological and technological advances from other fields.

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Since the publication of B. F. Skinner's *Verbal Behavior* (1957), interest in a behavioral approach to the study of language has grown. In the years immediately following publication, *Verbal Behavior* itself drew much criticism from the behavioral community because of the theoretical, rather than empirical, basis for the book. Skinner laid an impressive framework for the interpretation of many language-related phenomena that were traditionally left to linguists and philosophers. What Skinner lacked was any sound empirical data to support his analyses. The power of his book was largely dependent on the acceptance of language as behavior similar to the nonverbal behavior that had been studied in the laboratory by Skinner and his colleagues for 20-years.

However, the behavioral community's reluctance to accept Skinner's work with open arms is not to say that the topic itself was dismissed. Rather, it seemed that it was time for behavior analysts to "put their money where their mouths were." If no research had yet

demonstrated the effectiveness of Skinner's analysis, then it was time to put it to the test. The success that the behavioral community has had in doing so remains a subject of debate.

Recently, behavior analysts have suggested that, despite much promise, there is a scarcity of research derived from Skinner's *Verbal Behavior*. In reality, this oft-promoted idea seems largely unjustified. If one restricted themselves to the pages of *The Analysis of Verbal Behavior* (TAVB), which is arguably the flagship journal for verbal behavior, then it could seem that the fruits of Skinner's labor were largely theoretical in nature (see below). A closer look at other behavioral journals and journals outside of behavior analysis reveals a different picture, however.

John Eshleman (1991) undertook an exhaustive review of psychology journals searching for verbal behavior research, the results of which were published in *TAVB*. Although Eshleman started with "traditional" computer searches, he soon graduated to physically looking through actual journals and reviewing *each* article, not just those with seemingly related descriptors or mentions of Skinner. Additionally, he reviewed the proceedings of the Annual Convention of the Association for Behavior Analysis (ABA) since 1975 and tallied the number of verbal behavior presentations. Eshleman found that actually, the

## Author's Note

These suggestions are taken from the article "Publication Trends in *The Analysis of Verbal Behavior: 1982-1998*" written by Matthew Normand, Jeffrey Fossa, and Alan Poling and appearing in *The Analysis of Verbal Behavior*, 17, 167-173. The suggestions were intended to apply to increasing the amount of research submitted to that journal but are just as applicable to the field of verbal behavior in general.

amount of empirical research related to Skinner's 1957 analysis had steadily increased over the years. He proposed that comparisons of verbal behavior research to other areas of behavioral research resulted in a distorted picture. That is, the amount of verbal behavior research published each year continues to be much less than published research from other areas of behavior analysis. However, if verbal behavior research is compared to *itself* over the years, there is a clearly accelerating trend.

Even in light of Eshleman's findings, it does seem that a substantial portion of the field of verbal behavior (the study of language rooted in Skinner's analysis) remains theoretical. A recent review of *TAVB* suggests that much of the material published is theoretical in nature, though the prevalence of empirical research is increasing. One need only look to Mark Sundberg's (1991) infamous list of research topics suggested by *Verbal Behavior* (published in *TAVB* and presented at various ABA meetings) to see that much remains to be studied! Despite the best efforts of Sundberg and others, the "to-be-researched" list is shrinking ever so slowly. So, what is the problem?

To start, at least to the layperson, language seems to easily lend itself to the mysteries of "cognition." Surely, it is argued that such a complex phenomenon as language can't be explained by the same mechanisms responsible for a rat pressing a lever in the laboratory. Humans are able to "generate" language and "create" works of art, science, and simple conversation with language. Are these complex and awe-inspiring phenomena to be explained by reinforcement? The answer, of course, is a resounding "yes." Convincing the average person of this is quite a different matter. Cognitive psychology certainly has not wasted such an opportunity to leap into the fray.

A second major problem is that the area of language development is quite complex and the tools and methodology with which to study it remain in their infancy. Other areas of psychology, especially cognitive psychology, have had less trouble becoming involved. The

special problems of observation and functional analysis are not barriers to cognitive scientists, as much of cognitive theory rests on assumptions about internal workings inferred from overt behavior but never directly seen. As such, cognitive psychology has developed methods with which to study language that have surpassed, at least in breadth of adoption, those developed by the behavioral community.

Chief among these methods is protocol analysis, an approach characterized by the collection of concurrent verbal reports as participants work on some experimental task. Developed by Anders Ericsson and Herbert Simon, this has proven an effective tool although the interpretation of the collected data remains unsatisfactory to behavior analysts (Ericsson & Simon, 1984). The method itself is promising, however. At Florida State University, we currently are working to refine the methodology and analytic techniques of protocol analysis to better satisfy the requirements of behavior analytic research (it should be noted that Anders Ericsson himself has been a valuable collaborator). For an excellent review and critique of the application of protocol analysis to behavior analysis, see Critchfield and Epting (1998) in *TAVB*.

Another area of development has been the use of computer-simulated neural networks to study language acquisition. Originally intended to simulate problem-solving behaviors and mimic human decision-making, such research makes use of complex arrangements of computer simulated "neural networks" in an attempt to produce behavior products similar to those of humans. Long a staple of cognitive psychologists, behavior analysts have recently turned their attention to such computer models in an attempt to better understand verbal behavior. Hutchison and his colleagues at Behavior Systems LLC have been working diligently in this area and frequently present on their progress at ABA and other professional conferences.

In addition to methodological advances (mostly outside the field of behavior analysis), it seems that the topics under consideration have

increased in complexity. In the beginning, many interesting studies were conducted demonstrating the sensitivity of verbal behavior to reinforcement. Beginning with Greenspoon's famous demonstrations of the subtle reinforcement of specific verbal responses and continuing to more demonstrative reports of therapists' ability to significantly shape a conversation via appropriately placed "umms" and "ahhs," language has seemed as amenable to a behavioral interpretation as riding a bike or driving a car. However, many have grouped such research into the category of "no kidding, reinforcement works." Indeed, we know the power of reinforcement and continue to verify it empirically with each issue of the *Journal of Applied Behavior Analysis*, but further refinement is necessary if we are to understand the emergence of more complex language related phenomenon.

Since the 1970s, a great deal of experimental research has focused on issues of stimulus equivalence (i.e., the emergence of untrained stimulus-response relationships due to specific types of learning situations). More recently, such an analysis has been applied to language development. Of critical importance is the understanding of the types of integrated repertoires that can both facilitate basic language development and give rise to increasingly complex verbal repertoires. Toward this end, Pauline Horne and C. Fergus Lowe detailed an integrative account of the development of bi-directional relationships between classes of objects (or events) and his or her own verbal behavior (Horne & Lowe, 1996). In their account, the interaction between speaker and listener repertoires plays a crucial role in the development of what they term "emergent" behavior, similar to the type of behavior reported in the stimulus equivalence literature.

In yet another important move, behavior analysts are beginning to tackle some of the traditional problems of grammar and syntax that have been long studied by linguists yet neglected by behavior analysts. Recently, Palmer, Twyman, Silvestri, and Davies-Lackey have been investigating the role of automatic reinforcement in the development of autoclitic

frames. In their research, preschool children were shown pictures of one animal doing something to another animal. The experimenter began by describing a picture in the passive voice ("The chicken is being tickled by the panda.") The child was then shown the next picture with the roles reversed. There were no explicit contingencies on the child's behavior and the child could describe the picture in any way. Over the course of 20 trials or so, almost all children showed an increased use of the passive (i.e., matched the experimenter's responses).

The researchers interpreted this as an example of automatic reinforcement by achieving a match (parity) with the language of the experimenter, where the match is to an autoclitic frame. In light of such a robust phenomenon, this could be viewed as a model for the acquisition of all grammar. More than just a technological advance, such research shows great promise for the development of a cohesive framework with which to explain the development of what many people consider to be the essential aspect of language (i.e., grammar).

Verbal behavior has also made the leap into applied practice. Most notably, Skinner's analysis has been used to teach children with autism and developmental delays to use language. Spearheaded by the work of Lovaas in the 1960s, the field has grown immensely with the contributions of researchers and practitioners like Partington and Sundberg. This work has thrust behavior analysis into a social prominence not enjoyed since the "cognitive revolution" of the 1960s. By utilizing early and intensive behavior analytic interventions, many young children with a diagnosis of autism can develop so as to be virtually indistinguishable from their non-diagnosed peers.

#### FUTURE DIRECTIONS

In addition to the previously mentioned successes, several steps could be taken to stimulate further verbal behavior research. Recently, the Verbal Behavior Special Interest Group (VB SIG) of ABA has taken steps to

encourage more verbal behavior related presentations at the ABA by soliciting presentations through the VB SIG listserv and on the VB SIG website (psyc.csustan.edu/verbalbehavior). Continuing to do so hopefully will stimulate more research and perhaps encourage those presenting their research at conferences to submit their studies for publication. This activity already has resulted in many symposia being organized for and presented at the 2000 and 2001 Annual Conventions of the Association for Behavior Analysis.

A second possibility, albeit a more involved one, is to organize more conferences for the purpose of presenting and discussing verbal behavior research, the proceedings of which could then be published. This has been done successfully in the past, with some excellent books resulting (available from Context Press: www.contextpress.com). A third possibility for stimulating research is to incorporate some non-behavioral techniques into the analysis of verbal behavior, such as the aforementioned protocol analysis and neural network modeling.

It seems that interest in, and the study of, verbal behavior has grown in the years following the publication of Skinner's seminal treatise *Verbal Behavior*. However, though the amount of published verbal behavior research is increasing, other areas of behavioral research such as autism, developmental disabilities, organizational behavior, etc. still overshadow it. Also, in keeping with Skinner's original work, a substantial portion of the field remains

theoretical in nature, much to the chagrin of research-minded behavior analysts. Of course, to say that there is much interest in the theoretical aspects of verbal behavior is not necessarily bad. Schlinger has astutely pointed out that much empirical research is influenced by theoretical discussion. That is, such theoretical discussion could serve to "fuel the fire" of researchers and ultimately result in *more* verbal behavior research being conducted. It seems that we have come a long way since 1957 and the progress continues, albeit at a pace slower than some would care to see. In the words of John Eshleman (1991, p. 77), "the significance of research is not determined solely by quantity, but also by quality." Cheers to a good job and better work to come.

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## APPLIED BEHAVIOR ANALYSIS FOR CHILDHOOD AUTISM: DOES THE EMPEROR HAVE CLOTHES?

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## Abstract

Programs based on applied behavior analysis (ABA) have become increasingly popular as interventions for childhood autism. A number of leading behavior analysts even have claimed that many children with autism can be “cured” through such programs and therefore strongly recommend ABA over alternative interventions. The extant research literature, however, does not support these claims. ABA programs for childhood autism are indeed promising, but exaggerated claims may undermine confidence in the approach, and are misleading to families of autistic children and to other stakeholders.

Empiricism has always been one of the key defining features of applied behavior analysis (ABA) (Cooper, Heron & Heward, 1987). Both theoretical and technological developments are closely tied to objective data (Zuriff, 1985). In keeping with the high value placed on pragmatism, the link between basic behavioral principles and the technological developments that stem from these principles is emphasized. Technological developments such as interventions for psychological disorders and behavioral problems are not relegated to an afterthought, but are central to the entire enterprise.

The recent movement toward empirically supported treatments (ESTs) in the field of clinical psychology therefore represents nothing new to applied behavior analysts. Although debates are currently raging among clinical psychologists and other mental health professionals regarding the relevance of outcome research to clinical practice, the idea that interventions should be informed by data is axiomatic to the behavior analyst. Applied behavior analysts may join other empirically-minded professionals in quibbling over details (e.g., the specific criteria that should be used to justify claims of empirical support for an intervention; cf. Herbert, 2000; Lohr, DeMaio,

& McGlynn, in press), but the idea that “the data matter” is not in dispute.

## ABA AND CHILDHOOD AUTISM

The conventional wisdom within the field of ABA is that one of the most significant – if not the single most significant – empirically supported success story is ABA-based early intervention for developmental disabilities, and childhood autism in particular. In fact, the association of ABA with intervention programs for childhood autism has become so strong that Hayes (2001) recently warned that ABA “is gradually becoming a subfield of developmental disabilities” (p. 61). Indeed, the Internet home page of the Cambridge Center for Behavioral Studies ([www.behavior.org](http://www.behavior.org)) prominently features ABA programs for autism. The premier ABA journal, the *Journal of Applied Behavior Analysis*, frequently publishes articles on the application of ABA for developmental disabilities. In a feature article on Autism, *Newsweek* magazine described ABA as “the standard approach” to intervention with autism (Cowley, July 31, 2000, p. 52). The ABC News program *Nightline* recently featured ABA for autism (March 9, 2001). The New York State Department of Health (1999) recently issued clinical practice guidelines for autism in which ABA is recommended as a critical element of any intervention program for childhood autism.

The astounding success of ABA early intervention programs for children with autism is proclaimed not only in the professional literature, but also in books and Internet sites

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targeted to parents and other stakeholders. These publications frequently announce that ABA programs can result in dramatic developmental gains for many autistic individuals. In fact, it is claimed that many of these children can eventually function in normal education settings, and are indistinguishable from their normally developing peers. In other words, many can be “cured” of their disorder. Consider, for example, the following passages gleaned from the literature on ABA for autism:

Several studies have now shown that one treatment approach – early, intensive instruction using the methods of Applied Behavior Analysis – can result in dramatic improvements for children with autism: successful integration in regular schools for many, completely normal functioning for some (Green, 1996b, p. 29).

There is little doubt that early intervention based on the principles and practices of Applied Behavior Analysis can produce large, comprehensive, lasting, and meaningful improvements in many important domains for a large proportion of children with autism. For some, those improvements can amount to achievement of completely normal intellectual, social, academic, communicative and adaptive functioning (Green, 1996b, p. 38).

Furthermore, we also now know that applying effective interventions when children are very young (e.g., under the age of 3-4 years) has the potential for achieving substantial and widespread gains and even normal functioning in a certain number of these youngsters (Schreibman, 2000, p. 374).

During the past 15 years research has begun to demonstrate that significant proportions of children with autism or PDD who participate in early intensive intervention based on the principles of applied behavior analysis (ABA) achieve normal or near-normal

functioning... (Jacobson, Mulick, & Green, 1998, p. 204).

Similar claims abound on the Internet. For example, the Director of the Autism Research Institute claims on that organization’s web site ([www.autism.com/ari/editorials](http://www.autism.com/ari/editorials)) that “the evidence shows that it is possible for at least some autistic children to learn how to overcome their disability...” and “I am more than willing to accept, and to celebrate, recovery from autism. Let’s have more of it!” In addition to the claims made by professionals, parents have written books (e.g., Maurice, 1993) and developed websites (e.g., <http://rsaffran.tripod.com/aba.html>) extolling ABA as a cure for autism.

Given the strong value that ABA places on quantitative data, one would assume that such claims are firmly grounded in sound scientific research. Unfortunately, examination of the scientific literature tells a very different story. In fact, we believe that claims such as those above are not only unsupported by the available evidence, but are also highly misleading. Furthermore, some of the authors of such claims are themselves among the most vocal critics of various non-behavioral intervention approaches for autism. They rightly decry the wide gap between the claims made about the effectiveness of such programs and the extant scientific literature (Green, 1994; 1996a; 2001; Smith, 1996).

#### **What Does the Research Actually Say?**

A detailed review of the literature on the treatment of autism is beyond the scope of this paper; we refer the interested reader to papers by Herbert, Sharp, and Gaudiano (in press) and Rapin (1997). We will, however, highlight several features of this literature that bear on the claims made about ABA programs for autism.

It is first important to distinguish comprehensive ABA programs from behaviorally-based interventions targeting specific problems that are frequently associated with autism and other developmental disabilities (e.g., self-stimulation, self-injurious behavior;

Rogers, 1998). Our concern is not about the latter, which have not typically been associated with unwarranted claims, but instead with the former. Ivar Lovaas developed the most popular ABA program for childhood autism at the University of California at Los Angeles in the 1970s. Although the program was initially called the “Young Autism Project,” it is often termed “discrete trial training,” the “Lovaas model,” the “UCLA model,” or simply “ABA for autism”. Early intervention programs based on Lovaas’ pioneering work have become increasingly popular over the past decade, and several variations of his program have been developed (e.g., McClannahan & Krantz, 2001; Weiss & Piccolo, 2001). Although the details of these programs differ somewhat, they share an emphasis on the application of behavior analytic principles within a comprehensive educational and treatment program aimed at improving the overall functioning of individuals with autism.

Lovaas evaluated his program in a widely cited study published in 1987, in which 19 children with autism received at least 40 hours per week of ABA, relative to 19 others who received less than 10 hours, and 21 additional children who received no specialized ABA intervention (Lovaas, 1987). The results were dramatic: After at least two years of the program, 47% of the group who received 40 or more hours per week achieved normal IQ scores, and were functioning in regular education settings; only one child from either of the control groups achieved this level of functioning. Lovaas described these children as having “recovered” from autism. In a follow up several years later, McEachin et al. (1993) found that the results were largely maintained; 8 of the 9 children with the best outcomes from the original study continued to function in regular education classrooms.

The Lovaas (1987) study, along with the follow up by McEachin et al. (1993), are frequently cited as providing evidence that ABA can effectively “cure” autism, at least in some children. Despite these apparently impressive results, several scholars have raised serious methodological concerns about the study (Gresham & MacMillan, 1998; Mesibov, 1993;

Mundy, 1993; Schopler, Short, & Mesibov, 1989). For example, the outcome measures may not reflect true changes in functioning. Changes in IQ could reflect increased compliance with testing rather than true changes in cognitive abilities, and school placement could have more to do with parent advocacy and evolving school policies than with actual functional changes. Several important domains of functioning (e.g., social skills, conceptual reasoning skills) were not assessed. In addition, there are indications that Lovaas’ sample may have included relatively high functioning individuals with unusually good prognoses, and was therefore unrepresentative of children with autism in general. Most critically, the Lovaas study was not a true experiment, as participants were not randomly assigned to groups. The manner in which subjects were assigned to groups raises serious questions about the possibility of selection bias, which are underscored by pre-intervention differences between the experimental and control groups. These methodological weaknesses limit the conclusions that can be drawn from this hallmark study. Although the results are certainly promising, they are not probative with respect to the question of the effectiveness of ABA for autism.

Even if the Lovaas (1987) study did not have these methodological limitations, it alone would still be insufficient as a basis for claiming that ABA can result in recovery from autism. Replication of the findings by other independent investigators would be necessary. Such replication is especially critical when considering claims that contradict established conventional wisdom. In this context, it is noteworthy that attempts to replicate Lovaas’ original results have consistently failed to demonstrate the dramatic results he reported (Anderson, Avery, DiPietro, Edwards, & Christian, 1987; Birnbrauer & Leach, 1993; Sheinkopf & Siegel, 1998). Although all three of these studies reported gains for some children, the degree of change was consistently much more modest than that reported by Lovaas. In addition, like the original study, none of these replications was a true experiment, and all

differed in significant ways from the original study.

In addition to the home-based, one-on-one ABA programs described above, similar school-based ABA programs have been developed and evaluated. Fenske, Zalenski, Krantz and McClannahan (1985) reported positive results with children younger than 60 months who received at least two years of ABA at the Princeton Child Development Institute. Harris, Handleman, Gordon, Kristoff, and Fuentes (1991) also demonstrated gains in a group of relatively high functioning children with autism following 10 to 11 months of intervention through the Douglas Developmental Center of Rutgers University. Again, however, the gains reported were significantly more modest than those reported by Lovaas (1987).

Like the original Lovaas study, none of these replication studies utilized an experimental design; in fact, some were purely descriptive, having no control condition of any kind. There were pretreatment differences between the experimental and control conditions in each of the studies that included a control condition, further limiting the conclusions that can be drawn from these data. This literature is marked by consistent methodological limitations, including limited outcome measures, questions about the representativeness of samples, and unknown treatment fidelity. In all fairness, the many difficulties in conducting controlled outcome research with this population must be acknowledged. Nevertheless, these obstacles are no excuse for exaggerating the results or implications of the existing research literature.

Proponents of ABA might acknowledge the absence of randomized controlled trials, but counter that single-case research justifies the bold claims of ABA's extraordinary effectiveness. Indeed, the field of behavior analysis has a long and noble tradition of employing single-subject research methods. Such methods may be extremely useful for suggesting hypotheses concerning controlling variables of target behaviors and for documenting treatment outcome in individual cases. Single-case methods are not without

limitations, however. They cannot rule out several threats to internal validity, and are generally unable to compare the effects of competing treatment conditions, especially programs like ABA for childhood autism in which the intervention requires a long period of time and effects are hypothesized to be irreversible. Then there is the obvious problem of generalizing the findings beyond the individual case studied. Thus, although single-subject studies may be informative, they alone cannot constitute evidence for ABA's ability to cure autism, or of ABA's unique superiority over alternative programs.

### EXAGGERATED CLAIMS

The research that has been conducted to date therefore suggests that ABA early intervention programs are promising in the treatment of childhood autism. They do not, however, support dramatic claims about "recovery" from autism and "normal functioning." In addition, it is especially important to note that no research has compared comprehensive ABA programs to other comprehensive early intervention programs for autism. Several alternative programs have been developed, and initial studies have yielded promising results (e.g., the LEAP program, Hoyson, Jamieson & Strain, 1984; Strain, Kohler, & Goldstein, 1996; the TEACCH program, Schopler & Reichler, 1971; the Denver Health Sciences Program, Rogers & DiLalla, 1991). The limited outcome research on these alternative approaches is plagued by many of the same problems as the outcome research on ABA. Nevertheless, the advocates of these approaches have generally been careful to avoid making exaggerated claims about their effectiveness.

Without experimental studies directly comparing ABA with alternative early intervention programs, one can have little confidence in any unique benefits of ABA for autism. In fact, it is possible that factors common to all of these programs (e.g., a highly supportive teaching environment, a curriculum that emphasizes certain specific skills), rather than any specific interventions per se, may



account for any gains observed (Dawson & Osterling, 1997). No component analysis studies have assessed this possibility.

The chasm between the extant empirical research on ABA programs for childhood autism and the dramatic claims sometimes made on behalf of these programs is inconsistent with the core value of empiricism that lies at the heart of behavior analysis. Such claims may ultimately serve to undermine both the public's and professionals' confidence in ABA for autism, as well as confidence in reports of the impressive results that ABA has produced in other areas. More importantly, such claims risk misleading parents, teachers, and other stakeholders about the likely prognosis for their autistic child, and about the full range of viable intervention options. Families of autistic children are understandably quite distraught over this disorder, and many will go to great lengths to provide any treatment that may offer hope of a cure. In addition to the high financial cost and the emotional stress often associated with a comprehensive ABA program, when their child fails to "recover" from autism, the family may feel guilty, believing that they somehow did not do enough. Providing families of children with autism false hopes about the chances of recovery may promote denial about the apparent lifelong nature of autism.

ABA is one of the most – if not the most – promising interventions for childhood autism, and controlled research evaluating its effects is desperately needed. Fortunately, efforts to replicate Lovaas' intervention program are underway (Smith, Donahoe, & Davis, 2001). Unfortunately, to our knowledge, no controlled studies are underway that compare a comprehensive ABA program with an alternative (e.g., TEACCH). Until and unless convincing data from independent, methodologically strong studies become available demonstrating that autistic children can in fact achieve normal functioning, behavior analysts should refrain from making such claims. In addition, until and unless data from well-designed experiments demonstrate the superiority of ABA over other comprehensive intervention programs, behavior analysts should

refrain from suggesting that ABA offers unique benefits over other programs. In keeping with the historical value that behavior analysis places on empiricism, it is incumbent on behavior analysts to keep their conclusions consistent with the data.

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## SCHOOL-WIDE AND INDIVIDUALIZED EFFECTIVE BEHAVIOR SUPPORT: AN EXPLANATION AND AN EXAMPLE

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### Abstract

The principles of applied behavior analysis provide the foundation for the Effective Behavior Support (EBS) approach to school discipline. EBS in action is exemplified in the Individualized Positive Support (IPS) project, which emphasized teacher training in functional assessment and positive behavior support. The IPS project examined the effect of in-service training in function-based support for teachers and paraprofessionals on office discipline referrals for cohorts of elementary school students. Thirty cohorts of students, starting in Kindergarten through Grade 4, were studied in terms of discipline referrals over a three-year period. Five schools participated in the study and all were using the EBS approach with an 80% or higher level of implementation by the last year of the project. In the second year of the project, all five schools implemented the School Wide Information System (SWIS), a computerized system for recording and charting discipline referrals. Average reliability for SWIS data entry across 5 schools, when compared to the original paper referrals, was 86.56% (s.d., 6.69%). For 4 out of 5 schools, changes in school-wide discipline referrals were validated by teachers' perceptions of changes in students' behaviors. Four of the five schools also participated in the in-service training on function-based support, with 2 to 10 staff members per school receiving training. Schools where 6 or more staff members participated in training in function based support had more cohorts of students who improved or remained low in comparison to typical grade level expectations than schools where fewer staff members participated in the training. Implications for behavior therapists are discussed.

Effective Behavior Support (EBS) is a systems approach to school discipline designed to enhance the capacity of schools to educate all students, including students with challenging social behaviors, by establishing an efficient and effective approach of (a) systems that support staff, (b) practices that support students, and (c) data that guide decision-making. Although relatively young as an approach, EBS already has been adopted by many schools in the U.S. and Canada and interest in it is growing (e.g., Colvin & Fernandez, 2000; Horner, Sugai, Lewis-Palmer, & Todd, 2001; Horner, Sugai, & Todd, 2001; Lewis & Sugai, 1999; Nakasato, 2000; Sugai et al., 2000; Sugai & Horner, 1994, 1999, 2001; Taylor-Greene et al., 1997; Taylor-Greene, & Kartub, 2000; Todd, Horner, Sugai, & Colvin, 1999). EBS is not a "one-size-fits-all" curriculum but a process based on a set of

guiding principles to enable each school to proactively address the discipline needs of their students. The EBS process enables schools to apply to their own situation the basic concepts of applied behavior analysis (Baer, Wolf, & Risley, 1968) for individual students and classrooms (Wolery, Bailey, & Sugai, 1988) and on a school-wide level, using concepts from organizational behavior management (Gilbert & Gilbert, 1992). The following list represents the seven minimum requirements for a school to initiate the EBS systems approach:

1. Team-based approach to problem solving issues related to school-wide discipline.
2. Active administrator support and participation on the school-wide discipline team.
3. Proactive instructional approach (positive and preventative) to teaching social behaviors.
4. Local behavioral expertise that can provide specialized, individualized, and intensive support to individual students.
5. Data-based decision making to determine needs, strengths, and

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impact of interventions.

6. School-wide discipline as a high priority (one of the top 3 school improvement goals).
7. Sustained and long-term commitment (3-4 years) to systems approach.

The proactive instructional approach is the hallmark of successful EBS programs. Horner, Sugai, Lewis-Palmer, and Todd (2001) list the following guidelines for an effective instructional approach: (a) Identify 3 to 5 school-wide expectations for student behavior that all staff agree to support (e.g., “Be Responsible”); (b) Provide a definition for each expectation (e.g., To be responsible means to take care of yourself and your belongings); (c) Teach the rules to all students; (d) Teach in different settings (e.g., hallway, classroom, cafeteria, playground); (e) Teach specific social behaviors that are examples of the expectations (e.g., examples of being responsible include bringing a pencil to class, doing your homework, keeping books and litter off the floor); (f) Use “negative” examples when teaching (i.e., an example of not being responsible would be leaving the ball on the playground instead of putting it away); (g) Provide opportunities to practice and to demonstrate understanding; (h) Acknowledge and reward appropriate demonstrations of the desired behavior as a part of the teaching process; and (i) Continue to acknowledge and reward appropriate behavior on a regular, on-going basis, using age-appropriate and efficient methods.

EBS focuses on four sub-systems: school-wide, classroom, nonclassroom, and individual student. Typically, the school-wide system is developed first. The school-wide system focuses on all students, staff, and settings at all times and provides a foundation for the remaining three systems. The classroom system addresses the establishment of effective classroom behavior management and instruction. Nonclassroom refers to common settings within the school such as hallways, cafeterias, playgrounds, and/or bathrooms, school settings that “tend to be violence prone” (Astor & Meyer, 2001). Classroom and nonclassroom systems flow into place with relative ease once the school-wide system is established, with a

key task being to clarify the meaning of the school-wide rules in particular settings. When all staff agree on the school rules and use specific examples to teach them, then monitor and provide positive reinforcement to students for following the rules, most students will comply. The students who do not should be provided with additional, individualized support.

The individual student system requires more effort because the intensity of the selected individual students’ needs is high; schools are being asked to do more than they have done before and needed policies, practices, and structures are not yet in place (Crone & Horner, 1999-2000; Sugai, Lewis-Palmer, & Hagan-Burke, 1999-2000). This is particularly true with the use of functional behavioral assessment (FBA) and positive behavior support (PBS), strategies for individual support called for in the 1997 amendments to the Individuals with Disabilities Education Act (IDEA) (Wilcox, Turnbull, & Turnbull, 1999-2000). Successful use of these strategies depends on following the principles of applied behavior analysis (Anderson & Freeman, 2000).

The phrase “positive behavior support” has taken on a special meaning that developed in response to objections to the use of aversive and punitive means of behavioral control with individuals with disabilities. It refers to interventions designed to reduce inappropriate behavior in ways that would be as non-aversive as possible, by changing environmental conditions, modifying behavioral antecedents, teaching replacement behaviors, using extinction to eliminate consequences that inadvertently had been maintaining inappropriate behaviors, and increasing positive reinforcement for appropriate behaviors. The phrase “function-based support” is a form of “positive behavior support” and refers to the use of Functional Behavior Assessment to guide the development of the intervention.

#### **Relationship to Applied Behavior Analysis**

In *The Technology of Teaching*, B. F. Skinner (1968), identified four major problems that need to be faced in public education: “(1)

over-reliance on aversive procedures to control and motivate children, (2) the inability of teachers to give immediate feedback for student work, (3) the relative infrequency of positive reinforcement, and (4) the lack of small, well-sequenced curricula” (cited in Wolery et al., 1988, p. 12). A generation has grown up since Skinner identified these problems but in many schools, the same problems exist today (Bear, 1998; Rathvon, 1999; Shores & Wheby, 1999). The success of EBS in helping schools overcome these difficulties is based on using principles of applied behavior analysis (ABA) to prevent and reduce problem behaviors in the schools and to enable all students, including those with, or at risk for, emotional and behavioral disorders (EBD), to be successful in school. ABA is “the process of applying sometimes tentative principles of behavior to the improvement of specific behaviors, and simultaneously evaluating whether or not any changes noted are indeed attributable to the process of application -- and if so, to what parts of that process” (Baer et al., 1968, p. 91). Using applied behavior analysis in schools means “specifying learning objectives, implementing behavioral principles, and monitoring and evaluating student performance” (Wolery et al., 1988, p. 31). Behavioral principles are applicable to academic and social behaviors at school and include (a) recognizing individual differences, (b) gathering information about specific functional relationships between behaviors and environmental factors, (c) identifying overall goals and specific objectives, (d) planning and implementing an intervention based on the preceding steps, and (e) monitoring and evaluating the results.

### **Individual Students with Special Needs**

While the school-wide, classroom, and nonclassroom systems of EBS pertain to all students, and thus are universal and primary prevention interventions, the individual system addresses the needs of students who are (a) identified as having risk factors calling for targeted and secondary prevention interventions and (b) selected for highly individualized and tertiary prevention interventions. Most students need only the support provided in universal

interventions; the number of students who require additional support is relatively small in proportion to all students (Horner, Sugai, & Todd, 2001). However, if no additional support is provided, the few students who have serious discipline problems frequently will interrupt their own and their peers’ education (Lewis, 2001; Sugai, 1996; Tobin & Sugai, 1999a, 1999b; Walker et al., 1996).

Behavior problems in school affect students in both general and special education and range from classroom disruptions to dangerous incidents with legal consequences (Yell & Rozalski, 2000). Although schools generally are safer than other places in any community, many schools throughout the country continue to have problems with violence, threats, weapons, theft, bullying, and drugs (Kaufman et al., 2000). The use of expulsions and suspensions as a means of handling behavior problems has increased in recent years (Cartledge, Tillman, & Johnson, 2001), perhaps making schools safer but certainly not making communities safer nor furthering the education of the excluded students.

The individual system of EBS is designed to proactively provide behavior support to individual students who have discipline problems before reaching the point where dropping out, being expelled, or sent to an alternative placement are imminent for the individual student and also before a few individual students with serious behavior problems destabilize the school. The individual system of EBS is linked to the others systems. Improving the school-wide, classroom, and nonclassroom systems will reduce the number of individual students who stand out as having serious behavior problems, in part because, when most of the students accept and value school rules, positive peer pressure will have a beneficial effect. Interactions among students and peer attention are important aspects of school climate, whether in a positive or a negative way. A cohort of students that includes a few students with serious behavior problems whose needs are not adequately addressed, over time, will likely see a greater than typical

increase in disruptive behaviors for the whole group. Attending to an individual student who needs specially designed behavioral support helps not only that student, but also other students who spend time during the day with the student and may (a) be victimized, (b) retaliate, (c) imitate the student with the serious behavior problem, (d) observe how teachers handle behavior problems, and (e) imitate teachers' management strategies when dealing with interpersonal problems on their own.

### **The Study of Office Discipline Referrals**

The study of office discipline referrals (ODR) considers interactions among students, teachers, and administrators (Sugai, Sprague, Horner, & Walker, 2000). These records are important to examine because discipline referrals, like hospital records, prison records, and other institutional archival records, are real events of importance to all involved (Campbell, 1988). When students engage in defiance, violence, disruption, harassment, and other problem behaviors that come to the attention of school staff, records of the incidents usually are maintained. Although school discipline records traditionally have been written and maintained primarily for legal reasons and for staff reference, these records also can be useful sources of information in educational planning in that they can serve as an inexpensive and readily available way to identify students in need of PBS. Longitudinal research with boys identified as "antisocial" or "at-risk controls" (Walker, Stieber, Ramsey, & O'Neill, 1991, p. 44) has shown that records of discipline referrals in elementary and middle school have construct validity as a measure of elevated risk for persistent antisocial behavior (Walker, Shinn, O'Neill, & Ramsey, 1987; Walker, Stieber, and O'Neill, 1990; Walker, Stieber, Ramsey, & O'Neill, 1990, 1993; Walker, Colvin, & Ramsey, 1995). Both girls and boys who have discipline problems in middle school, without an effective positive intervention, are likely to continue to have discipline problems later, are at risk for emotional disorders, and are not likely to be on track for graduation when in high school (Tobin & Sugai, 1999a, 1999b).

The purpose of this report is to describe the results of an EBS research project that focused on one aspect of the individual system: in-service training in the use of FBA. The Individualized Positive Support (IPS) project started in the Fall of 1998 and continued for 3 years (Tobin, 1998). Preliminary results previously reported on IPS include (a) examples for practitioners of successful individualized interventions that emphasized frequent feedback and differential reinforcement of other behaviors (Condon & Tobin, 2001), (b) case studies of students whose discipline referral rates declined after their teachers learned about function-based support (Tobin & Martin, 2001), and (c) information on home-school cooperation (Tobin & von Ravensberg, 2001). The current report presents final results for all cohorts studied in five schools over the three years of the IPS project.

### **RESEARCH EXAMPLE: THE INDIVIDUALIZED POSITIVE SUPPORT PROJECT**

#### **Setting & Participants**

Participants included cohorts of students from five schools in one school district in a medium sized city in the Northwestern part of the United States. For this study, cohorts of students were studied on an aggregate level, according to grade levels over time, without identifying individual students. For example, for each school, students who were in Grade 1 in the 1998-1999 school year formed a cohort that became Grade 2 in 1999-2000 and Grade 3 in 2000-2001. All schools had kindergarten through Grade 5 classes. Six cohorts were studied over time for each school, two kindergarten cohorts and one each starting in Grades 1, 2, 3, and 4. Grade 5 for Year 1 did not form a cohort since it could not be followed for at least two years but it did contribute to an understanding of typical discipline referrals at the fifth grade level.

A total of 26 educators from 4 schools expressed interest in learning about FBA and related interventions and participated in in-service training: 20 certified teachers (3 special educators, 17 in general education) and 6 paraprofessionals. Paraprofessionals were

involved with providing behavioral interventions, remedial instruction, and/or playground supervision. The certified teachers were from all elementary grade levels, with the lower grade levels having slightly more representation than the higher grade levels. Two to ten staff members per school participated in the in-service training. We followed standard procedures for protecting the rights of human subjects and real school names and identifying demographic information are not used. Approximate numbers of students enrolled in kindergarten through Grade 5 for each of the five participating schools are indicated in Table 1. Student characteristics across the five participating schools were very similar, with the following averages (and standard deviations) for the percentage of students who were: (a) eligible for free or reduced lunch fees, 45% (6%); (b) White, 88% (5%); (c) Hispanic, 7% (4%); and (d) not able to meet state standards for reading achievement, 18% (6%).

Each school received ratings from the

of implementation of critical features of school-wide EBS. A trained, external evaluator administers and scores the SET. The areas assessed are as follows:

1. **Expectations Defined:** Are school-wide expectations defined and posted around the school?
2. **Behavioral Expectations Taught:** Has formal instruction occurred to teach the expectations? Do staff and students know the expectations?
3. **On-Going System for Rewarding Behavioral Expectations:** Is there a documented system for rewarding student behavior? Do students indicate they have received a reward over the last 2 months? Do staff members indicate they have delivered a reward for positive behavior?
4. **System for Responding to Behavioral Violations:** Does a documented system exist? Is there an agreement on office vs. classroom-managed problems? Is

**Table 1: School Sizes by Enrollment Range (Grades K – 5) and Year of Study**

	Kennedy	Adams	Jefferson	Madison	Lincoln
Year 1	350-399	450-499	400-449	350-399	400-449
Year 2	400-449	500-549	400-449	350-399	400-449
Year 3	400-449	500-549	400-449	350-399	350-399

state department of education assessing progress in meeting academic and behavioral goals. State assessments for Year 1 of the project were not available. From Year 2 to Year 3 of the study, all participating schools moved from “satisfactory” to “excellent” in state assessment of “school climate” which is a measure of inclusiveness and support for students with disabilities.

All participating schools developed an EBS approach to school-wide discipline and all achieved a score of 80% or higher on the Systems Evaluation Tool: School-Wide (SET-SW) (Sugai, Lewis-Palmer, Todd, & Horner, 1999) in the Spring of 2001. The SET-SW is a research instrument designed to assess the level

5. **Monitoring and Decision-Making:** Does the referral form list specific information for decision-making? Is there a system for collecting and summarizing discipline data? Do staff members receive reports about discipline? Do EBS team members report that data are used to make decisions?
6. **Leadership:** Is improving behavior one of the top three School Improvement Plan goals? Is there a behavior support team? Does the team represent the entire staff? Does the team have at least one person who can conduct functional assessments and implement related

plans? Is the administrator an active part of the team? Does the team meet at least monthly and report to the staff at least 4 times a year? Does the team have an action plan with specific goals?

7. **District Level Support:** Does the school budget include money for EBS support? Do team members know who the district EBS facilitator is? Is there a district-wide EBS training plan?

District level support for EBS increased during the course of the project. In Years 1 and 2, none of the questions about district support were answered affirmatively. However, in Year 3 each school could request up to \$1,000 from the district to support EBS related activities, the district employed an EBS facilitator, and an on-going EBS training plan was established.

## Method

Given that the independent and the dependent variables involved new technologies and/or new strategies or approaches that did not lend themselves to either traditional or single subject designs, methods used in this study were empirical but descriptive and exploratory. Both the independent and the dependent variables were measured, and relationships were examined quantitatively and qualitatively. Procedures are described in detail for possible replication.

## All Five Schools Used Charted Discipline Referral Data

The first year of the project, all schools used paper management procedures to document discipline referrals. The first author prepared charts of discipline referral data and provided information about how to use charts for making decisions about school-wide and individual student and staff needs. To help schools use school records systematically to screen for students with or at risk for EBD, directions for using chart templates and interpreting the charts of discipline referrals were developed in the first year of the project and given to each school (Tobin, Sugai, & Colvin, 2000). On going consultation also was provided. The charts illustrated monthly rate of office discipline

referrals per day per 100 students; types of infractions; types of consequences (e.g., suspension, detention); percentages of the student body receiving zero, one, and repeated referrals; students with the highest number of referrals; and other aspects of disciplinary situations. EBS teams used charts to communicate with others and develop and monitor action plans.

In the second year of the project, the first author trained three staff members at each school to use the School-Wide Information System (SWIS) (May et al., 2000; Todd & Horner, 2001, <http://swis.org>), a web based program for recording and charting discipline referral data. As had been done in Year 1, the charts generated by SWIS were used by the school staff members to make decisions about their school-wide discipline and to identify specific needs. However, school personnel were no longer dependent on having someone else prepare their charts because they could quickly and efficiently generate their own charts with SWIS.

## Independent Variable: Staff Development in Four Schools

### **Individualized Positive Support (IPS).**

The provision of in-service training to help teachers and educational assistants understand function-based behavior support was called *Individualized Positive Support (IPS)* and represented the independent variable. In 1998-1999, Kennedy and Adams (pseudonyms) received this intervention while Jefferson, Madison, and Lincoln, (pseudonyms) served as “wait list control” schools. In 1999-2000, Jefferson and Madison received the IPS intervention, Lincoln continued as a comparison school, and Kennedy and Adams shifted into the second, more independent or “follow up,” phase of the intervention.

### **“Educator Months” of Training.**

In-service training and technical assistance were provided to teachers and other school staff (e.g., paraprofessionals, specialists). Educators attended in-service training sessions after school for one hour, once a week. These small groups



or teams of educators expressed an interest in learning more about function-based support and were expected to help others in their building when on committees developing behavioral intervention plans (e.g. Teacher Assistance Teams, EBS teams). Sixteen of the 26 educators attended weekly sessions for 6 months. Five received 9 months of training and 5 received 3 months of training. The amount of training varied because some teachers were interested in more training than others (continuing education credit could be earned) and because paraprofessionals were assigned varied amounts of training by their employers. By school, multiplying the number of educators by the number of months of training (i.e., if 6 teachers attended IPS sessions for 6 months, then  $6 \times 6 = 36$  educator months), the amount of IPS in-service training each school received in “*Educator Months*” was as follows: (a) Kennedy, 18; (b) Adams, 36; (c) Jefferson, 45; (d) Madison, 36, and (e) Lincoln, 0.

#### **“Competing Behaviors” Approach.**

Although some differences in the format of the in-service training existed as the study progressed (see below), the “*Competing Behaviors*” approach to function based support was emphasized (O’Neill et al., 1997). The Competing Behaviors approach is based on the principle that under adequate schedules of reinforcement, appropriate behavior will be established and maintained (Skinner, 1953). Behaviors are said to “compete” based on the likelihood of attaining or avoiding something. If appropriate behavior leads to reinforcement that, from the student’s perspective, is more desirable or greater in amount, easier to obtain, and/or provided more quickly than the reinforcement that maintains the problem behavior, appropriate behavior might replace (i.e., successfully compete with) the problem behavior (Horner & Billingsley, 1988; Horner & Day, 1991; Neef, Shade, & Miller, 1994; O’Neill et al., 1997). Although the value of teaching and reinforcing replacement behaviors that are functionally equivalent to problem behaviors is well established as “best practice” in the field of developmental disabilities (e.g., Durand & Carr, 1991; Horner, O’Neill, & Flannery, 1993; Iwata, Dorsey, Slifer, Bauman, Richman, 1982;

Koegel, Koegel, & Dunlap, 1996; Lalli, Casey, & Kates, 1995), wider uses, including use in public schools with any student who has serious behavior problems, regardless of disability status, are relatively new (e.g., Artesani & Mallar, 1998; Condon & Tobin, 2001; Cowick & Storey, 2000; Heckaman, Conroy, Fox, & Chait, 2000; Kearney & Tillotson, 1998; Kern, Dunlap, Clarke, & Childs, 1994; Lane, Umbreit, & Beebe-Frankenberger, 1999; NASDSE, 1998; Reed, Thomas, Sprague, & Horner, 1997; Sprague, Sugai, & Walker, 1998; Sugai et al., 2000; Sugai, Lewis-Palmer, & Hagen, 1998; Sugai, Lewis-Palmer, & Hagen-Burke, 1999-2000; Tobin, 1994a, 1994b, 2000; Tobin & Martin, 2001; Tobin & von Ravensberg, 2001; Todd, Horner, Sugai, & Colvin, 1999) and not without difficulties (Nelson, Roberts, Rutherford, Mathur, & Aaroe, 1999; Sasso, Conroy, Stichter, & Fox, 2001).

**Content of the IPS Training.** The IPS training content emphasized a function based approach that highlighted (a) assessment of factors that triggered and maintained problem behavior, (b) environmental manipulations that decreased the effectiveness of consequences maintaining occurrences of problem behavior, and (c) instructional manipulations that increased opportunities for more acceptable alternative behaviors to be occasioned and maintained.

#### **“Intrinsic Motivation” Myths**

**Addressed.** The value of positive reinforcement was emphasized in terms of functionally equivalent reinforcers for specific competing behaviors and general incentives for appropriate behavior. In particular, myths about the negative impact of positive reinforcement on intrinsic motivation were addressed by providing data and logical explanations, for example, (a) positive reinforcement during childhood has long term benefits on reading (Flora & Flora, 1999), (b) criticisms of poorly designed attempts at behavior management featuring crude use of arbitrary reinforcers are not valid for “state-of-the-art” behavioral support interventions (e.g., based on FBA, using general case programming) (Reitman, 1998), and (c) the most recent and comprehensive meta analyses found “no

evidence for detrimental effects of reward on measures of intrinsic motivation” (Cameron, Banko, & Pierce, 2001, p. 21).

**First Year of Training.** In Year 1, the in-service training took the form of weekly didactic presentations to small groups of educators followed up with occasional individual behavioral consultations when a teacher requested specific help. In Year 1, these formal sessions were provided during Winter and Spring terms for Kennedy and Adams. Some informal sessions and behavioral consultations also took place in the Fall of 1998 and throughout the course of the project.

**Focus Group’s Advice.** A focus group consisting of the district behavior consultant, a school psychologist, and a school counselor, participated in meetings with the first author at the end of the 1999-2000 school year to clarify needs and to suggest future directions for the project. The focus group concluded that individual teachers needed additional training and practice with using effective classroom and behavior management strategies. As a result of the focus group discussions and on the basis of other data and information collected during the first half of the project, a decision was made to increase the level of participation required of teachers receiving in-service training. Participating school staff who were earning continuing education credit were required to (a) study and evaluate books and other new materials related to functional assessment and intervention; (b) identify a particular student for whom they would conduct a functional assessment (or work with others to do this); (c) fill out a form identifying the student’s competing behavior pathway and strategies for potential interventions (from O’Neill et al., 1997); (d) participate in discussions and problem solving activities using the format of a team meeting; and (e) develop a specific plan of support based on the functional assessment that they conducted, try the plan, and evaluate the results.

**Second and Third Years of Training.** During the 1999-2000 school year, a variety of resources were introduced to participating

school staff members, studied, and assessed for value in helping practitioners in schools conduct functional assessments and implement positive interventions. Resources included both print (e.g., Center for Effective Collaboration and Practice, 1998; Fad, Patton, & Polloway, 2000; O’Neill et al., 1997; Rolider & Axelrod, 2000; Tobin, 1994b; Witt, Daly, & Noell, 2000) and digital formats, including software programs (Hofmeister et al., 1999; Liaupsin, Scott, & Nelson, 2000) and Web sites (e.g., <http://pbis.org>, <http://www.air.dc.org/cecp>). In the 2000-2001 school year, as a result of the previous year’s efforts, a more streamlined version of an in-service was developed and provided in the fall when Jefferson requested additional training.<sup>5</sup>

The functional assessments the teachers conducted followed the recommendations in O’Neill et al. (1997), Tobin (1994b), and/or Witt, Daly, and Noell (2000). When teachers were working alone, the assessments were simple and based primarily on interviews, records reviews, and the informal observations that teachers could do while teaching. In some cases, teachers were working with Educational Assistants under the direction of a district behavior specialist and more formal observations were included. Interventions typically involved modification of environmental variables directly under the control of the teachers, many of whom were surprised to learn that their attention, even when scolding or redirecting, was a powerful reinforcer for some children. In such cases, the teachers generally were successful in shifting their attention by using strategies involving differential reinforcement of other behaviors (Condon & Tobin, 2001).

#### **Dependent Variable: Discipline Referrals**

**Reliability of SWIS Assessed.** The reliability of the discipline referral data was examined by comparing, item by item, information recorded on the original paper referral with information recorded in the

<sup>5</sup> This version of IPS has been adapted for use as an on-line, distance education course; more information is available at <http://darkwing.uoregon.edu/~ttobin>.

computerized SWIS database. A random sample of students with frequent discipline referrals was selected for this analysis. We also checked the reliability of students' records for individuals participating in case studies because they received function-based support, even if they did not have frequent discipline referrals (Tobin & Martin, 2000). The average reliability for the referrals for both groups combined was determined for each participating school. First, data collectors determined if there was an "Office Discipline Referral (ODR) Match or Miss." A match was scored when an ODR listed in the SWIS database could be matched with one located on paper in the office file and vice versa (i.e., the description and information were exactly or almost exactly alike on both paper and electronic records). A "miss" was recorded if no match could be found; this could be either because no paper record was found that matched the electronic record, or because a paper record was found for which there was no electronic match. The following formula was used to calculate percent agreement:  $((\text{Match}/(\text{Match} + \text{Miss})) \times 100)$ .

For the "matched" records, we also determined the extent to which they had (a) exactly the same dates and location and (b) substantial agreement on behavior problem and administrative decision. Paper referrals generally include multiple administrative actions (e.g., suspension, written apology required) and multiple student offenses per incident (e.g., hitting, name calling). In the SWIS reports we used, only the most serious behavior (e.g., hitting) and the most serious administrative action (the suspension) would be listed<sup>6</sup>. A data decision rule was established that it was an "agreement" if the one behavior (or administrative action) in SWIS was also on paper and a more serious one was not also on the paper. Data collectors agreed in advance that behaviors were more serious if more dangerous (e.g., bringing a gun would be more serious than hitting), and more restrictive and intrusive administrative actions were more serious (e.g.,

an expulsion hearing would be more serious than a suspension).

**Validity of SWIS Assessed.** IPS Project Teacher Questionnaires were distributed in Year 2 and Year 3 to determine teachers' perceptions of students' behavior problems and the strategies used in individualized, positive interventions (Tobin, 2001). In Year 2, questionnaires were given to teachers and other school personnel who were identified by the district behavior specialist as having been involved in individualized interventions. In Year 3, questionnaires were given to all staff members involved in teaching and a question was added to determine the validity of discipline referrals as a measure of student behavior: "*If you have been teaching at the same school for at least two years, do you think the students' behavior is getting worse or better? Please explain what you mean and what reasons you have for your opinion.*" The IPS Questionnaire also was used to determine if the educator had used FBA in providing support to an individual student and found it to be helpful.

#### **Whole School Rates: Method**

Whole school rates of ODR were determined every month, using the following formula:

$$((\# \text{ ODR per month} / \# \text{ school days in the month}) / \# \text{ of students enrolled}) \times 100 = \text{ODR Rate per day per 100 students for the month.}$$

#### **Cohort Analysis: Description and Rationale for Method**

For the cohort analysis, six cohorts that could be followed for at least two years were identified. The first five were the classes that started in Year 1 of the study in Kindergarten through Grade 4. The Year 1, Grade 4 cohort was followed through fifth grade and the others were followed for three years. The final cohort for each school was the Kindergarten class starting Year 2 of the study and followed through first grade. The percentage of the whole school's discipline referrals that were for

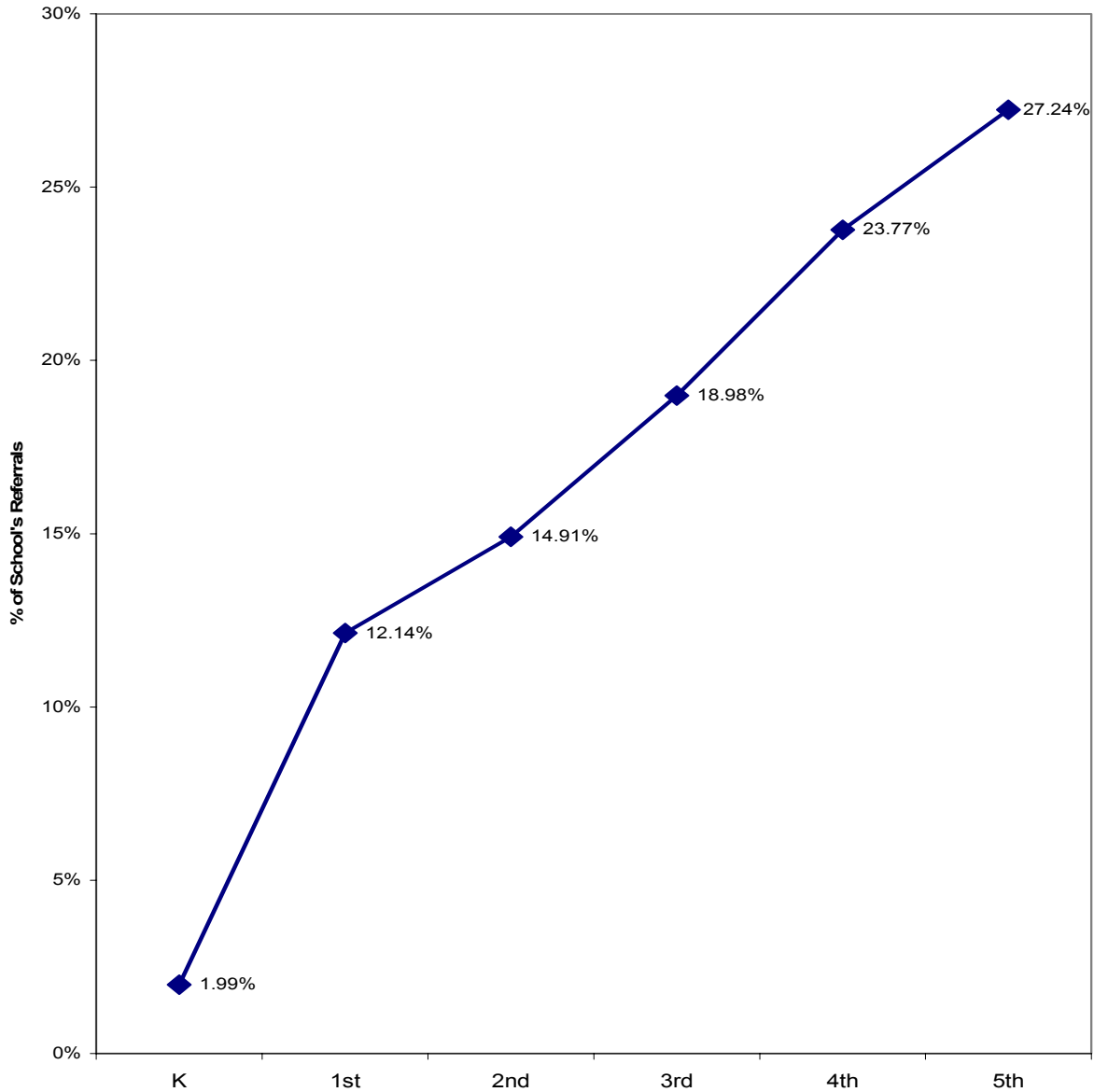
<sup>6</sup> Current versions of SWIS provide options for reporting multiple infractions and administrative actions.

students in each cohort, year by year, was determined. To determine what percentage would be expected at each grade level, (e.g., what percent of an elementary school's referrals

the study was determined and charted (see Figure 1).

For the cohort analysis, each cohort's

**Figure 1. Typical percent of whole schools' referrals for each grade level**



typically come from 5th graders?), the average percentage of their whole schools' referrals for each grade level for all schools for all years of

percentage of the school's referrals for the years it was in the study was charted and compared to typical percentages for those grade levels. The

question, “Did this cohort improve, or keep its percent low, over the time period studied?” was answered “Yes” if (a) the percentage of the school’s referrals from the cohort remained (or became) lower than typical or (b) the cohort had a higher than typical percentage in Year 1 and/or Year 2 but reversed the trend in Year 3. The number of cohorts per school who improved or maintained a low level of referrals was compared to the number who did not and to the amount of IPS training for the school in terms of

terms of administrative policies that affect referral rates. Looking at the percent of the whole school’s referrals from a particular class cohort within that school controls for the administrator’s influence because, within a school, all class cohorts have the same administrator. Even when administrators change from one year to the next, the class cohorts in that school all experience the same change and the percent of the whole school referrals generated by a cohort is not influenced by

**Table 2: Reliability as Percent Agreement between SWIS and Paper Records**

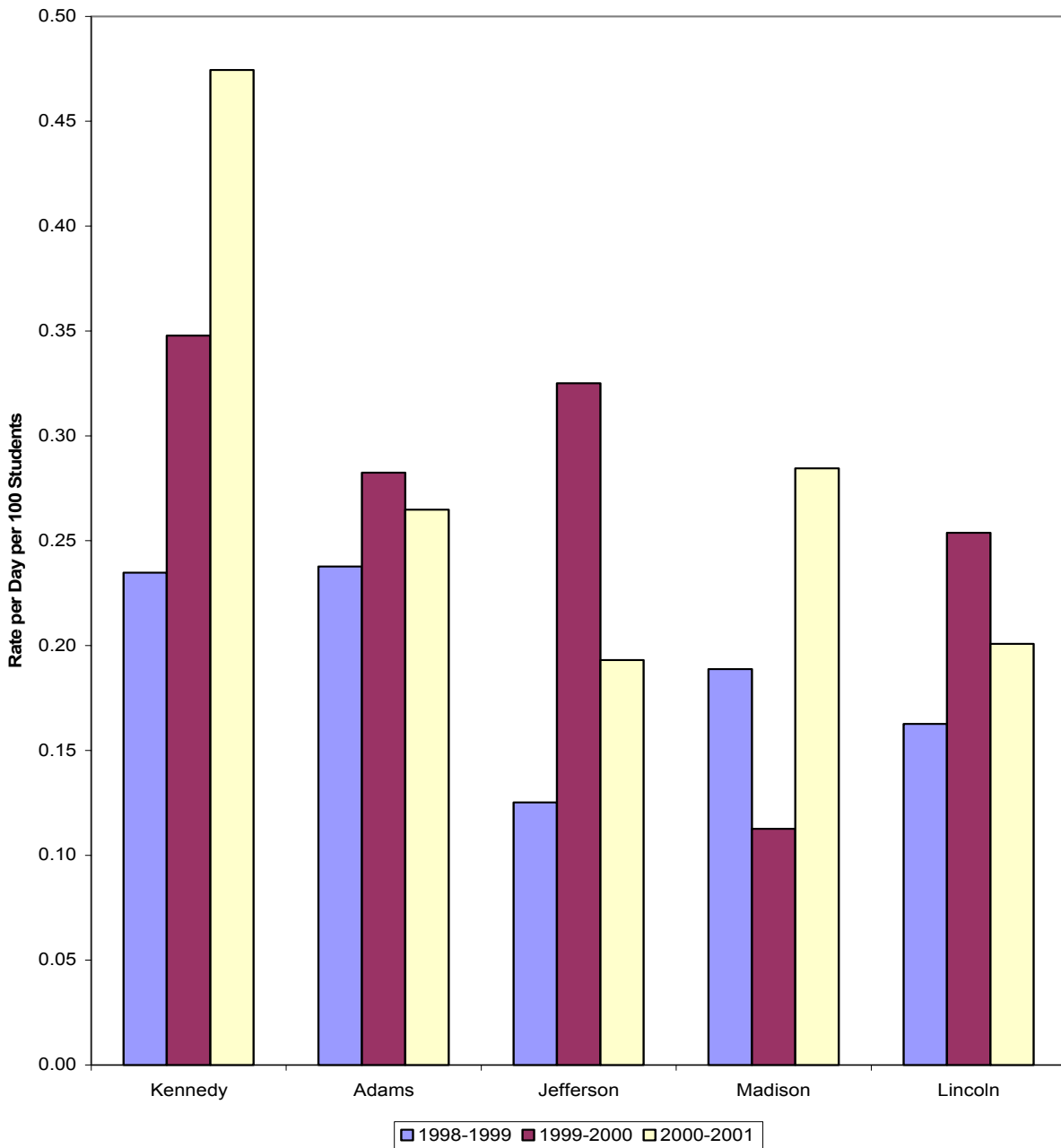
	ODR MATCH?	Date	Location	Behavior	Admin Decision
<b>Kennedy</b>					
# Disagree	10	2	1	2	3
# Agree	49	46	47	46	45
% Agree	83.05%	95.83%	97.92%	95.83%	93.75%
Total	59	48	48	48	48
% Observed	16.30%				
<b>Adams</b>					
# Disagree	5	12	2	3	0
# Agree	24	12	22	21	24
% Agree	82.76%	50.00%	91.67%	87.50%	100.00%
Total	29	24	24	24	24
% Observed	11.74%				
<b>Jefferson</b>					
# Disagree	9	2	2	1	1
# Agree	52	45	45	46	46
% Agree	85.25%	95.74%	95.74%	97.87%	97.87%
Total	61	47	47	47	47
% Observed	40.94%				
<b>Madison</b>					
# Disagree	1	4	5	1	3
# Agree	61	57	56	60	58
% Agree	98.39%	93.44%	91.80%	98.36%	95.08%
Total	62	61	61	61	61
% Observed	30.85%				
<b>Lincoln</b>					
# Disagree	3	1	3	0	0
# Agree	15	14	12	15	15
% Agree	83.33%	93.33%	80.00%	100.00%	100.00%
Total	18	15	15	15	15
% Observed	13.33%				
<b>For All Schools:</b>					
Average					
(St. Dev.)	86.56%	85.67%	91.43%	95.91%	97.34%
	(6.69%)	(19.98%)	(6.92%)	(4.93%)	(2.85%)

the “educator months.”

One factor that affects the whole school is the attitude and policy of the administrator, who easily can encourage or discourage teachers to write more or fewer referrals. By looking at the percent of the whole school referrals each class cohort generates, it is possible to compare across schools, even when schools differ in

administrator change in the same way that raw number of referrals for the whole school would be. That is, even if a new administrative policy or attitude causes teachers to write more (or fewer) referrals, the class that is the most troublesome will still have the greatest percentage of the referrals and the class that is the least troublesome will still have the smallest percentage. Thus, a cohort analysis reflects the

**Figure 2. Average rate of Office Discipline referrals per day per 100 students for 5 schools over 3 years**



combined influences of (a) student behavior, (b) peer-to-peer influence, and (c) teacher-student interactions, all factors expected to be affected by in-service training for a school-based team of teachers on function-based support, while

minimizing the effects of changes in administrative policies.

## RESULTS

### SWIS Reliability and Validity

**Comparison with Paper Records for Reliability.** The average agreement for all schools for matching paper and electronic records was 86.56% (s.d., 6.69%) (see Table 2). When the electronic and the paper databases did not agree, it was slightly more likely that the referral would be in SWIS but not in the paper file. The number of referrals that could be checked varied from a low of 11.74% at Adams to a high of 40.94% at Jefferson, with the average percentage of all referrals checked being 22.63%. Of the details examined on the matched referrals, the highest agreement was on the Administrative Action (97.34%) and the lowest was on the date (85.67%).

**Comparison with Teacher Perceptions for Validity.** Teachers who had been at the same school for at least two years and who responded to the IPS questionnaire in the Spring of 2001, were asked, "Was student behavior better, the same, or worse compared to last year?" Of the 28 of the educators who responded to this question, 57% of respondents perceived that student behavior was better, 11% felt that it stayed the same, 25% felt that it was worse, and 7% were unable to say whether there was a change. Respondents who said that behavior in their school was getting better most often said that their school worked as a team, more school-wide practices were in place, and positive reinforcement was given to the students. One respondent stated:

"There is a school-wide focus to teach, recognize, and reward ... [behavioral expectations] and applied problem solving. All of our school community -- students, teachers, and parents -- have raised levels of awareness. It is resulting in positive peer support and high standards for behavior with caring, individualized assistance to those who exhibit problem behaviors." (1<sup>st</sup> anonymous respondent to the IPS Teacher Survey, 2001.)

Respondents who felt that behaviors had worsened generally indicated reasons outside the school. Most respondents who perceived

behaviors in their schools as being the same or worse said that they were dealing with students with more high intensity behaviors and with dysfunctional families. For example, one stated:

"[Worse, but it is] not a reflection of how our school's EBS system is working – it's a reflection of our society, and this change in the severity and number of behavior problems is what drives our EBS system. We have a very active EBS team, focusing on a positive school climate, and zeroing in on kids who need additional support. I still feel, however, that we don't always have the help needed for some of these kids." (2<sup>nd</sup> anonymous respondent to the IPS Teacher Survey, 2001.)

Average yearly rates of discipline referrals per day per 100 students are shown for all 5 schools for all 3 years of the project in Figure 2. To compare these rates with the teachers' perceptions, note the change between the 1999-2000 and 2000-2001 school years. Adams, Jefferson, and Lincoln show lower rates, while Kennedy and Madison show higher rates. In three of the four schools that received the IPS intervention (Adams, Jefferson, and Madison) more than 75% of the respondents to the teachers' questionnaire perceived that student behavior was better than last year. Sixty-three percent of respondents from Kennedy reported that student behavior in their school was worse than last year. Two-thirds of the respondents from Lincoln felt that student behavior was better than last year. Teachers' perceptions at Kennedy, Adams, Jefferson, and Lincoln were in line with their office discipline referral rates. In contrast, referrals at Madison increased yet teachers perceived improved behavior. An anonymous Lincoln respondent who, unlike the other respondents from Lincoln, felt that behavior was worse, commented on possible discrepancies between discipline referral rates and actual behavior problems, although in the opposite direction from the situation at Madison:

"It seems that there are less referrals written, but I wonder if some of this is because we are ignoring a lot of the misbehaviors. In some ways the behaviors are worse because the students are not always made accountable for

**Table 3: Cohort Analysis Summary:**

	Did This Cohort (C #) Improve (or Keep Its Percent Low) Over the Time Period Studied? <sup>a</sup>				
	Kennedy	Adams	Jefferson	Madison	Lincoln
1st Kindergarten	C10a	C20a	C30a	C40a	C50a
(in 98-99)	No	Yes	Yes	Yes	Yes
Grade 1	C11	C21	C31	C41	C51
(in 98-99)	Yes	Yes	Yes	Yes	No
Grade 2	C12	C22	C32	C42	C52
(in 98-99)	Yes	Yes	Yes	No	No
Grade 3	C13	C23	C33	C43	C53
(in 98-99)	No	Yes	No	No	Yes
Grade 4	C14	C24	C34	C44	C54
(in 98-99)	Yes	Yes	Yes	Yes	No
2nd Kindergarten	C10b	C20b	C30b	C40b	C50b
(in 99-00)	No	No	Yes	Yes	Yes
Total (%) "Yes"	3 (50%)	5 (83%)	5 (83%)	4 (67%)	3 (50%)
Total "No"	3	1	1	2	3
Educator Months <sup>b</sup>	18	36	45	36	0

Notes: <sup>a</sup> The questions are answered by visual analysis of Figures 1 and 3 – 7; comparing the percent of the school referrals for the cohort with typical percents for each grade level and the patterns of trends.

<sup>b</sup> "Educator Months" are based on the number of educators who participated in the IPS in-service training multiplied by the number of months of training each received.

their actions.” (3<sup>rd</sup> anonymous respondent to the IPS Teacher Survey, 2001.)

behaviors in their school were worse this year, 43% had used functional assessment and found it to be helpful, while 14% had used functional assessment and did not find it helpful.

**Whole School Rates**

Rates varied between and within schools. Adams’ rates were most stable, ranging from 0.24 to 0.26. Kennedy’s were most variable, ranging from 0.23 to 0.47. All schools had higher rates in Year 3 than in Year 1. Rates for Year 2, the year that SWIS was introduced, were higher in all schools except Madison.

**Cohort Analysis**

Results of the cohort analysis for each school are presented in Figures 3 – 7 and an overall analysis, based on these figures, is presented in Table 3, below. In comparison with the percent of a school’s ODR typical at each grade level, both of the Kennedy kindergarten classes (Cohort 10a and 10b), and the 3<sup>rd</sup> grade class from 1998-1999 (Cohort 13), have a greater percent of the school’s referrals than would be expected (see Figure 3). The 1<sup>st</sup>, 2<sup>nd</sup>, and 4<sup>th</sup> grade classes from 1998-1999 (Cohorts 11, 12, and 14), however, all improved in Year 3 by reversing a rising trend.

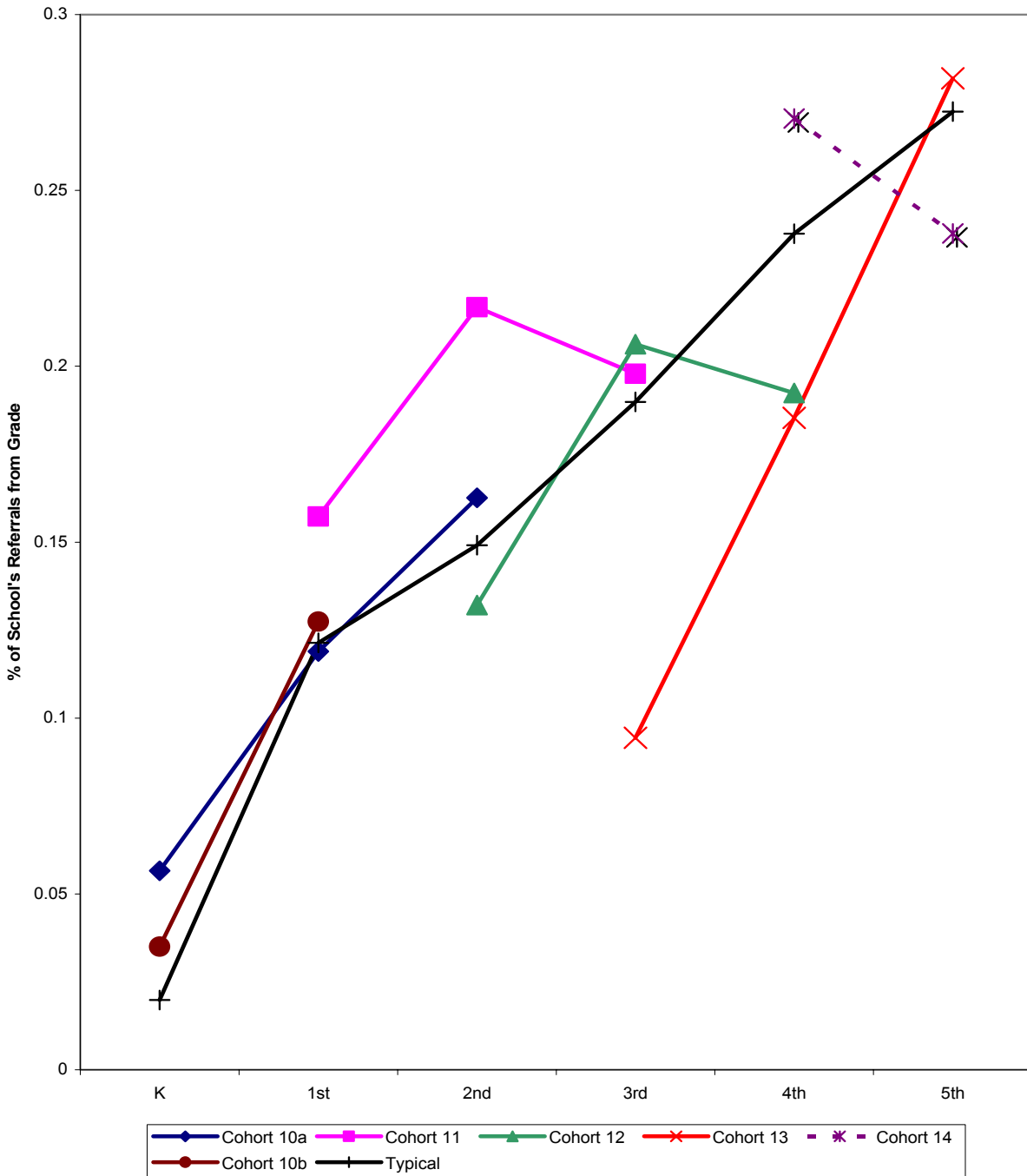
**Functional Behavioral Assessment Considered Helpful**

The IPS Teacher Survey results provide some evidence that FBA was generally considered helpful in improving student behavior. Twenty-eight respondents (62%) reported using functional assessment. Of the respondents who said that behaviors in their school were better this year, 69% had used functional assessment and found it to be helpful. Of the respondents who said that students’ behavior in their school was the same this year as last year, 67% had used functional assessment and found it to be helpful. No respondents in either of these groups who used FBA did not find it helpful. Of the respondents who said that

Every Adams cohort, kindergarten through Grade 4 (Cohorts, 20a, 21, 22, 23, 24) that started in 1998-1999 either remained below typical levels of ODR or improved by reversing a rising trend (Figure 4). However, the kindergarten cohort that started in 1999-2000 (Cohort 20b) had an unusually sharp rise the next year in the percent of the referrals for students in kindergarten through Grade 5. This



**Figure 3. Kennedy's Cohorts' Percents of All ODRs Compared to Typical Grade Level Percents**



cohort contributed 28.03% of the referrals for the elementary grades when they were in first

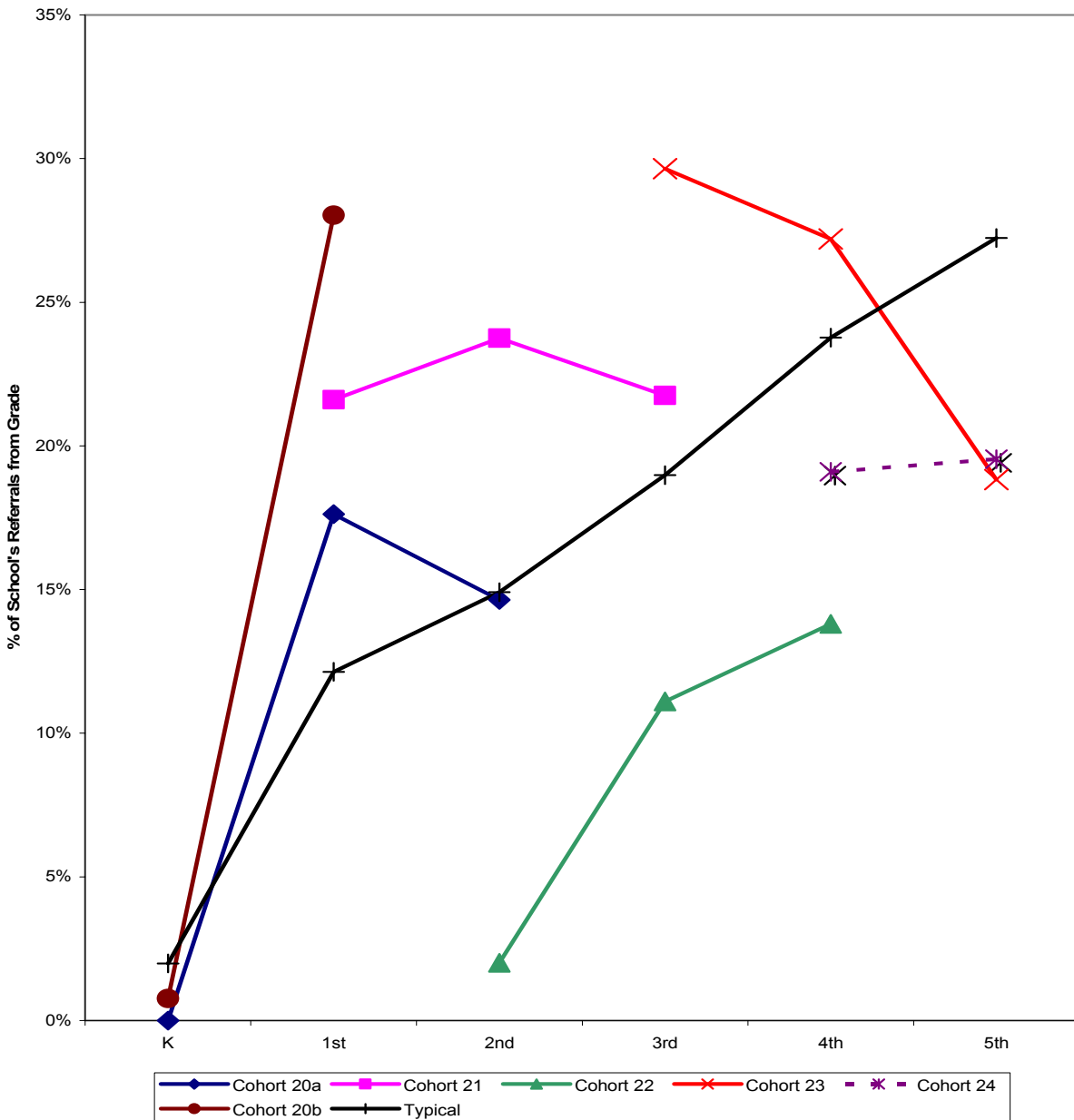
grade. In contrast, a typical first grade would contribute only 12.14%.

For Jefferson, every cohort's percentage of the whole school's discipline problems is lower than would typically be expected, with the exception of the class cohort that was in Grade 3 in 1998-1999 (Cohort 33) (Figure 5). This Grade

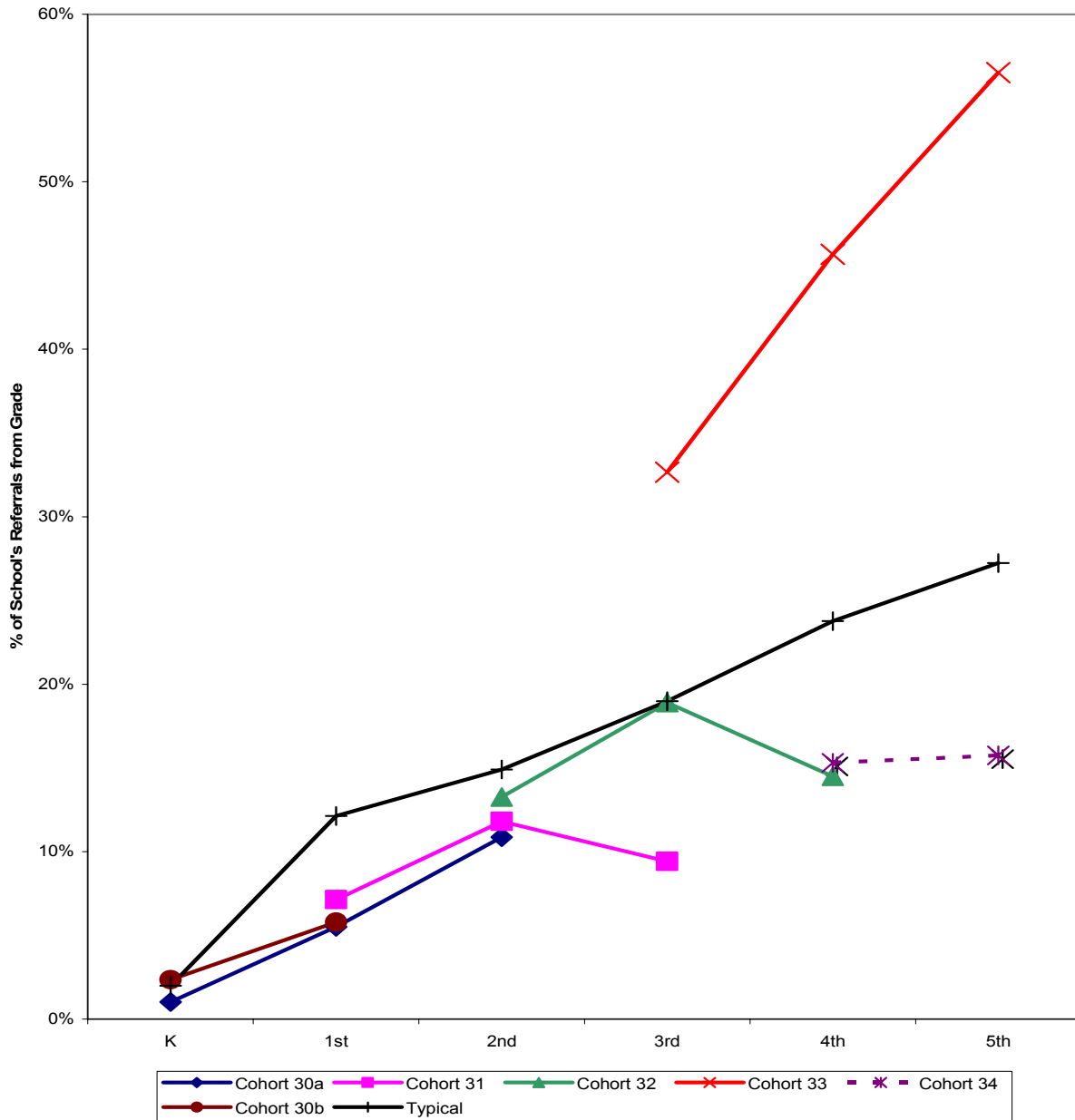
3 cohort, however, has an extremely high percent of the school's referrals, much higher than any of the other school's Grade 3 cohorts.

For Madison, three of the cohorts

**Figure 4. Adam's Cohorts' Percents of All ODRs Compared to Typical Grade Level Percents**



**Figure 5 Jefferson's Cohorts' Percents of All ODRs Compared to Typical Grade Level Percents**



starting in 1998-1999 reversed rising trends (that year's kindergarten class, Cohort 40a; the first grade class, Cohort 41; and the fourth grade class, Cohort 44) (Figure 6). The second and third grade classes from 1998-1999 (Cohorts 42 and 43), however, show rising trends and a higher than typical percentage of the school's

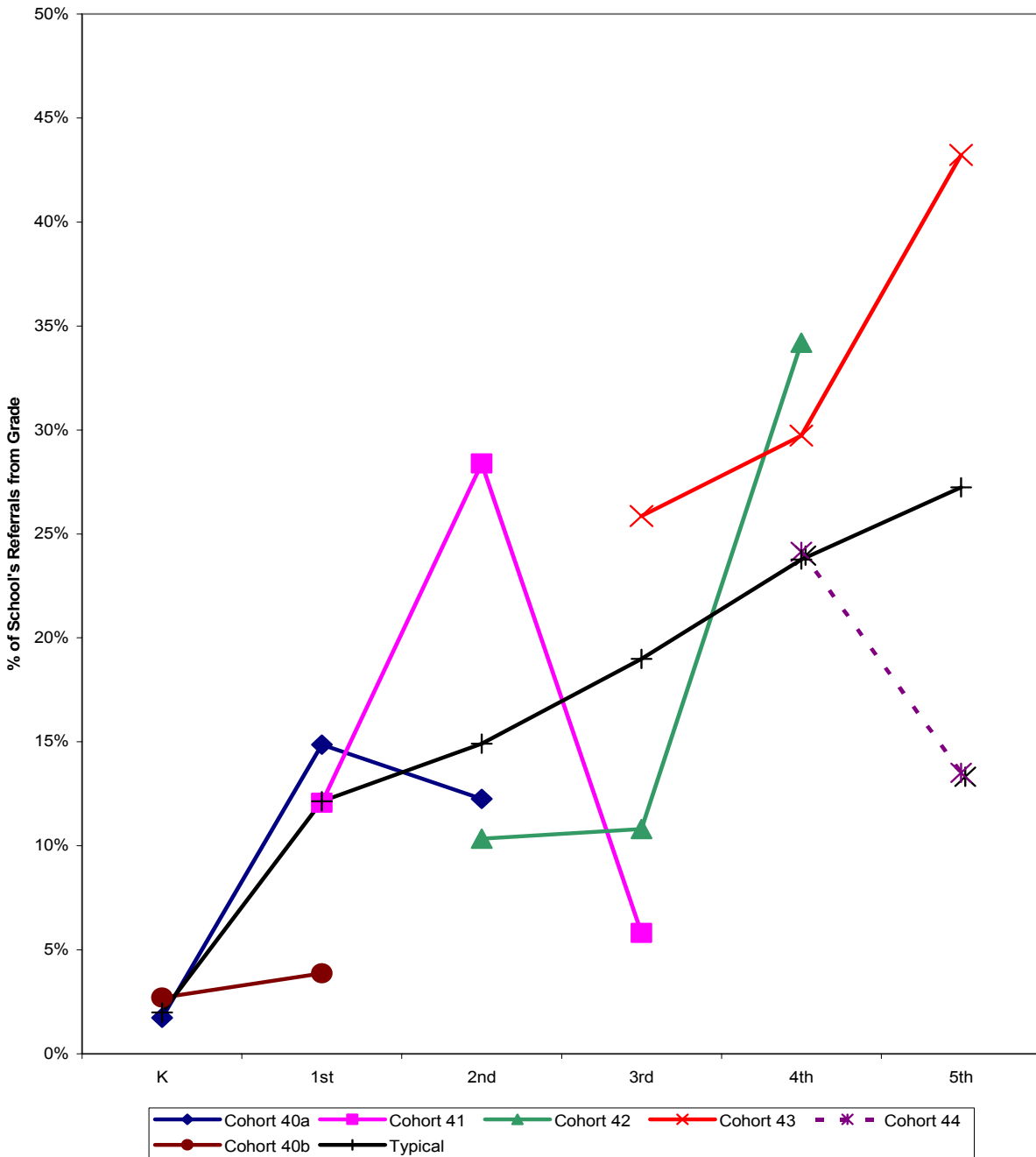
referrals. The kindergarten class that started in 1999-2000 (Cohort 40b) shows a lower than typical percent in their first grade year.

Both kindergarten cohorts at Lincoln (Cohorts 50a, 50b) had lower than typical

percentages of the school's referrals (Figure 7). The first grade cohort (Cohort 51), however, while starting out with a lower than typical percentage, had a steep increase and two years later was well above the typical percentage for grade level. The second grade cohort (Cohort

52) was low for two years but on reaching 4<sup>th</sup> grade, was higher than typical. The third grade cohort (Cohort 53) started high but reversed itself. The fourth grade cohort (Cohort 54) started out with a typical percent but had a higher than typical percentage the next year.

**Figure 6. Madison's Cohorts' Percents of All ODRs Compared to Typical Grade Level Percents**

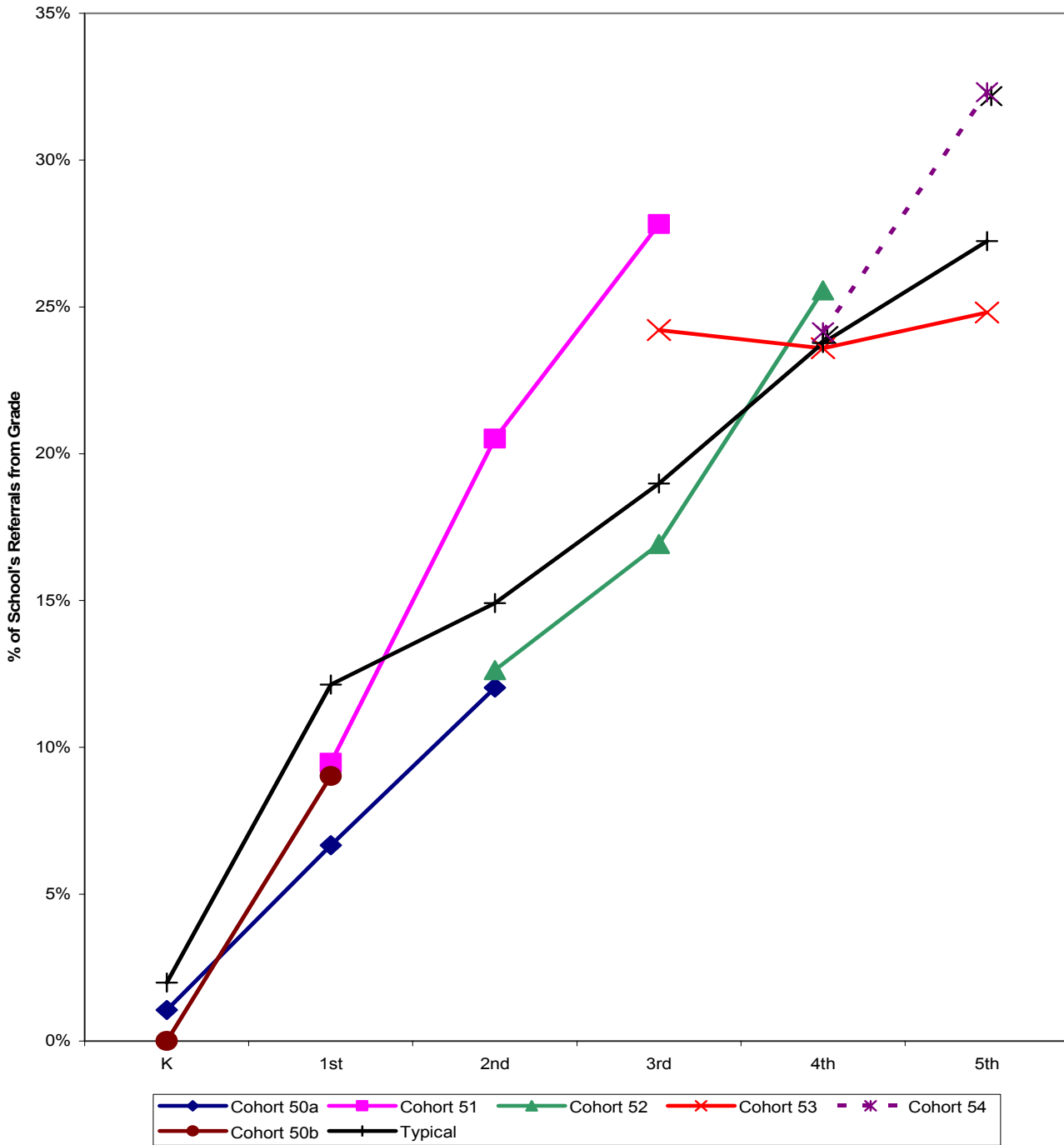


**Summary of Cohort Analysis**

At Adams and Madison, schools with 36 Educator Months of IPS training, 5 out of 6 cohorts and 4 out of 6, respectively, improved or

remained low in terms of their percentage of their school's discipline referrals (Table 3). At Jefferson, with 45 Educator Months of training, 5 out of 6 cohorts improved or remained low.

**Figure 7. Lincoln's Cohorts' Percents of All ODRs Compared to Typical Grade Level Percents**



Kennedy and Lincoln had the fewest Educator Months of IPS training and half the cohorts improved or remained low, while half did not. In-service training involving 36 Educator Months (e.g., 6 educators attending a 6 month series of 1 hour weekly sessions) or more appears to be helpful. The lower level, 18 Educator Months (e.g., 2 educators attending a 9 month series of 1 hour training sessions) had the same results, in terms of effect on cohorts, as the school that did not participate in the IPS training.

#### DISCUSSION OF INDIVIDUALIZED POSITIVE SUPPORT PROJECT

The IPS project examined the effect of in-service training in function-based support for teachers and Educational Assistants on office discipline referrals for cohorts of elementary school students. Thirty cohorts of students, starting in Kindergarten through Grade 4, were studied in terms of their percentage of schools' discipline referrals over a three year period. Five schools participated in the study and all were using the EBS approach with an 80% or higher level of implementation of the school-wide system by the last year of the project. In the second year of the project, all five schools implemented SWIS, a computerized system for recording and charting discipline referrals. Four of the schools also participated in the in-service training on function-based support, with a range of 2 to 10 staff members per school receiving training.

#### Summary of Key Findings

In general, we see three main and interesting findings from this study:

1. Average reliability for SWIS (Versions 1 and 1.5) data entry across 5 schools, when compared to the original paper referrals, was 86.56% (s.d., 6.69%).
2. For 4 out of 5 schools, changes in school-wide discipline referrals as shown by SWIS were validated by teachers' perceptions of changes in students' behaviors.
3. Schools where 6 or more staff members participated in training in function based support had more cohorts of students

who improved or remained low in comparison to typical grade level expectations, in terms of their percentage of their school's discipline referrals, than schools where fewer staff members participated in the training.

#### Comments on Discipline Referrals, Administrators, and SWIS

IPS originally was designed to use in-service training for staff in function-based support as the independent variable and discipline referral data primarily as a dependent variable. Ordinarily, collecting discipline referral data, or any archival data, has an advantage over more intrusive forms of data collection in that reactivity is lessened. However, the introduction of an efficient computerized system for analysis of discipline referral data, SWIS, appears to have functioned as an independent variable at the school-wide level and to have increased reporting due to heightened awareness and interest in discipline referrals.

Whole school numbers and rates are strongly influenced by administrators' interests, preferences, and policies regarding discipline referrals. Although EBS calls for administrators and teachers to proactively agree on which behavior problems should result in an office discipline referral and which should be managed by the teacher, we found considerable variation in the way administrators communicated with teachers about discipline referrals. For example, one administrator tended to discourage teachers from referring often, for example, by sending referrals back to teachers with notes saying, "This is something you should be able to handle yourself." In contrast, another administrator would go from classroom to classroom, asking the teachers for documentation of students' offenses. Anecdotally, one staff member commented that the administrator would seem annoyed if the teacher had not written up any problem behaviors. In yet another school, the administrator strongly encouraged all staff to document and praise appropriate student behavior by handing out "positive" notes. These notes could be entered into a lottery for prizes donated to the school by community businesses

and awarded in an assembly program that reportedly generated considerable excitement among both students and staff. In contrast, in most schools, students are asked to take positive notes home, with the hope that parents would take time to praise the child and provide reinforcement. These examples of different administrative approaches illustrate the difficulty with comparing whole school discipline referrals. In the current study, these differences were accentuated by the introduction of SWIS because some administrators were more interested in SWIS than others.

Future research should study, describe, and measure administrators' attitudes, policies, interests, and procedures more systematically than was done in this study. Our observations and results suggest that not only do administrators have a strong influence on the total number of discipline referrals written, they also have a strong influence on how accurately records are kept. With regard to the reliability of SWIS, office procedures undoubtedly affected the results. For example, when a referral was found in SWIS but not in the paper file, probably a paper referral existed and just had not been filed yet. Some schools establish a protocol for turning in and filing office discipline referrals and make sure that everyone understands the system. Other schools are more informal and may file paper referrals without first entering into SWIS. Likewise, accuracy of dates depends on training the person who enters data to consistently use the date of the student's infraction rather than the date of the administrator's action. However, the overall accuracy of the SWIS data entry for the schools in this study was probably underestimated because of the small sample size used for reliability checks in three of the schools. In the schools where a higher percentage of the total number of referrals was checked, the agreement between the paper and electronic records was higher (e.g., Jefferson, Madison) than in the schools where the sample was smaller.

A limitation of this study was the lack of multiple measures of student behavior. If systematic observations of student's behavior had been made throughout the study, it might

have been possible to determine if an increase or a decrease in discipline referrals corresponded to an increase or a decrease in problem behavior. Although teacher perceptions tended to agree with the SWIS changes, as one of the teachers pointed out, fewer referrals might mean that misbehavior is being ignored. Also, if an increase in referrals occurs because teachers write up behaviors they previously ignored, the overall amount of misbehavior might decline. Without multiple measures, it is difficult to say when a change reflects a change in students' behavior and when it reflects a change in staff behavior.

Another Limitation was the difference in months of training received by the educators at different schools. However, the use of "Educator Months" (number of educators trained multiplied by number of months of training) and the use of the school as the unit of analysis, made it possible to compare across schools. However, future research should investigate further the duration of staff development needed as a separate measure from the number of school staff members trained.

#### COMMENTS ON IN-SERVICE TRAINING IN FUNCTION-BASED SUPPORT

The competing behaviors approach was logical for school-based prevention efforts because of its (a) focus on factors that teachers can change, (b) easily recognized applications in school setting, (c) emphasis on teaching and developing fluency, (d) recognition that setting events might include factors in the home or outside the direct control of school staff, (e) ability to stimulate creative problem-solving, and (f) potential for providing a foundation for behavioral gains that will maintain and generalize to other settings as the child comes to recognize the value of the appropriate and alternative behaviors. We found the competing behaviors conceptual framework encouraged trying new interventions. However, it was still difficult for many teachers to develop and use effective, function-based, positive, behavioral interventions. Given the many responsibilities that teachers have, and the intensity of many students' challenging behavior problems, we

conclude that schools need to enlist the help of behavior specialists willing to work with teachers.

### Implications for Behavior Therapists

Behavior therapists have much to contribute to schools interested in serving all students, including those with, or at risk for EBD. Although many schools currently do not have systems in place that facilitate collaboration with behavior therapists, that situation may change. Schools need to develop relationships with behavior therapists who are knowledgeable about FBA and PBS and willing to work with teachers to design interventions that teachers can implement.

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## INSTITUTIONALIZING BEHAVIOR-BASED SAFETY: THEORIES, CONCEPTS, AND PRACTICAL SUGGESTIONS

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### Abstract

This paper describes issues related to the institutionalization of behavior-based safety interventions. Key theoretical positions are discussed, practical suggestions are made, and preliminary data are presented. It is suggested that institutionalization requires an understanding of the relationship between how people talk about safety and how they manage safety on a daily basis. Furthermore, to increase the probability of institutionalization, it is argued that we must first intervene at the level of the controller of contingencies. Finally, it is claimed that institutionalizing behavior-based safety starts in our graduate training programs and requires that we train students to communicate the principles of behavior analysis more effectively.

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The Occupational Safety and Health Act of 1970 was a catalyst for psychological research related to proactive injury reduction. Initial research consisted of examining behavioral and psychological factors related to exposure of workers to toxic substances, workers' abilities to detect occupational hazards, individual differences related to injury proneness and job stress, and intervention techniques for improving occupational safety and health behaviors (Cohen & Margolis, 1973).

Early attempts to increase safety relied heavily on engineering strategies (Guastello, 1993) or a redesign of the environment. These strategies were often paired with enforcement procedures that provided disincentives or announcements of punitive consequences for not obeying policy. Policies, if consistently enforced, can be effective. However, in the domain of occupational safety, applications of punitive consequences for inappropriate behavior are inconsistent and rare, and when they are delivered, occur too late to be effective.

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Thus, the success of these programs has been modest at best.

For the purpose of this paper, safety is defined as injury control. And, injuries are the permanent products (Cooper, Heron, & Heward, 1987) or outcomes of behaviors in the context of a dynamic physical and social environment. Behavior-based safety (BBS) presumes that promoting safe behaviors will reduce the frequency of at-risk behaviors that lead to injuries and thus result in a decrease in injuries (Reber & Wallin, 1983). The challenge of institutionalizing BBS is to produce long-term changes in environmental contingencies that will result in a reduction of work-related injuries. This paper will detail theoretical and practical issues involved in the institutionalization of BBS.

To explore factors that facilitate institutionalization of BBS requires an understanding of both overt safety-related behaviors and corresponding verbal behaviors, and how contingencies in the organization exert control over each. In addition, we must have an operational definition of institutionalization. Boyce and Geller (2001) defined institutionalization by making it distinct from the concept of "maintenance," which they defined (in the context of increasing safe behaviors) as the occurrence of one or more target behaviors above baseline levels of performance after the withdrawal of contrived intervention contingencies. They suggested for

maintenance to be claimed, levels “above baseline” need to be detectable through visual inspection of time-series data or reported in terms of statistical significance. This definition was distinguished from the concept of “institutionalization,” which Boyce and Geller (2001, p. 33) defined as the “continuation of program-related contingencies by on-site workers after outside intervention agents or researchers have left the setting.” This concept seems to parallel Holland’s (1978) argument that we must intervene at the level of the controller of local contingencies, not at the level of the local contingencies controlling worker behavior, if we want to institutionalize BBS.

Thus, according to Boyce and Geller (2001), like maintenance, institutionalization is not necessarily a natural by-product of behavior change techniques, but needs to be programmed using variations of the presentation or removal of behavioral antecedents and consequences that affect how safety is managed on a day-to-day basis. Boyce and Geller (2001) provided an account of *maintenance* in terms of generalization technologies (Stokes & Baer, 1977) applied to generalization of behavior change across time. This paper was a bit controversial and prompted several commentaries which were also published in the same volume (Baer, 2001; Fleming, 2001; Malott, 2001; McSween & Matthews, 2001). Interestingly, the responses to Boyce and Geller’s (2001) paper on technologies of maintenance shared a common theme. Specifically, they suggested institutionalization of behavioral safety interventions is as important as selecting interventions that produce enduring behavior change. In practice, however, selecting interventions that produce enduring behavior change may indeed facilitate “institutionalization” of behavior-based safety. Thus, from our perspective maintenance and institutionalization are necessarily related.

For example, we could set up a behavioral feedback process that shows workers’ progress toward a specific attainable safety-goal. The goal, an antecedent, may alter the function of feedback (previously neutral) such that data points showing improvements are now

reinforcing and data points showing decrements are punishing. Feedback of either improvements or decrements may also alter the function of other environmental stimuli, some of which come to function as reinforcers.

Some workers may verbalize an avoidance contingency: “I better perform today so I don’t disappoint my peers by preventing us from reaching our goal.” Others may verbalize a contingency of positive reinforcement: “If I perform today my peers will like me and I’ll help move us toward our goal.” Although the feedback process is the same, different rules are described by different workers. In this sense, one could argue that controlling variables are verbally-mediated and this type of rule-governance may be related to institutionalization of BBS.

#### LESSONS BEING LEARNED: FROM THE THEORETICAL TO PRACTICAL ASPECTS OF INSTITUTIONALIZATION

Put simply, the practical aspect of institutionalizing BBS involves teaching the basic principles of behavior analysis to the people in organizations who can benefit from them. And, this must be done in a manner that facilitates communication, dissemination, and use of these concepts. This basic idea of promoting acceptability of behavioral strategies to solve socially significant problems has been discussed elsewhere under the concept of social validity (Wolf, 1978). In short, aspects of social validity seem to be important for institutionalizing BBS (cf. Fawcett, 1991; Schwartz & Baer, 1991). When applied to institutionalization, social validity can be thought of as “employee buy-in.”

There seems to be no clear definition of employee buy-in in the diverse organizational psychology literature. Moreover, attempts to describe what is meant by “buy-in” quickly lead to more questions than answers. However, we do know from “informal” definitions, that buy-in is a desired outcome across various phases of organizational change. Thus, the concept is

presumed to be important to institutionalizing BBS.

For example, in the senior author's customized BBS process, an early phase of change involves the need to gain acceptance of a proposal for the implementation of a new process or technology. Gaining acceptance involves interactions among the change agent (or consultant), upper management, and front-line supervisors. Once approval has been obtained, the implementation plan is presented to key players representing middle management and front line workers (who often form a "steering committee"). Presumably buy-in from this group facilitates the effectiveness and efficiency of initial process implementation. During the implementation, an effective change agent seeks approval from the persons who are likely to be impacted by the forthcoming changes. Although employee buy-in is used often to describe the expressed approval (or acceptance) by front-line workers, it is rarely measured systematically.

Interestingly, however, the concept of acceptance of change is not unfamiliar to behavior analysts. For example, within the Organization Behavior Management (OBM) staff management literature, acceptance of behavior analytic procedures has received some attention (Reid & Parsons, 2000; Parsons, 1998). Parsons' (1998) review of acceptability research described acceptability as the extent to which consumers view an organizational practice as fair, appropriate, non-intrusive, practical, consistent, and not likely to result in negative side effects. Given this definition, it is not unreasonable to call employee buy-in the opposite of resistance to organizational change. Resistance has been defined as behavior that is intended to protect individuals from the effects of real or imagined change (Dent, Galloway, & Goldberg, 1999).

Because employee buy-in can be seen as the opposite of resistance to change, we can define change as an alteration of existing (baseline) response-reinforcement relations. And, these changes can be aversive or reinforcing. This interpretation is consistent

with response-deprivation disequilibrium theory discussed by Timberlake and Farmer-Dougan (1991). However, in field settings with verbal humans, resistance can result from either actual or perceived reductions of contingent reinforcement (i.e., extinction, response cost) or from increases in the response requirements necessary to obtain reinforcement (i.e., response effort). For example, in an organization, we can look at work time as the target response and break time as an alternate reinforcing activity. The ratio of work time to break time could be evaluated during a baseline (Matthews & Dickinson, 2000). According to the response-deprivation disequilibrium approach, increasing work time (while leaving break time unchanged) or decreasing break time (while leaving work time unchanged) should have punishing effects and produce some resistance to that change.

#### **Behavior analytic interpretations of resistance to change**

Within the behavior analytic literature, Skinner referred to resistance as counter-control (Skinner, 1953; 1971). There is also ample evidence demonstrating that aversive stimulation (e.g., response cost, extinction, shock delivery, etc.) evokes negative side effects (resistance). Such side-effects of change are often reported by the Fortune 500 organizations with whom the senior author has worked.

Recently, Sonia Goltz (2001) provided a sophisticated operant explanation of organizational resistance to change using an analysis of power. From this perspective, resistance occurs when the organizational change being introduced changes in who has control of reinforcing and aversive stimuli in the organization (Goltz, 2001). However, there is still no clear operational definition of employee buy-in. Without an operational definition, how do we know what we are measuring? We must address this issue if we expect to understand and promote institutionalization of BBS.

## A “working” operational definition of employee buy-in

Given the issues described above, we define employee buy-in as verbal support for changes in an organization by individuals who are directly affected by these changes *in conjunction with* overt non-verbal behavior necessary for changes to take place. The verbal component of employee buy-in (as defined here) can be measured as instances of positive statements or gestures emitted by a group of employees in reference to planned or ongoing changes in the workplace. Comments can be measured through questionnaires, surveys, talk aloud procedures, or direct observations of interactions between employees. This latter procedure was used to record audience comments during three 4-hour safety workshops, conducted by the senior author at two independent sites in Northern Nevada.

Specifically, using a partial-interval recording procedure, two independent observers recorded during two 10 min. observation probes each hour of the workshop, whether positive, negative, or neutral statements were emitted by individuals in the audience. Forty-six percent of all statements recorded were positive and 52% were neutral. There were no negative statements recorded. Interobserver agreement was calculated for all observations and averaged 75% across both sites. The non-verbal component is currently being measured through direct observation and evaluated by comparing the correspondence of observed employee behaviors with specific target behaviors required for change (i.e., making behavioral observations), and the verbal behavior previously measured. Because employees often feel threatened when individual behavior is tracked, we are not able to track a one-to-one correspondence between comments in training and participation in BBS. However, preliminary data from both sites indicates that overall participation of employees in the BBS process is approximately 50%. Thus, the level of participation appears to be related to the percentage of positive statements recorded during the implementation workshops.

## LESSONS LEARNED: WHAT WE DO KNOW

Although the discussion to this point leaves many questions, we do know some factors that will facilitate institutionalization of behavioral interventions in various settings. These recommendations for creating employee buy-in and institutionalizing BBS as discussed below are consistent with Stolz's (1981) list of key variables necessary for the adoption of behavior-change technology. In short, to institutionalize behavior-based interventions, the process must include the following criteria: a) funds are available for dissemination; b) the intervention is tailored to local conditions; c) key persons, trained and enthusiastic, persist through obstacles; d) the intervention is timely (i.e., the problem is perceived); and e) the data must show the intervention improves the targeted behaviors (Stolz, 1981). The answers to two questions will help us evaluate a BBS change process according to these criteria.

### IS THE PROBLEM WORTH SOLVING?

According to Baer, Wolf, and Risley (1968, 1987), applied behavior analysis is an effort to solve socially significant problems by directly observing and measuring behavior while manipulating some aspect of the environment in a manner that yields a believable demonstration of the effects of the manipulation. It is also useful that the problem addressed is visible and obvious to the target community. If an intervention target is not seen as a real problem, then time and effort could be wasted. These latter points revolve around the core issues of social validity (Wolf, 1978).

Interventions to improve safety certainly qualify as efforts to solve socially significant problems in organizational settings. Furthermore, we may include quality in this list, especially if quality control can prevent injury and death as might have been the case with Firestone tires. Easy to understand baseline data, appropriately disseminated to the target population can help to justify the need for the proposed BBS intervention.

Regarding the social validity of a behavior change intervention, it is important to consider the benefits and social acceptability to the relevant consumers (Kazdin, 1977; Wolf, 1978). Specifically, how important is the proposed behavior change to individuals giving and receiving the intervention? Is the inconvenience or intrusiveness of the intervention process worth the potential benefits? Wolf (1978) detailed these evaluations of social validity with regard to the importance of effects, significance of goals, and appropriateness of procedures. It is intuitive that the answer to all of the above questions would support the need for a “user-friendly” intervention, not necessarily more enforcement. The positive comments generated by a BBS process may be used to facilitate institutionalization by tapping into appropriate social contingencies. At a minimum, they will help us to identify sources of resistance.

#### **Are We Taking the Appropriate Measures?**

It seems the behavior analyst in behavioral safety is concerned with whether or not an organization, as a whole, is better off after (than it was before) the BBS process. If so, does the organization describe that change to be beneficial and the methods used to produce the change usable? The answers to these questions help us determine, after the intervention has been used, if our BBS efforts are likely to be institutionalized. What we measure also determines if our effort is behavior analytic.

When we refer to a behavior analysis, we refer to a believable demonstration. From the rigors of science, a believable demonstration occurs when one can exert enough control over response contingencies such that one can “turn behavior on and off” at will (Baer et al., 1968, 1987). To “turn behavior on and off” is the kind of believable demonstration produced by a within-subject A-B-A withdrawal or multiple baseline design, of which the latter is often more desirable because it is not prudent to withdraw an effective intervention in applied research.

In the latter case we would require measurement of at least two baselines

concurrently across behaviors, settings, etc. and staggered introduction of BBS. If behavior changes in each baseline, only after addition of the intervention (i.e., BBS), then a believable demonstration has been achieved (Kazdin, 1994). Thus, the appropriate selection of a research design (often described as an implementation plan in the field) may facilitate institutionalization if it is understood by those people using the intervention. A natural multiple baseline design and its limitations was nicely illustrated by the work of Fox, Hopkins, and Anger (1987), who documented the long-term effects of a token economy that had been clearly institutionalized in two open-pit mining operations.

Finally, consistent with the recommendations of Azrin (1977), it could be speculated that a combination of strategies is necessary for institutionalizing behavior-based safety. This notion parallels the Boyce and Geller (2001) argument that a combination of strategies used to promote generalization of BBS increases the probability that behavior change will be maintained. To illustrate, an intervention package to increase pedestrian safety was evaluated by Malenfant and Van Houten (1989) who used advance stop lines for vehicles at pedestrian crossings as well as “pedestrian crossing” warning signs. The intervention also involved (a) the local police who ticketed drivers not yielding to pedestrians, (b) community feedback signs to track safety progress, and (c) community education on crosswalk behavior delivered through flyers, signs, and other forms of media attention. The total program resulted in a 50% reduction in pedestrian injuries. Because there was a simultaneous implementation of several intervention strategies, the impact of any one intervention component could not be determined. However, in a different study, Harrell (1994) reported that crosswalk warning signs alone, placed at various distances from a crosswalk, had no effect on motorists’ yielding. Regardless, the combined strategy in various forms has been adopted and is still being used in various communities throughout Canada (Van Houten, personal communication May, 1998).



To summarize, it is necessary to solicit support from employees at all levels of the organization and entities with business interests. It is particularly important to involve members of the organizational community in the development of the intervention materials. People are more likely to use strategies they have designed themselves, if only to maintain a consistency between saying and doing (Rogers-Warren & Baer, 1976). The preliminary data from our research suggests this is indeed the case. Thus, the relationship between how people talk about BBS and their involvement in BBS is a line of research worth pursuing.

#### EPILOGUE: SEEING THE FOREST THROUGH THE TREES

To promote institutionalization of BBS, we must communicate effectively. This will require two verbal repertoires, a precise technical language under the stimulus control of the academic audience, and a more easily understood, but still technically correct language under the stimulus control of the lay audience. Thus, the responsibility of graduate training programs that have adopted a scientist-practitioner model is to train two verbal repertoires among students as well as their ability to discriminate which is appropriate for what audiences. In the laboratory of the senior author, an emphasis is placed on public dissemination of knowledge and encouraging students to seek forums in which to present their work. Students are also explicitly trained to ask the organizer of any event who they can expect to be in the audience. Presentations are prepared with this audience in mind. Furthermore, use of language appropriate to the audience is reinforced during practice of the presentation. Our field needs to do more of this type of training if we expect our technologies to be institutionalized. In short, institutionalization begins in our graduate training programs.

As a field we need to abandon the “I’m right, you’re wrong” arrogance often seen among behavior analysts. Instead, we must explicitly train humility in our graduate programs (cf. Chase, 1991) and discourage the

use of “cookie-cutter” technologies. Furthermore, we must acknowledge that performance changes in one aspect of an organization may produce changes in others. We must also encourage that potential concomitant changes in the system be measured with respect to primary targets being measured (cf. Ludwig & Geller, 1999). This approach has been called an “ecobehavioral analysis” (Sulzer-Azaroff, Blake-McCann, & Harris, 2001; Sulzer-Azaroff, 2000), and forces the behavior analyst to acknowledge the concept of metacontingencies (e.g., Glenn, 1988), the behavior analytic measure of “organizational culture.”

Unfortunately, competing contingencies and time constraints imposed by the production demands, real or perceived, may be a major source of resistance preventing institutionalization of BBS (cf. Goldiamond, 1978; Holland, 1978). Thus, an ecobehavioral approach that clearly demonstrates desired changes in other organizational systems is necessary for institutionalization of BBS. Indeed, we can train current students to approach their work in this manner, but we should not hope it will happen unless we set out to make it happen. In this sense, we must train students to discriminate applications that are science from those that are service, to document them as such, and discuss them in this context. Our training efforts should explicitly facilitate the transfer of relevant responses to the relevant contexts, including those of the people we serve. It is precisely this process that defines and will facilitate institutionalization of BBS and other behavior-based solutions to real-world problems.

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## RESEARCH IN PRACTICE: PRACTICAL APPROACHES TO CONDUCTING FUNCTIONAL ANALYSES THAT ALL EDUCATORS CAN USE

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### Abstract

Educators strive to provide services to many complex problems in our schools. Identifying assessment methodologies that serve multiple outcomes and assist with a variety of educational decisions is paramount. Functional Analysis (FA) procedures have greatly advanced our understanding of how to change problem behaviors. Such assessment procedures can be especially useful in the classroom because they focus on the environmental etiology rather than the topography of problem behaviors as a basis for the selection of treatment procedures (Mace & Roberts, 1993). Thus, FA procedures can be used to identify the function of the problem behavior (e.g., escape-motivated or attention-seeking) by examining events related to its occurrence. This information can then be used to develop a positive behavioral intervention plan that directly addresses the identified function of the behavior. (Nelson, Roberts, & Smith, 1998).

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In general, any behavior may be maintained by positive or negative reinforcement. A FA can help determine whether a problem behavior is maintained by positive or negative reinforcement. Often problem behaviors are maintained by negative reinforcement or escape from or avoidance of aversive stimuli, which in turn increases the amount of the problem behavior. Likewise, problem behavior can also increase because it is maintained by positive reinforcement contingent upon the occurrence of the problem behavior (e.g., attention). A FA requires the direct experimental manipulation of key environmental variables hypothesized to be associated with the function of the problem behavior in order to make “causal” rather than descriptive statements about the function of behavior (Horner, 1994; Mace, Lalli, & Lalli 1991; Touchette, MacDonald & Langer, 1985).

Despite the wealth of knowledge generated from FA research, relatively few studies have empirically demonstrated the influence of antecedent events on problematic behavior (Michael, 1982, 1993). Iwata (1994) proposed two factors that may account for the limited exploration of antecedent influences on behavior. First is the inability to describe the effects of setting in terms of behavioral mechanism. The second factor is the absence of a methodology to establish the functional relation between setting events and behavior while ruling out other potential sources of

influence. Within in this context, this paper will discuss a methodology to examine the relationship between academic variables and off-task behavior. Specifically, a FA methodology that uses Curriculum-based Assessment (CBA) to identify antecedent events that occasion off-task classroom behaviors will be described.

### **The Relationship between Academic Difficulty and Off-Task Behavior**

One of the most common reasons for referral to school support personnel is “off-task” behavior—students who are inattentive, distractible, and/or fail to complete assignments. Many educators believe there is a collateral relationship between the difficulty level of academic tasks and off-task classroom behavior. More recently, researchers have been expanding FA procedures so that the relationship between academic and social behaviors in the classroom setting can be empirically examined (Lee, Sugai, & Horner, 1999; Roberts, 2001; Roberts, Marshall, Nelson & Albers, 2001). These efforts have demonstrated that the difficulty of academic materials may increase escape and/or avoidance responses of students. For example if the function of off-task behavior were escape from a difficult task, it would be possible to conduct an FA by systematically manipulating the presentation of easy and difficult academic tasks. Conversely, if the difficulty of the academic task is reduced, one should observe a reduction in the rate or percentage of problem

behaviors. Until recently, this hypothesis was not empirically validated within regular classrooms in part because a methodology for examining this relationship was not established. However, some researchers (Lee et al., 1999; Roberts et al., 2001) have presented an empirically based methodology for conducting FA in the classroom that incorporates the use of curriculum-based assessment procedures.

**RECENT EMPIRICAL  
FINDINGS USING FA  
AND CBA  
METHODOLOGY**

Roberts et al. (2001) have examined whether CBA procedures can be used to identify the antecedent conditions that prompt off-task behaviors in general education classrooms. To specifically examine this question, a two-phase assessment process was implemented. Phase one consisted of a teacher interview, an academic assessment and the descriptive analysis of the problem behavior. The functional analysis was

descriptive and experimental conditions. The length of these conditions was consistent with the length of independent seatwork time within these classrooms.

The results suggest a functional relationship between difficult and easier academic activities and off-task classroom behaviors of student in the classroom setting was established for each student. Collateral effects between the difficulty of the curriculum and off-task classroom behavior were noted. When given difficult curriculum materials relative to the students' skill level, the percentage of off-task classroom behavior increased and conversely, fewer off-task classroom behaviors were observed when students were working on easier level academic activities. Therefore, it may be important to consider the influence of academic variables on problem behaviors within the classroom settings.

**Why Use Curriculum-Based Assessment?**

Curriculum-based Assessment (CBA) procedures offer a pragmatic method for manipulating and determining antecedent events that occasion off-task classroom behaviors in classroom settings. CBA as classified by Fuchs and Deno (1991) is defined as a direct measurement procedure that employs the student's curriculum to determine current and ongoing performance. It is important to note that many different models of CBA have been developed over the years (Blankenship, 1985; Deno, 1985; Gickling & Havertape, 1981; Idol, Nevin & Paolucci-Whitcomb, 1986; Shapiro & Lentz, 1985). For the purposes of this article, we use the term CBA to describe measurement procedures to assess basic academic skills and establish academic performance levels.

**Table 1 : Examples of Performance Levels in Math**

Criteria for Establishing Academic Performance Levels		
Grades 1-3	Digits Correct	Digits Incorrect
Easier task	10-19	3-7
Difficult task	0-9	8 or more

conducted in phase two, the difficulty level of academic tasks was experimentally manipulated to determine events that occasion off-task classroom behaviors for each student. Off-task classroom behaviors included inappropriate movements (e.g., out of seat, running around, and fidgeting in seat), inappropriate vocalizations (e.g., calling out, off-task classroom noises, and arguing), and physical aggression (e.g., hitting, kicking, and pushing). A 15-s partial interval recording system was used to measure the occurrence of off-task classroom behaviors during both the 15-minute

CBA is also advantageous for conducting an FA in classrooms because it provides standardized procedures that are reliable and valid, requires short administration times, and is sensitive to indexing student

growth over brief periods. Also, it uses the same academic materials that occasion the problem behavior in the classroom and can be used to determine the difficulty of academic tasks relative to a student's skills. Two performance levels-easier and difficult levels-can be established to represent student's skill level

relative to curriculum materials. The performance levels are defined by the correct and incorrect responses on CBA probes (Deno & Mirkin, 1977; Fuchs & Deno, 1982; Gickling & Havertape, 1981; Gunter, Denny, Jack, Shores & Nelson, 1993; Shapiro, 1996). Once performance levels are established, educators can manipulate the difficulty level of academic

on these findings, it is important for educators to understand the steps involved in an FA. What follows is a description of a practical and efficient way to conduct an FA in the schools to examine the relationship between task difficulty and problem behaviors.

**PREPARING TO CONDUCT AN FA**

Prior to conducting an FA, a student's skill level in the subject area that the child is struggling in needs to be assessed in order to establish easier and difficult performance levels. Specifically, one needs to identify the current

**Table 2: A Data Collection Form That Can Be Used During A Functional Analysis**

FUNCTIONAL ANALYSIS DATA COLLECTION FORM													
Behavior		Antecedent		Consequence			Behavior		Antecedent		Consequence		
1	E	D	E	T	P	11	E	D	E	T	P		
2	E	D	E	T	P	12	E	D	E	T	P		
3	E	D	E	T	P	13	E		E	T	P		
4	E	D	E	T	P	14	E	D	E	T	P		
5	E	D	E	T	P	15	E	D	E	T	P		
6	E	D	E	T	P	16	E	D	E	T	P		
7	E	D	E	T	P	17	E	D	E	T	P		
8	E	D	E	T	P	18	E	D	E	T	P		
9	E	D	E	T	P	19	E	D	E	T	P		
10	E	D	E	T	P	20	E	D	E	T	P		
<b>Antecedents</b>		<b>Problem Behavior</b>					<b>Consequences</b>						

tasks to conduct a functional analysis. This experimental manipulation will reveal whether escape from task difficulty functions as the maintaining variable of problem behavior. Based

and prior skills being taught in the classroom. Next, one should administer three CBA probes, which consist of the current curriculum materials to the student. Each probe should be

administered for a total of two-minutes to determine the fluency and error rates as measures of the student's skill performance in the relevant subject area (see Table 1 for an example of performance levels in math created by Deno & Mirkin, 1977). Based on the student's performance, additional probes with easier and more difficult material should be administered until both easier and difficult performance levels are identified (Shapiro and Lentz; 1985, 1986).

### Conducting the FA

Once the easier and difficult performance levels have been established, it is important to construct individual packets of CBA subject area probes. Each packet should represent either Easier or Difficult materials. To begin each FA session, randomly administer one of these packets to the student during classroom time (e.g., independent seatwork time) and systematically record the antecedents and consequences associated with each behavior. Table 2 represents a data collection form that could be used to document the relationship between antecedents and consequences that maintain the problem behavior.

As one can see, it does not require an interval recording system but rather it requires the observer to put a hash mark through the number indicated under the behavior column every time it occurs. This will provide an indication as to the amount of times the behavior occurs. Also indicate the antecedent events as either "E" for easier or "D" for Difficult materials with which the student is working. Also, there is space to record the consequence associated with each occurrence of the problem behaviors (E = escape, T = teacher attention, P = Peer attention). After the session is completed, simply tally the number of times the behavior occurred during each antecedent and consequence condition to confirm the hypothesis function of the problem behavior.

### FUTURE DIRECTIONS AND PRACTICAL IMPLICATIONS

Emerging research suggests that CBA offers an alternative context for conducting a functional analysis and developing interventions that can be used in a variety of classroom settings. In turn, these procedures are useful for developing effective interventions and monitoring the effectiveness of FA long-term. Specifically, CBA measures have distinct advantages related to students demonstrating off-task classroom behaviors. First, CBA procedures can be used to systematically manipulate antecedent conditions that may occasion off-task behaviors in general education classrooms. Second, the information from a CBA can be used to design and evaluate instructional interventions related to the function of off-task classroom behaviors. Finally, CBA procedures can be used to continuously evaluate treatment outcomes based on a student's performance (e.g., progress monitoring). Taken together, CBA provides educators with a contiguous set of measurement procedures that can be used throughout the FA and the behavioral intervention plan to remediate student's off-task classroom behavior in general education classrooms.

Although embedding CBA within a functional analysis appears to be a practical and effective approach to determine antecedent events that occasion off-task classroom behaviors in the classroom, clearly more research is needed to examine the impact of these procedures on larger samples of students with varying educational needs and the treatment integrity of these procedures. It is also critical that educators examine the long-term impact of interventions derived from this alternative assessment methodology on student behaviors and academic performance in naturalistic classroom settings.

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## DIFFERENT EFFECTS OF INDIVIDUAL AND SMALL GROUP MONETARY INCENTIVES ON HIGH PERFORMANCE

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### Abstract

The effects of individual and small group monetary incentives on the performance and satisfaction of high performers were examined. The design was an ABCB within-subject reversal design, where A = hourly pay, B = individual incentives and C = group incentives. Four college students were told that they were members of a 10-person group. During the group monetary incentive condition, the simulated group's performance was manipulated so that the participants were "high" performers. Participants performed four simultaneous computerized tasks, an arithmetic task, a memory task, a visual monitoring task and an auditory monitoring task, earning points for correct responding. Three of the four participants performed an average of 16%, 14% and 12% lower when paid group incentives than when paid individual incentives. All four preferred individual incentives to group incentives and hourly pay, and three of the four reported that group incentives were more stressful than either hourly pay or individual incentives.

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Laboratory and field studies have consistently demonstrated that individual monetary incentives and small group monetary incentives increase performance in comparison to hourly pay (for recent reviews, see Bucklin & Dickinson, in press; Honeywell-Johnson & Dickinson, 1999; Jenkins, Gupta, Mitra, & Shaw, 1998). Given the relevance of compensation systems to business organizations, most of this research has been conducted within that context. The results of these studies, however, have implications for other settings and, perhaps, for rewards other than money (Hantula, 2001). No doubt this is because individual and group monetary incentives have

many of the same characteristics that have been identified by behavior analysts as features of any type of effective management reward system (Braksick, 2000; Brown, 1982; Daniels, 1989; O'Brien & Dickinson, 1982). They: (a) are based on the performance of the individual or the performance of only a small number of individuals; (b) are based on clearly specified behaviors or outputs; (c) are certain (that is, if the behavior/output occurs, the individual will receive the incentives); and (d) are paid as soon after the performance as possible as part of the individual's paycheck. Nonetheless, the current discussion will be restricted to the examination of the effects of individual and group monetary incentive systems within the field of organizational behavior.

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Surveys conducted over the past decade have consistently reported that about 35% of U.S. companies pay their employees individual monetary incentives and about 15%-20% pay their employees small group monetary incentives (Gross, 1995; Lawler, Ledford, & Mohrman, 1989; Mitchell, Lewin, & Lawler, 1990; O'Dell & McAdams, 1987; Peck, 1990). While individual monetary incentive systems are currently more prevalent in business and industry, the use of small group incentives is increasing. In one survey, 39% of the respondents who did not use group incentives reported that they were considering them (Gross, 1995). Based on the results of another survey,



Ledford and Hawk (2000) reported that the use of small group monetary incentives in Fortune 1000 firms increased by 50% between 1987 and 1996. This increase reflects the fact that many organizations have adopted group pay plans to support new organizational structures based on work teams (Flannery, Hofrichter, & Platten, 1996).

When individuals are paid individual monetary incentives, the incentives are based

individual incentives (Blinder, 1990; Dierks & McNally, 1987; Honeywell, Dickinson, & Poling, 1997; McCoy, 1992). On the other hand, in small groups, workers can substantially influence the group's performance, thereby increasing or decreasing their own earnings. Therefore, they may perform as well when they receive small group monetary incentives as when they receive individual monetary incentives (Honeywell-Johnson & Dickinson,

**Table 1: Studies That Have Compared Individual and Equally-Divided Small Group Monetary Incentives**

Authors	Participants	Performance Measure	Experimental Design	Results
Allison et al. (1992)	Teaching assistants, disabled children 1 group of 12	Tasks completed	Within subject, reversal	Higher with group incentives $p < .03$
Farr (1976)	College students 48 groups of 3	Cards sorted	Between group	No difference $p > .05$
Honeywell et al. (1997)	College students 2 groups of 10	Cards sorted	Within subject, alternating treatment	No difference $p > .05$
Stoneman & Dickinson (1989)	College students 5 groups of 2 1 group of 4 1 group of 5 1 group of 9	Parts assembled	Within subject, reversal	No difference Visual analysis
Thurkow et al. (2000)	Telephone interviewers 6 participants with group size varying; average group size was 7, ranging from 2-24	Surveys completed per hour	Within subject, multi-element	Higher with individual incentives Visual analysis

solely on the performance of the individual employee. In contrast, when individuals are paid group incentives, the incentives are based on the total performance of the group. Because workers have less control over the group's performance and hence their individual earnings, they may be less productive than when they are paid

1999; Honeywell et al., 1997).

Somewhat surprisingly, given the prevalence of small group monetary incentives in business and industry, only five experimental studies (as opposed to survey studies) have compared the effects of individual and small

group incentives on performance (Allison, Silverstein, & Galante, 1992; Farr, 1976; Honeywell et al., 1997; Stoneman & Dickinson, 1989; Thurkow, Bailey, & Stamper, 2000). In business and industry, the median number of members in a work team is 10 (Peck, 1990); in the preceding studies, the size of the groups ranged from 2-12 members<sup>7</sup>. The general features of these studies and a summary of their results are presented in Table 1.

All five studies examined equally-divided small group monetary incentives, the most common type of group monetary incentive system, while two (Allison et al., 1992; Farr, 1976) also examined the effects of differentially-divided group incentives. With equally-divided incentives, the performance of the group members is pooled, and the incentives earned by the group are divided equally among group members. With differentially-divided incentives, the performance of the group is also pooled, but the incentives earned by each member of the group are based on the individual's contribution to the group's productivity. For example, in Farr's (1976) three-person groups, the top performer received 50% of the available incentives, the middle performer received 33%, and the bottom performer received 17%. Due to the fact that only two studies have compared the effects of individual incentives and differentially-divided group incentives and the results were conflicting, this comparison will not be discussed further here. Readers who are interested in a detailed description and analysis of the results of these comparisons are instead referred to Honeywell-Johnson and Dickinson (1999).

In three of the five studies, individuals performed comparably when paid individual and group incentives (Farr, 1976; Honeywell et al.,

1977; Stoneman & Dickinson, 1989); in one, individuals performed better when they were paid group incentives (Allison et al., 1992); and in one, individuals performed better when they were paid individual incentives (Thurkow et al., 2000). Thus, in four of the five studies, individuals performed as well or better when they were paid equally-divided small group incentives as when they were paid individual incentives.

Honeywell-Johnson and Dickinson (1999) proposed that when individuals perform the same when paid individual and group monetary incentives it may be due to the fact that individuals within the group perform similarly to one another. If individuals within the group perform similarly to one another, the amount of pay they receive when they earn individual and group incentives does not vary much. If pay does not vary, then one would not expect performance to vary. Rather, individuals are most likely to change their performance if they are relatively high performers and see their earnings decrease over time due to the lower performance of others. In this situation, they would be likely to decrease their performance (Dierks & McNally, 1987). This, in turn, would decrease the group's total performance.

The individual performance data necessary to determine whether members of the group performed similarly to one another were reported in three of the five studies that were conducted (Honeywell et al., 1997; Stoneman & Dickinson, 1989; Thurkow et al., 2000). Only group data were reported in the other two (Allison et al., 1992; Farr, 1976). In the studies that reported individual data, the data support the proposition made by Honeywell-Johnson and Dickinson (1999). In Honeywell et al. (1997) and Stoneman and Dickinson (1989), members of the groups performed similarly to one another when paid individual incentives and also performed similarly when paid individual and group monetary incentives. As indicated above, in Thurkow et al. (2000) workers performed better when they were paid individual incentives than when they were paid group incentives. Although there are several reasons why Thurkow et al.'s (2000) results may have differed

1. <sup>7</sup> In Thurkow et al. (2000), the results were based on the performance of six participants; however, the participants were part of groups that varied in size from day-to-day depending upon how many other employees were scheduled to work. The average size of the work group was seven, but ranged from two to twenty-four members.

from the results of the other four studies (i.e., lack of a clear group goal during the group incentive condition, the day-to-day changes in the group size, and the changing membership of the group), Turkow et al.'s six participants performed better than the other members in their groups in 67% of the sessions. Hence, it is possible, as suggested by Dierks and McNally (1987) and Honeywell-Johnson and Dickinson (1999), that they decreased their performance during the group incentive condition because they earned less money due to the performance of the other members of the group.

Results from London and Oldham (1977) and Honeywell et al. (1997) provide the strongest support for the proposition made by Dierks and McNally (1987) and Honeywell-Johnson and Dickinson (1999). Using a between-group experimental design, London and Oldham compared the effectiveness of fixed-rate pay, individual monetary incentives and three different small group monetary incentive systems, one of which was equally-divided group incentives. After each participant had been exposed to individual monetary incentives for one session but before they were exposed to one of the five pay systems for an additional three sessions, one-half of the participants were told that they were high performers while one-half were told that they were low performers. Due to the unique nature of this intervention, this study was not discussed earlier or included in Table 1. Seven two-person groups were assigned to each of the five experimental pay conditions (fixed-rate pay, individual monetary incentives or one of three different small group monetary incentive systems). The two group members were introduced to each other and then separated to work in different rooms. The experimental task consisted of sorting cards punched with holes into separate piles based on the pattern of the holes punched in the cards. Participants were first exposed to an individual monetary incentive condition for one 5-minute session, during which they were paid \$.01 for each card they sorted. After participants were paid for this trial, one of the group members was told that he or she sorted 25% more cards than his or her partner, while the other was told that

he or she sorted 25% fewer cards than his or her partner. Participants were then exposed to one of the five pay conditions for three 5-minute sessions. Only the results for participants who were exposed to the equally-divided group incentives based on their average performance will be reported here due to the fact that the other results are not relevant to the current discussion. Readers who are interested in a detailed analysis of all of the results are referred to the original study or to Honeywell-Johnson and Dickinson (1999). Participants who were told that they were low performers sorted about the same number of cards when they were paid equally-divided group incentives and when they were paid individual monetary incentives (average = 56.5 cards versus 58.5 cards, *SDs* not reported). Participants who were told that they were high performers, however, sorted 16% fewer cards when they were paid equally-divided group incentives than when they were paid individual incentives (average = 58.2 cards versus 69.6, *SDs* not reported). Statistical analyses were not conducted for these within-subject comparisons, nor were the results of between-group analyses reported for individual incentives and equally-divided group incentives. Thus, while these results support the contention that high performers may perform lower when they are paid group incentives than when they are paid individual incentives, they cannot be considered conclusive.

Honeywell et al. (1997) compared the effects of individual and equally-divided small group monetary incentives on the performance of individuals who were members of 10-person groups. Two groups were included in the study. The experimental task was a card sorting task, similar to the one used by London and Oldham (1977). An alternating treatment design was employed. Individual and group incentives were alternated during successive 20-minute sessions for 14 sessions, seven of which were conducted on one day and seven of which were conducted on the following day. As indicated previously, performance did not differ under individual and group monetary incentives. Because there were a few distinct high performers in the groups, these results appear to contradict the proposition made by Dierks and McNally (1987) and Honeywell-

Johnson and Dickinson (1999). A detailed analysis of the results, however, supports their position. When Honeywell et al. statistically analyzed their data, they collapsed the data across the two groups of participants. When the data for the two groups were analyzed separately, performance was statistically significantly lower during the group incentive conditions than during the individual incentive conditions for one of the groups (Honeywell, 1995). This group contained the highest performers. A visual inspection of their data revealed that these participants performed lower during the group incentive condition than during the individual incentive condition, prompting Honeywell to state that the results warranted further study.

When individuals are exposed to different types of pay systems, their preference for a particular pay system is correlated with the amount of money earned (for reviews, see Bucklin & Dickinson, in press; Dickinson & Gillette, 1993); thus, because high performers earn more money when they are paid individual incentives than when they are paid group incentives and low performers earn more money when they are paid group incentives than when they are paid individual incentives, one would expect high performers to prefer individual incentives and low performers to prefer group incentives. Unfortunately, the data are sparse because only one study (Honeywell et al., 1997) reported the individual data that are necessary to identify high and low performers and also assessed employee preference. In that study, point-biserial correlations between performance and choice of incentive system, revealed that, indeed, high performers preferred individual incentives and low performers preferred group incentives.

The purpose of the present study was to compare the effects of individual and small group monetary incentives on the performance and satisfaction of high performers. Simulated, rather than co-acting groups were used. That is, the four participants were told that they were members of a 10-person group, when, in fact, they were not. Participants worked on networked computers and were told that their data would be

combined with the data from nine other "group" members. Simulated groups have been used in a number of experiments that have examined the effects of group membership on individual performance (e.g., Harcum & Badura, 1990; Hollingshead, McGrath, & O'Connor, 1993; Mullen, Johnson, & Anthony, 1994; Weaver, Bowers, Salas, & Cannon-Bowers, 1995). When group members make individual contributions to the pooled performance of the group (as opposed to tasks that require extensive interaction and negotiation), the results from simulated-group studies have been consistent with the results from co-acting group studies (e.g., Hollingshead et al., 1993; London & Oldham, 1977; Mullen et al., 1994). The results of Mullen et al. (1994) are of particular relevance to the current study. In that study, participants who believed that their sub-group constituted 75% of the total group and those who believed that their sub-group constituted only 25% of the total group responded differently on a classification task. These results indicate that group size can be successfully manipulated in a computerized simulation.

## METHOD

### Participants

Participants were four undergraduate students recruited from psychology classes and student employment services at a large Midwestern university. Participants were included if they passed (a) a quiz containing arithmetic problems that were identical to the ones in the experimental task and (b) a quiz that tested their understanding of the three pay systems that served as the independent variables. The arithmetic quiz consisted of 20 addition problems. Participants were required to solve 90% of the problems correctly, with only one remediation. To pass the pay condition quiz, participants had to correctly answer six questions about the pay conditions, with only one remediation. Participants received hourly pay, individual monetary incentive pay and group monetary incentive pay as detailed in the Independent Variable section. They were also

given \$10.00 for completing the study and attending a final session during which they completed a post-experimental questionnaire. All participants signed an informed consent form that was approved by the university's Human Subjects Institutional Review Board.

### Setting

The study was conducted in a university computer laboratory containing 15 Pentium computers connected through a Local Area Network. Each participant had a work area consisting of a computer with a keyboard, mouse and headphones. An adjacent computer provided access to alternative activities (computer games, email access, and internet access). Participants could engage in these break activities at any time during the sessions.

### Experimental Task

The task was a computerized synthetic work task called SYNWORK (Elsmore, 1994). SYNWORK has two features that are similar to many jobs in actual work settings: concurrent tasks and measurable outcomes for completion of those tasks. In addition, the four sub-tasks were selected for this program because they require simultaneous attention to tasks that are similar to those required for many jobs (Elsmore, 1994). Each of the four sub-tasks, a memory task, an arithmetic task, a visual monitoring task, and an auditory monitoring task was presented in one of the four quadrants of the computer screen. Participants earned points for correct responses and lost points for incorrect responses. Points were not deducted for non-responding because that would have penalized off-task activities. The points earned on the sub-tasks were added together to obtain a cumulative point total.

In the memory sub-task, presented in the upper left quadrant of the computer, a list of six letters was displayed on the screen for 5 s. Twenty seconds later, a sample letter appeared and remained on the screen for 10 s. Participants could click on a "Retrieve List" box to review the set of letters, but each retrieval resulted in a loss of 10 points. Participants

indicated whether the sample letter was part of the original list of letters by clicking on the word "Yes" or "No." Participants earned 10 points for correct responses and lost 10 points for incorrect responses.

In the arithmetic sub-task, presented in the upper right quadrant, an addition problem consisting of two 3-digit numbers was presented. An answer of "0000" was displayed below the problem. Two boxes, one containing a "+" and one containing a "-" were located directly below each zero. Participants clicked the "+" box to increase the answer digit by one and clicked the "-" box to decrease the answer digit by one. When participants solved the problem, they clicked the "Done" box and a new problem was presented. Participants earned 5 points for correct answers and lost 5 points for incorrect answers.

A visual monitoring task was in the lower left quadrant. A line, 201 pixels in length, was displayed on the screen. A pointer, initially positioned at the center of the line, moved to the left or to the right at 200 msec per pixel. Participants clicked on a box labeled "Reset" to move the pointer back to the center of the line. The number of points awarded for resetting the pointer was proportional to how close the pointer was to either end of the line. Participants earned 10 points for resetting the pointer when it was at the distant 10 percent of either end of the line but did not earn any points for resetting the pointer if it was at the center. Participants earned a variable number of points (between 1 and 10) for resetting the pointer when it was at other points along the line.

In the auditory monitoring task, presented in the lower right quadrant, a brief tone was presented every 5 s through the headphones. The tone was either a high frequency (1319 Hz) tone or a low frequency (1046 Hz) tone. High frequency tones were "signals" while low frequency tones were "nonsignals." To earn points, participants clicked on a box labeled "High Sound Report" after the presentation of a high frequency tone. They had to click on the box before the presentation of the next tone or they did not earn

any points. Participants earned 10 points for correctly identifying a high tone and lost 10 points for clicking the "High Sound Report" after a low tone.

### Alternative Activities

In the absence of alternative activities, participants would be likely to perform the experimental task for the entire 2-hr session regardless of what pay condition was in effect. Because monetary incentives have been shown to increase the amount of time individuals spend working in comparison to hourly pay (Matthews & Dickinson, 2000; Pritchard, Hollenbeck, & DeLeo, 1980), the effects of the three different pay systems on performance might be masked if SYNWORK was the only task available. To prevent that possibility, alternative activities were made available to participants on an adjacent computer. The alternative activities consisted of computer games, access to email and access to the internet. These particular alternative activities are available in work settings, and surveys have reported that employees spend time (sometimes considerable time) engaging in them (Betts, 1995; Eng & Schwartz, 1993; Klett, 1994); thus the presence of these particular activities also increased the realism of the simulation.

Participants could perform the alternative tasks whenever they wanted for as long as they wanted during the 2-hr sessions. In addition, the experimenter prompted the participants to take three 5-min work-breaks during the session.

### Dependent Variables

The primary dependent variables were: (a) the total number of points earned on the four sub-tasks, (b) the number of points earned on each sub-task and (c) the percentage of correct responses on each sub-task. The computer automatically recorded these data. Secondary dependent variables consisted of participant reaction data. On a post-experimental questionnaire, participants rank-ordered the three pay conditions in terms of preference, satisfaction and evocation of stress.

### Independent Variable

The independent variable was the type of pay system: hourly pay, individual incentive pay and small group (N=10) incentive pay. The participants worked alone under all pay systems, but during the group pay condition they were told that their point score was combined with the point scores from nine other individuals and that their pay was based on the average performance of the ten individuals in the group.

In the hourly pay condition, participants earned \$10.00 for each 2-hr session, regardless of how many points they earned. The total number of points they earned was displayed on the computer screen at the end of each session. During the individual incentive pay condition, participants earned \$.10 for every 100 points earned. If participants performed at the estimated average level (10,400 points), they would earn approximately \$10.40 per session, similar to what they would earn when paid hourly. This estimate was based on the performance of pilot subjects who were paid *hourly* when performing SYNWORK. As in the hourly pay condition, the total number of points participants earned was displayed on the computer screen at the end of each session.

During the group incentive condition, the pay earned by each participant was based on the average performance of the members of the simulated group. Similar to the individual incentive condition, participants received \$.10 per 100 points in the group average. Thus, participants earned \$10.40 per session if members of the group averaged 10,400 points per session. The performance average of the simulated group was calculated in a way that made it likely that participants would be high performers. Each of the nine *simulated members* of the group was assigned a point score of 11,400 points for each session. This score was 1.5 standard deviations below the average performance of pilot subjects who were paid *individual incentives* when performing SYNWORK. Thus, even if participants performed at the estimated average level, their point score would be higher than the point scores of the other "members" of their group.

The following formula was used to determine the average performance of the group members:  $[(11,400 \text{ points} \times 9 \text{ simulated members}) + \text{Participant's point score for the session}] / 10$ . Unlike the other two conditions, to better simulate an actual work setting, the computer did not display the participant's individual point score at the end of the session. Rather, the average performance of the members of the group was displayed. During the first individual incentive phase, all of the participants earned considerably more points than 11,400 per session, thus this manipulation was successful; that is, they were high performers in comparison to the other members of the simulated group.

After each session in every pay condition, participants received a receipt indicating their point score or, in the group incentive condition, the average point score for the members of the group, and the amount of money they earned during the session. Participants were paid after their last session of the week or after the last session in an experimental phase.

### Experimental Design and Procedures

A within-subject reversal design was used in which participants were exposed to each of the pay conditions in an ABCB sequence, with A = hourly pay, B = individual incentive pay, and C = group incentive pay. Experimental sessions were 2 hours. Participants were exposed to each pay condition for a minimum of five sessions. If performance was not stable, the phase was continued until performance stabilized or until participants completed 10 sessions. The 10-session maximum was imposed because of economic and time constraints. Performance was considered stable if, during three sessions, the participant's point scores varied by no more than plus or minus 1,000 points from the mean of those three sessions (1,000 points was .5 standard deviation from the mean performance of pilot subjects when they were paid hourly). The performance of each participant reached stability for every phase, with one exception: Participant 2, Phase 3 (group monetary incentive pay phase). The point scores for this participant showed a sharp

decreasing trend during the last four sessions of this phase. This trend was immediately reversed when Phase 4 was implemented (the individual monetary incentive pay phase); hence, the lack of stability does not confound the interpretation of the data.

Before the study began, each participant attended two 2-hr training sessions. Participants performed SYNWORK and the alternative activities that were on the adjacent computer. The experimenter demonstrated the tasks, remained in the room with the participants, and answered any questions. The training sessions were designed to enable participants to become proficient with SYNWORK. According to Elsmore (1994), "In most studies, six 15-min sessions are sufficient to achieve near-maximal performance [on SYNWORK]" (p. 423).

Before each session, the experimenter reminded the participants of the pay system in effect and described its features. The experimenter also reminded participants that they could take work breaks whenever they wanted for as long as they wanted and told them that computer games, access to email and access to the internet were available on the adjacent computer. The experimenter also told them that they could leave the laboratory if they wished to do so, pointing out that bathrooms, vending machines, and pay phones were near by. The experimenter either left the room during the session or remained in the front of the room facing away from the participants, engaging in a task<sup>8</sup>. In either case, the experimenter made it clear that she was not monitoring the performance of the participants. This was done to reduce the possibility that participants would continue to perform SYNWORK instead of the off-task activities because of potential disapproval from the experimenter. In actual work settings, employees can engage in off-task

2. <sup>8</sup> Initially, the experimenter left the computer laboratory during the sessions. However, there were two doors to the computer laboratory, and college students with keys to the laboratory often entered the laboratory, ignoring their observation schedule. To prevent the disruption of the session, the experimenter thus stayed in the room and, when intruders entered, quietly escorted them out.

activities without observation by the supervisor; hence, this procedure was intended to recreate that type of situation. In addition, three times during the session, the experimenter asked participants if they wanted to take a work break. The computer automatically terminated the session after 2 hours.

## RESULTS

Figure 1 displays: (a) the total number of points earned by each participant for each phase; (b) the average total number points earned per phase; and (c) the standard deviations for each phase. All participants increased their point scores when switched from hourly pay (Phase 1) to individual monetary incentive pay (Phase 2). Average increases were 1,010 points (Participant 4), 1,143 points (Participant 1), 2,347 points (Participant 3) and 3,047 points (Participant 2). In addition, the variability of performance decreased considerably for each participant as indicated by the changes in the standard deviations. These data indicate that the performance of each participant was controlled by monetary incentives, which is necessary to demonstrate before the effects of different types of monetary incentive pay can be validly compared.

Three of the participants (Participants 1, 2 and 4) earned considerably more points during both individual monetary incentive phases than during the group monetary incentive phase, although in each case, performance was lower during the second individual monetary incentive phase (Phase 4) than during the first individual monetary incentive phase (Phase 2). When performance is averaged across the individual monetary incentive phases and compared to the average performance during the group monetary incentive phase, the data indicate that these participants performed an average of 16% (Participant 2), 14% (Participant 1) and 12% (Participant 4) lower during the group incentive phase than during the individual monetary incentive phases. Average differences were 2,210 points (Individual incentive mean = 13,070, Group incentive mean = 10,860), 1,791 points (Individual incentive mean = 12,885,

Group incentive mean = 11,094), and 1,492 points (Individual incentive mean = 12,939, Group incentive mean = 11,447) for Participants 2, 1 and 4, respectively. Participant 3, the exception, increased her performance across all phases of the study.

The above data indicate that group monetary incentives decreased the performance of three of the four high performers in the study. Interestingly, the performance of these three participants was higher when they were paid hourly wages than when they were paid group monetary incentives. These results conflict with the results of prior studies (e.g., Allison et al., 1992; Farr, 1976). These current results, however, might well have been influenced by the fact that the participants were exposed to individual monetary incentives before they were exposed to group monetary incentives.

Figure 2 displays the number of points earned by each participant on each of the four sub-tasks. For all four participants, point scores for the memory task, the visual monitoring task and the auditory monitoring task remained relatively constant across all experimental phases. Differences in the total number of points earned across phases were due to differences in the performance of the arithmetic sub-task. This is probably due to the fact that participants had more control over the number of arithmetic problems they completed. While participants could influence the rate of presentation of the memory, visual and auditory sub-tasks by responding as soon as the computer generated the stimuli, participants had more control over their rate of responding on the arithmetic task. Thus, the number of points they earned was less restricted. Nonetheless, it is possible that these other types of tasks may be less sensitive to influence by monetary incentives than are production tasks, which are analogous to the arithmetic task. Little is known about the effects of monetary incentives on tasks other than production tasks, thus further research addressing this issue is warranted.



Figure 1

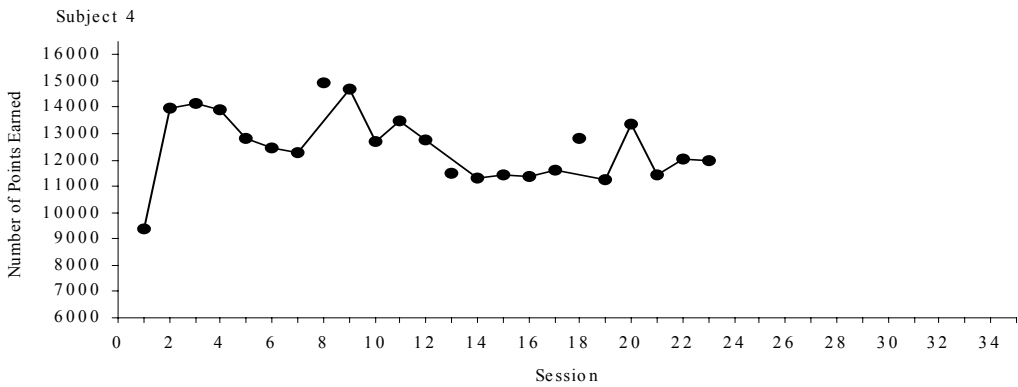
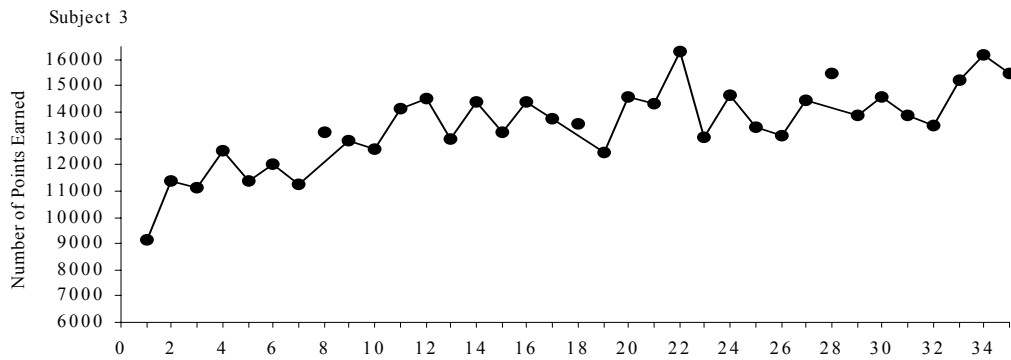
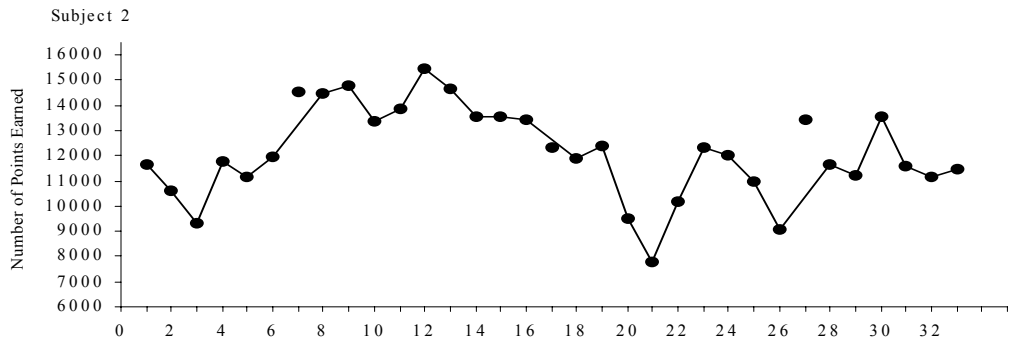
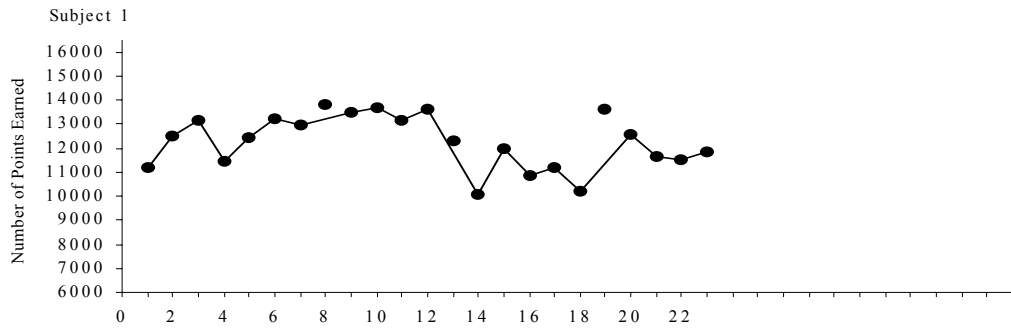


Figure 2

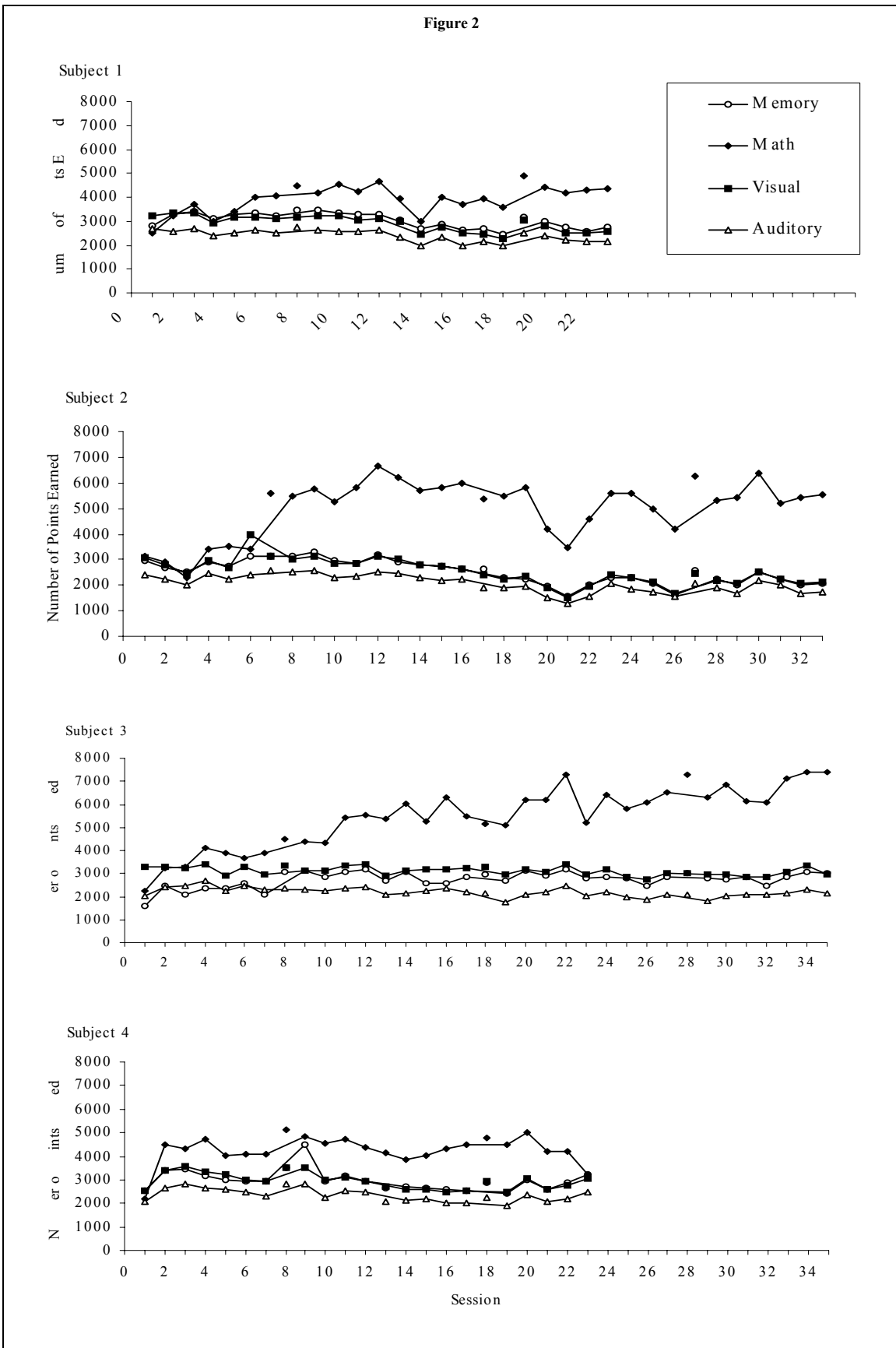


Figure 3

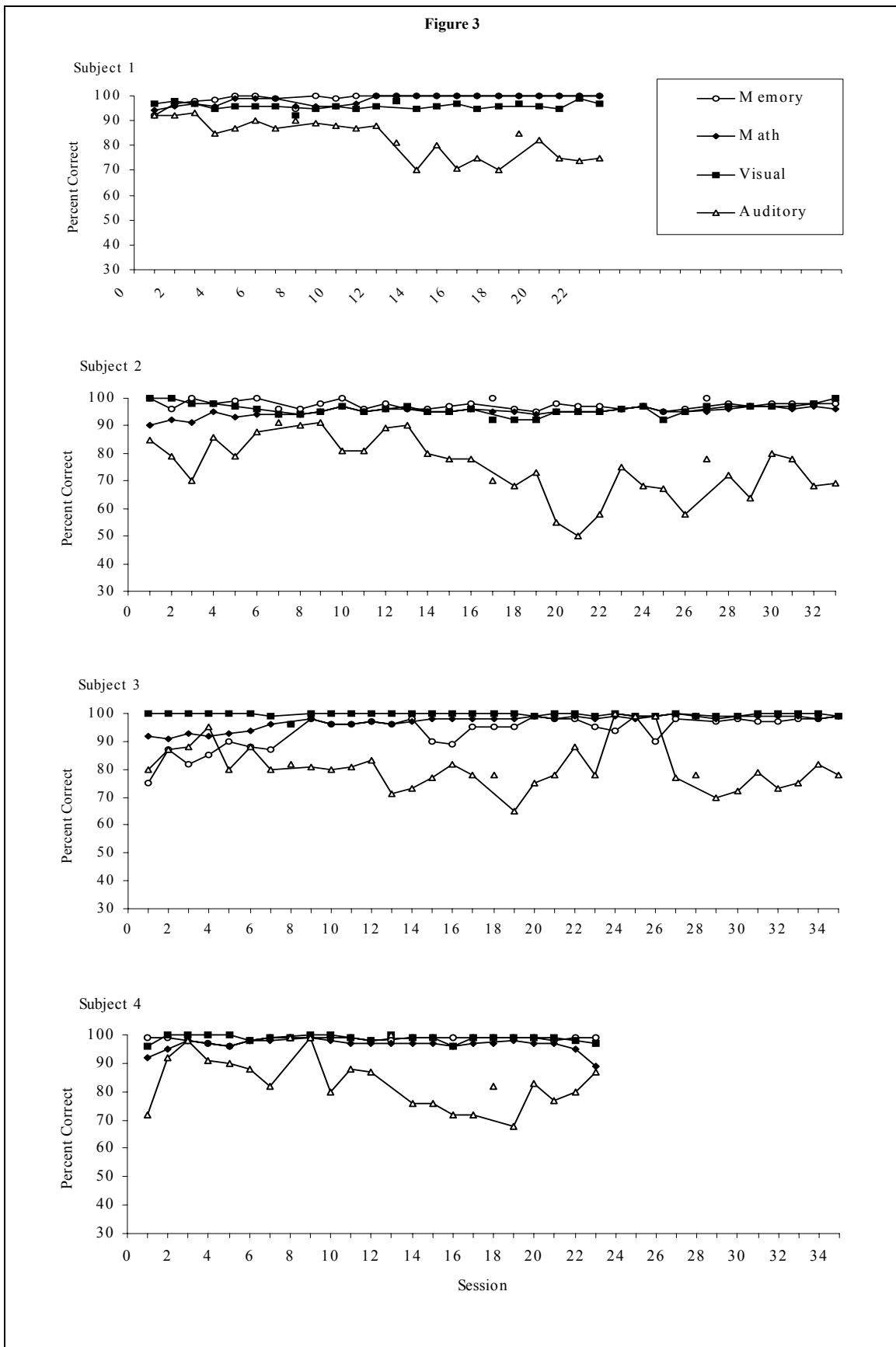


Figure 3 displays the percentage of correct responses on each of the sub-tasks for each participant. The four participants responded very accurately on the memory, visual monitoring and arithmetic sub-tasks across all phases of the study. Responding was less accurate on the auditory monitoring tasks and accuracy decreased over time; it was not, however, systematically affected by changes in the pay systems. Thus, accuracy was not differentially affected by the pay systems for any of the participants. It is particularly important to note that accuracy did not suffer when performance increased.

Participants rank-ordered the hourly pay, individual incentive pay and group incentive pay in terms of preference, satisfaction and evocation of stress on a post-experimental questionnaire. All four indicated that the individual incentive pay system was their most preferred pay system and the one with which they were most satisfied. Three of the four reported that the group incentive system was the most stressful and the hourly pay was the least stressful. In contrast, one ranked the individual incentive system as the most stressful and one ranked the individual incentive system as the least stressful. Participants were also asked to choose the pay system they would like to work under in the future. All four chose the individual incentive pay system. Thus, even though most of the participants found hourly pay to be the least stressful, all participants favored the individual incentive pay. When asked to explain their preferences on the questionnaire, participants indicated that they preferred the individual monetary incentive system because they earned more money under this system than under either of the other two systems, which was true. Thus, consistent with the results of previous studies (Bucklin & Dickinson, in press; Dickinson & Gillette, 1993; Honeywell et al., 1997), worker preference, satisfaction and choice were influenced by the amount of money earned. Nonetheless, it is the case that high performers will always earn more when they are paid individual incentives than when they are paid group incentives. Thus, for high performers, the amount of pay and the type of incentive system

will always be confounded in actual work settings.

Finally, to assess the integrity of the group simulation, participants were asked to identify the number of people they thought participated in their work group during the small group monetary incentive phase on a post-experimental questionnaire. All four reported that there were 10 members in the group.

## DISCUSSION

Three of the four participants performed lower when they were paid small group monetary incentives than when they were paid individual incentives. These data indicate that high performers are likely to decrease their performance when they are paid small group monetary incentives, which supports the position of Dierks and McNally (1997) and Honeywell-Johnson and Dickinson (1999). Of interest is the fact that quality did not suffer when participants performed at higher levels. Participant reaction data indicated that all four participants preferred the individual monetary incentive system in spite of the fact that three of the four found hourly pay to be less stressful. In addition, three of the four reported that group monetary incentive pay was more stressful than either individual monetary incentive pay or hourly pay. As indicated earlier, all four participants reported that they preferred the individual monetary incentive system because they earned more money. Taken together with the performance data, these verbal statements imply that participants may have performed lower when paid group monetary incentives because their earnings decreased, as originally suggested by Dierks and McNally (1997).

This study is important in that it was the first to demonstrate that high performers may perform lower when they are paid equally-divided monetary incentives than when they are paid individual monetary incentives, although this phenomenon was suggested in two prior studies (Honeywell et al., 1999; London & Oldham, 1977). The results have important implications for organizational settings, particularly given the prevalence of small group

monetary incentives in business and industry. If there are distinct high performers in a small group, they may perform lower if they are paid group monetary incentives than if they are paid individual incentives, thereby decreasing the overall performance of the group. The nature of the work task may preclude the use of individual incentives; nonetheless, if they are a reasonable option, companies should consider them in light of these data. It is equally important to note that, in the current study, quality did not suffer when performance increased. If these results are replicated, employers need not fear that increases in performance will lead to decreased quality when individuals are paid individual monetary incentives. Finally, the results of this study help delineate the conditions under which performance differences will occur when workers are paid individual versus small group monetary incentives and may explain why the results of some of the prior studies have conflicted.

Performance is not the only concern when analyzing the effects of monetary incentive systems; rather, employee acceptance is critical to the success of a pay system as well. Moreover, Mawhinney (1984) has insightfully argued that behavior analysts have an ethical responsibility to evaluate employee satisfaction: "If we are seriously committed to the values of improved productivity *and* [sic] job satisfaction we must come to grips with the satisfaction issue. Our theory is clear on this point. We can achieve high productivity *and* [sic] high satisfaction. But we can also achieve high productivity *with* [sic] low satisfaction. Unless we measure Eden-actual value received discrepancies (dissatisfaction) we cannot hope to achieve our equally worthy objectives of high productivity and high satisfaction" (p. 23). In the current study, all four high performers expressed strong preference for the individual monetary incentive system. Three of the four found group monetary incentives to be more stressful than either individual incentive pay or hourly pay. While it is certainly the case that individual monetary incentive systems can be designed in such a way as to be exploitative and aversive<sup>9</sup>,

the data herein suggest that individual incentive systems can, when designed well, evoke more positive reactions from high performers than either hourly pay or group monetary incentive pay. On the other hand, it should be pointed out that low performers are likely to prefer group monetary incentive pay and find that type of pay to be more satisfying (Honeywell et al., 1997).

There are limitations to the generality of the results of this study. First, the group was simulated, eliminating social influences on performance. While this procedure has experimental advantages in that it prevents within- and across-study confounds due to uncontrolled interactions among group members, such social interactions could well influence the results in other settings. For example, praise and recognition from others may sustain the high performance of individuals when they are paid small group monetary incentives. Links to other potential organizational rewards, such as increases in base pay, preferred work schedules and vacation days, promotions, etc., could also sustain such high performance. Second, task structure could influence the results. In the current study, as in all of the studies that have compared the effects of individual and equally-divided small group monetary incentives, the task was "additive." That is, the performance of each member of the group was independent and added together to determine the group's performance. Interdependent tasks may lead to different results. As suggested in the current study, the type of task could also affect the results. Production tasks and tasks where the rate of performance is largely controlled by the individual (tasks that are analogous to the arithmetic task in this study) may be more susceptible to influence by monetary incentives, and hence, to performance differences when linked to individual versus group monetary incentives than tasks that are analogous to the other types of tasks in this study (memory, visual monitoring, and auditory monitoring tasks). Four, different feedback procedures might lead to different results. In this study,

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incentive systems aversive and how they can be avoided, readers are referred to Dickinson and Gillette (1993), pages 10-14.

3. <sup>9</sup> For a discussion of the factors that make monetary

participants were given individual feedback when they were paid hourly and when they were paid individual incentives, but given only group feedback when they were paid group incentives. In business and industry, when employees are paid group incentives they typically receive only group feedback. In fact, often, the only performance feedback employees receive are the monetary incentives themselves. Thus, the group feedback procedure was used because it reflects current practice. Nonetheless, results may differ if individuals receive individual feedback along with group monetary incentives. Finally, the size of the group may influence the results. In the current study, participants believed that they were members of a ten-person group. If high performers believed that the group was smaller (or, if indeed it was smaller), their performance might be maintained under group monetary incentives, due to the fact that their performance contributes proportionately more to the group's performance and thus they have more control over their own earnings. Therefore, "top performers may recognize, particularly in small groups, that decreases in their own performance would lead to further reductions in their earnings" (Stoneman & Dickinson, 1989, p. 147).

The limitations of generality discussed above provide direction for future research. Additionally, one logical extension of the study is to determine whether individual and small group monetary incentives have different effects on average and low performance. As argued earlier, it is likely that performance will not differ under individual and group monetary incentives if all members of the group perform similarly. However, it is not clear that average performance would remain the same if an individual is aware of the fact that other members of the group are performing considerably higher or lower. Nor is it clear how low performance would be affected. Honeywell et al. (1997) argued that low performers are likely to continue to perform below average when switched from individual to group monetary incentives because they benefit from the labor of other group members. The results of one study (London & Oldham, 1977) support their argument. The study was conducted for other reasons, however, and although the data

were highly suggestive, the authors did not conduct statistical tests that compared the performance of low performers when they were paid individual incentives and when they were paid equally-divided group incentives that were based on the average performance of the members of the group. However, in that same study, when low performers believed that their partner performed 25% better than they did and received incentives based on the performance of their partner (rather than on the average performance of the two), low performers increased their performance considerably. Thus, when faced with extreme overpayment, low performers may increase their performance. Clearly, the results of the current study together with those reported by London & Oldham (1977) provide fertile ground for further research.

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EXPANDING THE EXPLANATORY BASE OF BEHAVIOR ANALYSIS VIA  
MODERN CONNECTIONISM: SELECTIONISM AS A COMMON  
EXPLANATORY CORE

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Abstract

Selection is an important component of Darwin's functional explanation of the origin and extinction of species. It is an equally important component of Skinner's functional explanation of the origin and extinction of behavior. Darwin's functional explanation was marginalized within biology on the basis that it was an incomplete explanation because it lacked any plausible proximal causal mechanism for how variation was instantiated and for how natural selection could operate on this variation. Population genetics completed Darwin's evolutionary explanation by providing the required proximal causal mechanism information. Skinner's functional explanation of behavior has been marginalized within psychology for the same general reason that Darwin's theory was marginalized within biology. No proximal causal mechanisms are available to explain behavioral variation and how contingent consequences can selectively reinforce or strengthen target behaviors. Arguments that the experimental analysis of behavior can proceed without this information are correct in the same way that Darwin could continue his research in the absence of population genetics. However, history demonstrates that marginalization will remain until proximal causal information is provided. Parallel Distributed Processing Connectionist Neural Networks provide the requisite proximal causal explanations. This article demonstrates how this explanatory approach is fully compatible with the experimental analysis of behavior. Expansion of the explanatory basis of behavior analysis could potentially promote it within psychology to the same degree that population genetics promoted evolution within biology.

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This article notes that applied behavior analysis and its selectionist orientation have been marginalized but that selectionism is gaining acceptance at an exponential rate in the form of Parallel Distributed Processing (PDP) connectionism<sup>10</sup> which is theoretically consistent with radical behaviorism because it is a superset of radical behaviorism. It therefore follows that applied behavior analysis may be able to expand its appeal by extending its explanatory base to include the new selectionist explanations used by PDP connectionism.

The first section of this article summarizes the selectionist approach that

underlies the experimental analysis of behavior and its behavior therapeutic applications. This is done to emphasize the importance and value of this explanatory approach and to demonstrate my commitment to this perspective so that there can be no doubt as to my sincerity in this matter. Another reason for beginning with this section is that PDP connectionism supports selectionism.

The second section of this article notes that explanation based on selection outside of PDP connectionism has become severely marginalized within psychology. A future consequence of this trend, if left unchecked, is that fewer and fewer proponents of applied behavior analysis will have less and less impact on science, clinical practice, and education. Representation and influence in professional societies will continue to wane. It is time to act in new more effective ways before extinction fully occurs.

The third portion of this article proposes a "recovery plan" based on PDP connectionism. The main reasons are: 1) this form of connectionism fully embraces selectionist explanation, 2) it constitutes a superset of

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<sup>10</sup> E. L. Thorndike's (1898) theory of animal intelligence was called connectionism because he described learned associations between stimuli and responses as bonds or connections. Making or breaking habits strengthened or weakened connecting bonds between sense impressions and actions. His spread of effect papers (Thorndike, 1933) described the beginnings of a network theory. He argued that reinforcement automatically influenced the connection at hand but it also acted on temporarily adjacent connections occurring just before or just after the time when reinforcement was given.



behaviorism that is compatible with mainstream psychology, and 3) its growth is exponential. Empirical support for these three claims is provided by the work of John Donahoe, a “card-carrying” behaviorist.

### SELECTION OF BEHAVIOR

The word operant means to operate on the physical and/or social environment. Operants refer to theoretical distributions that describe slight variations in how the same behavior recurs in the same situation. We shall refer to them as response variations to highlight explanation by selection. For example, a rat does not consistently press a bar in exactly the same way. Slight variations in force, duration, and body position characterize each bar press. Some response variants effectively depress the lever; others do not. Contingent food access alters the distribution of operant response variants. The frequency of ineffective response variants will decrease whereas the frequency of effective response variants will increase. We therefore say that the environment selects behavior. We can equivalently assert that consequences shape behavior.

Extensive experimental evidence clearly demonstrates that contingent consequences alter the shape of operant response variant distributions. Removing response variants from the low end of a distribution causes the mean of the remaining response variants to be higher than the original mean. Removing response variants at the high end of a distribution causes the mean of the remaining response variants to be lower than the original mean. Stated otherwise, selectively deleting response variants from either end of an operant distribution modifies the remainder of the response variant distribution in predictable ways, which modifies the organism’s future behavior. This scientific principle or law has been empirically supported by laboratory evidence derived from many species and over various responses. Supporting evidence is too extensive and well known to be reviewed here.

It is descriptively accurate to say that the effective response variants are reinforced by contingent access to food as long as reinforced only means to make stronger, more forceful and/or of longer duration or more probable. It is equally correct to say that the ineffective response variants are extinguished as long as extinguished means only that the organism emits them less frequently if at all. The devastating distortions that currently surround this terminology have altered my vocabulary variations to where I now speak almost exclusively of selecting response variants.

The selection of behavior is a truly general process and pertains to all aspects of what people do; including relationships with their pets and other people. A well-known psychologist related the following informative story. His routine upon arriving home from work began by petting his dog who eagerly greeted him. At some point he became increasingly preoccupied with work and gradually paid less and less attention to his dog upon arriving home. This behavior change on his part meant that an increasingly large proportion of his dog’s greeting response variants became ineffective in that they no longer set the occasion for being petted. This behavioral change on the part of the pet owner steadily modified the dog’s greeting response distribution. The modal greeting response variant gradually shifted and was shaped toward more aggressive behavior. The pet owner first noticed these behavior changes when his dog greeted him by jumping up on him and licking his face. Initially he was puzzled and wondered what had “gotten into his dog”; why had he changed so much. The dog’s greeting behavior generalized to visitors and thereby became more problematic. This psychologist’s understanding of behavioral selection enabled him to see how his behavior had shaped his dog’s greeting response variants. This insight led to an effective treatment. He greeted his dog before his dog greeted him thereby drastically reducing what the dog had to do to get petted. That behavioral change on his part edited the dog’s response variant distribution in the opposite way. The distribution of the dog greeting response variants soon returned to what it once

was and all was well ever after. This dog story would work just as well if it were about two people. Relationships entail mutual control and influence, whether based on positive or negative consequences. We continually modify response variants about many facets of each other's behavior whether we intend on doing so or not. Sometimes this process produces behavior disorder that leads to professional referral. People are frequently unable to improve their situation because they do not understand the selection process whereby distributions of response variants are shaped. Formulating behavior disorder in selectionist terms is a special skill that all behavior therapists should have. Bringing this knowledge to psychologists in general and clinical psychologists in particular is one important contribution that behaviorists have long been trying to make.

Cognitive and trait explanations have not clarified the functional relationship between consequences and the shape of response variant distributions because they do not address these issues. Rather, they engage explanation on a structural basis. They look inside the organism for personality structures such as traits and when such are found they are not related to distributions of response variants. Instead, trait proponents presume an unexplained relationship between internal psychological states and the behaviors to be explained; they show no interest nor make any effort to explain how psychological states are related to distributions of response variants. These structural explanations impede selectionist explanations because they take the explanatory search away from response variation distributions and the contingent consequences that reshape them.

Selectionist explanations are developmental explanations because they are based on the life history of the organism. The selection of behavior frequently entails the behavior of other people and often occurs in social contexts, which makes selection relevant to social, family, community, and group psychology. The selection of behavior changes the organism physically in ways that biologists and neuroscientists can now measure which makes behavioral selection relevant to and

compatible with neuroscience. Hence, many developmental, social, and biological changes can be explained on the basis of behavioral selection. A science of behavior based on selection provides general scientific explanations that stand on their own. For example, neuroscience explanations will only add relevant details about how the process of behavioral selection takes place but will not alter the fact that behavioral selection occurs in the way that the experimental analysis of behavior has established. Modern inquiry within biology complements and supports selectionist explanations. Modern inquiry within psychology occurs mainly in opposition to selectionist explanations.

#### THE MARGINALIZATION AND POSSIBLE EXTINCTION OF BEHAVIOR ANALYSIS

Selectionist explanation dominates biological theory. Darwin's evolution by variation and natural selection has been hailed as perhaps the most important and revolutionary idea in all of science. Skinner's explanation of behavioral selection is directly parallel with Darwin's explanation in that both depend upon variation and selection (Skinner, 1963, 1966, 1975, 1981, 1984a, 1984b; Smith 1983, 1984; Tryon, 1993). Selectionist explanation of behavior is both parsimonious and superbly supported by data collected under well-controlled laboratory conditions for various behaviors in multiple species including human behavior. Many useful clinical studies and demonstrations of therapeutic value could be cited that are based on selectionism. One would therefore think that explanation by selection should be highly regarded and commonly practiced in psychology generally and clinical psychology in particular.

It is therefore surprising that selection is a decidedly unpopular and marginalized explanatory approach within psychology. When discussed at all, it is usually pitted against a preferred cognitive explanatory approach. This sentiment is reflected in professional affiliations. Figures recently obtained from the American

Psychological Association show that of its 155,000 current members only 650, less than half of one percent, support the experimental analysis of behavior by membership in Division 25. Only a small minority of Association for the Advancement of Behavior Therapy (AABT) members identify themselves with the experimental analysis of behavior. The large majority of psychologists and AABT members endorse a cognitive-behavioral perspective while many others claim a purely cognitive orientation. This was not always the case. The selectionist approach once was much better represented in these and related professional organizations. We may therefore reasonably conclude that selectionism is on the decline in psychology. The graying of the American professorate implies accelerated retirement of selectionists as well as cognitivists. However, the differential rates with which selectionists and cognitivists are replacing themselves professionally indicates that cognitivists will predominate among new hires thereby further eroding and marginalizing the selectionist position. We can anticipate that fewer and fewer courses will teach selectionism thereby educating fewer and fewer students about this orientation resulting in fewer and fewer selectionist job candidates and less interest in hiring them. Left unchecked, these developments will decimate membership in professional organizations to the point where revenues will no longer support journal publication. It is alarming but not altogether incorrect to say that explanation by selection has been marginalized to the point of where its extinction is within view. Current verbal response variants by advocates of selectionism may be technically correct and highly articulate but the effects of their rhetoric seem either to be ineffective or to be further alienating the majority of psychologists. What is wrong here? Perhaps a functional analysis of this behavior is in order.

We need look no further than the history of biology and its initial response to Darwin's theory of evolution by variation and selection to find a major reason why selection is not an acceptable or satisfactory explanation to many psychologists (cf. Donahoe, 1997). One could

not possibly tell from the current fanfare surrounding Darwin that most biologists initially rejected his views for more than 75 years. See Bowler (1983), Catania (1978, 1987), Donahoe, Burgos, and Palmer (1993), Mayer (1982), and Tryon (1993) for further details. Darwin presented a *functional analysis* that interrelated biological variation and selection by natural consequences. Opposition to his functional analysis was based on his lack of plausible proximal causal mechanisms for how variation was instantiated and for how consequences altered that variation because genetics was an unknown science at that time. His functional explanation was therefore deemed *partial* and *insufficient* even though he spent the greater portion of his adult life compiling voluminous and meticulous support for his views. No amount of empirical support for his functional theory could have persuaded other scientists because such data did not address the absence of plausible proximal causal, explanatory, mechanisms for how variation and selection exerted their effects. No amount of confirmation *that* his functional analysis was correct could explain *why* it was correct. Biologists rejected Darwin's functional theory of evolution for more than 75 years until the field of population genetics satisfactorily explained both issues. Addressing the genetic basis of variation and selection augmented rather than diminished Darwin's contributions. Darwin would likely be an obscure figure in the history of science today if plausible proximal explanatory mechanisms had not been found for his functional theory. I submit that psychologists are withholding general acceptance of selectionist explanations of behavior for similar reasons. It follows logically that marginalization of selectionist explanations within psychology will continue until satisfactory explanations of these matters have are presented. Donahoe (1997) concurs. It also follows that Skinner may be promoted within psychology as Darwin was within biology by extending explanation to plausible proximal causal mechanisms underlying behavioral selection.

A second reason why I believe that psychologists have not accepted behavioral

selection is that current explanations by selection are not psychological because they do not engage psychological processes of perception, learning, and/or memory, etc. Put otherwise, the absence of psychological processes from plausible proximal causal mechanisms driving behavioral variation and selection precludes such explanations of behavior from being psychological. Making no contact with any psychological process has not proved to be a very good marketing strategy for convincing psychologists to endorse behavioral selection<sup>11</sup>.

Isolationism is a third factor; corollary to the second factor that inhibits the acceptance of selectionist explanation of behavior. Wilson (1998) observed that the natural sciences are integrated. He coined the term *consilience* to refer to the integration of theory and method across the natural sciences. The experimental analysis of behavior presently shows little evidence of consilience. Behaviorists shun attempts to provide plausible proximal causal explanations in neuroscience terms as much as they resist explanations in psychological terms. Behaviorists do not have plausible proximal causal mechanisms that they prefer to psychological or neuroscience explanations; they simply oppose all attempts to completely explain behavioral selection by addressing intermediary causal steps; by addressing the O in the S-O-R model. At least three motivations can

be identified for this position. One motive is that a complete explanation is not necessary because one can conduct behavioral experiments and perform behavior therapy in the absence of a complete scientific understanding of behavioral selection. A second motive is that all considerations of plausible proximal causal mechanisms get in the way of completing a functional analysis and therefore are to be opposed as part of the problem rather than part of the solution. A third motive is that all proximal causal explanations are necessarily circular and therefore unacceptable.

All three motives are misguided. With regard to the first motive, just as it was possible for Darwin to conduct many studies in the absence of any plausible proximal mechanisms to explain his functional analyses, so it is possible for behaviorists to conduct experiments and provide therapy based on functional analysis without any further causal understanding of behavioral selection. However, behaviorists should also expect to be marginalized by the scientific community as completely as Darwin initially was because they cannot fully explain why their functional relationships work as they do. Assertions that a complete understanding of behavioral selection is beyond the scope of behavioral analysis are unacceptable. Darwin's functional theory of evolution was never accepted on its own terms. Its marginalization prevailed for more than 75 years and would have continued indefinitely had explanation not proceeded past a functional analysis. Skinner's functional theory is currently marginalized and will remain so until a more complete understanding of behavioral selection is provided. Arguments that the experimental analysis of behavior stands on its own may be motivated by an attempt to justify this branch of science but such behavior has had the unintended consequence of shunning all other scientists on the basis that their work makes no contribution to understanding behavioral selection. Such ruptures of consilience continue to isolate the experimental analysis of behavior within the general scientific community. Acceptance of evolutionary theory was conditional upon consilience with population genetics because it provided the necessary

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<sup>11</sup> Behaviorists do not have preferred plausible proximal causal mechanisms that they feel are superior to psychological and/or biological mechanisms but rather they reject all efforts as closing the explanatory gap. Hence, behaviorists can only presume rather than explain the ability of contingent consequences to reshape response variant distributions. The question of why reinforcers work as they do remains unaddressed and unanswered. Behaviorists suppose that understanding how selection works within the organism is not their responsibility and they refuse to devote time and resources to these questions. Assertions that neuroscience can only confirm functional relationships established by behavior analysis implies openness to biological explanations as compatible with and extending functional analytic explanations but resistance remains high to including contemporary neuroscience into behavioral analytic explanations. Even the need or desirability of extending functional analytic explanations in any way remains unacknowledged.

explanatory extensions to account for how behavioral variation was instantiated and how the process of natural selection could work as Darwin described. Darwin had to “go it alone” because the field of genetics had not yet been developed. Skinner and his intellectual descendents have chosen to go it alone. Isolation and marginalization are the clear consequences in both cases.

With regard to the second motive, Darwin’s functional analysis in terms of variation and selection was advanced not retarded by genetic mechanisms. It is therefore not true that consideration of proximal causal mechanisms always interferes with a functional analysis. Citing instances where attention to proximal causal mechanisms has interrupted completion of a functional analysis is not proof that all efforts to understand the proximal causal processes associated with behavioral selection will do so.

With regard to the third motive, the formerly circularly defined hypothetical construct of learning has been replaced by an objective neuroscience analysis of underlying biological events (see below). Further progress in this arena is the objective of cognitive neuroscience. Not incorporating neuroscience findings has not proved to be a very good marketing strategy for convincing scientists in general to endorse behavioral selection.

All three of these reasons for rejecting behavioral selection must be addressed, in my opinion, if the selectionist understanding of behavior is to become widely endorsed by psychologists. Some proximal causal mechanism for how response variant distributions are instantiated and how they are reshaped by contingent consequences that engage the interests of psychologists, neuroscientists, and other natural scientists must be found or endorsed if the experimental analysis of behavior hopes to maintain the interest of more than a few people. PDP connectionism provides an opportunity to do this in a way that does not repudiate fundamental theory construction values held by behavior

analysts. Donahoe and Dorsel (1997) and their contributor’s concur with this view.

### PDP CONNECTIONISM - NEURAL NETWORK LEARNING THEORY

Connectionism exists in many forms. I refer exclusively to the parallel-distributed processing (PDP) version of connectionism. This form of connectionism is opposed to the same black box and arrow symbol manipulating cognitive psychology that Skinner and others have long criticized. PDP connectionists note that symbol manipulating cognitive psychologists do not explain how cognition works or how it influences behavior. Ascribing functional properties to cognitive constructs such as schemas is insufficient because no explanation of how schemas accomplish their functions is provided. Their theoretical assertions are functional statements absent any plausible proximal causal explanation for how these functions are implemented<sup>12</sup>. On the other hand, symbol manipulating cognitive psychologists criticize PDP connectionism as a form of neo-Behaviorism (cf. Elman et al., 1996, pp. 103-104).

The sections below sketch essential points regarding PDP connectionism. Those who wish to learn more should consult introductory texts to this field (e.g., Elman et al., 1996; McLeod, Plunkett & Rolls, 1998; O’Reilly, & Munakata, 2000; Thagard, 2000).

#### Learning and Reinforcement

Learning has long been factually, empirically, defined as “... a more or less permanent change in behavior which occurs as a result of practice” (Kimble, 1961, p. 2). This approach defines learning as an inferred variable, a hypothetical construct, characterized

<sup>12</sup> It is notable that PDP connectionism criticizes symbol manipulating cognitive psychology on the same grounds that symbol manipulating cognitive psychology criticizes radical behaviorism; namely that their explanations entirely entail functional statements that lack plausible proximal causal mechanisms to account for *why* and *how* these functions occur as they do.

in terms of behavior change. It therefore cannot be used to explain behavior change. To argue: 1) behavior has changed, 2) this behavior change is evidence that learning occurred, 3) This behavior change occurred because of learning is logically defective because it entails circular reasoning. Observation is followed by inference, which is used to explain the observation. Observed behavior change is being used to both infer learning and to explain itself. The concept of conditioning is considered to be a subset of learning that is associated with contingent environmental consequence and therefore entails the same circular reasoning. So is the concept of reinforcement (see below).

There have been many theoretical definitions of learning. We confine ourselves to Hebb (1949) who speculated that learning alters synaptic properties. Hebb (1949, p. 62) conjectured "When the axon of cell A is near enough to excite a cell B and repeatedly or persistently takes part in firing it, some growth process or metabolic change takes place in one or both cells such that A's efficiency, as one of the cells firing B, is increased" (Levine, 1991, pp. 16-18; Wasserman, 1989, pp. 212-214). This approach once suffered from the "and then something magical happens about here" limitation. Skinner (1938, p. 421) criticized such speculations as involving the Conceptual Nervous System (CNS) rather than the Central Nervous System. However, neuroscience has since confirmed Hebb's conjecture and demonstrated through direct measurement under controlled laboratory conditions that learning entails synaptic change (see Function alters Structure section below). Reinforcement occurs because synaptic properties are changed by certain contingent consequences. These findings are sufficiently dependable that one can now safely and correctly infer specific biological changes on the basis of the specific behavioral changes that have previously been taken as evidence of learning. Defining learning in biological terms: 1) infuses it with physical reality and removes it from the realm of hypothetical speculation and 2) solves the circularity problem.

Hebb's learning principle is called the Hebbian learning rule when implemented mathematically in PDP simulations. Another learning rule, the Delta learning rule, is mathematically equal to the Rescorla-Wagner model of classical conditioning (Levine, 1991, pp. 58-60). This similarity reflects fundamental agreement between behaviorism and PDP connectionism about how learning occurs.

The singularly most important fact here for present purposes is the role played by selection in the learning process. Consider a network of neurons interconnected with synapses. Contingent consequences selectively strengthen, reinforce, particular pathways by creating synaptic Long-term Potentiation (LTP) or selectively weaken specific pathways by creating synaptic Long-term Depression (LTD) (See Function Alters Structure section). Synapses connecting pairs of neurons are strengthened or not depending upon their activation levels, which depends on the sum of the stimuli received across their many dendrites and the sigmoidal activation function that triggers depolarization. These are all deterministic processes that begin with sensory input and are modified by contingent consequences. Neural Darwinism is a term that has been used to characterize these processes (cf. Levine, 1991, pp. 239-241). These selectionist processes are driven by consequences rather than by theorist design. PDP connectionism provides a selectionist account of how structure and function interact in a cumulative way to produce behavioral and psychological development. It is an important theory construction advance that PDP connectionism can support such an integrated causal explanation.

It is not generally acknowledged that the concept of reinforcement is also circularly defined. A reinforcer is functionally identified by the increase in frequency, intensity, duration, or probability of behavior associated with its onset contingent upon the emission of a target behavior. But then the increased frequency, intensity, duration, or probability of the target behavior is explained in terms of reinforcement. Woods' (1974) taxonomy of instrumental

conditioning provides another way to see this. He defines Reward Conditioning in terms of the contingent onset of a positive reinforcer and notes that this results in the strengthening of behavior. However, a positive reinforcer is identified by its ability to strengthen behavior when presented contingently. Explaining an increase in the frequency, intensity, duration, or probability of behavior via reinforcement is circular. This explanatory practice has been accepted despite its flawed circular logic because investigators and therapists can manipulate reinforcers once they have been identified. However, it remains the case that the observation, behavior change, used to identify a reinforcer makes explaining the behavior change in terms of reinforcement circular. The problem is parallel with the concept of learning and other behaviorally defined constructs. In general, functional theories cannot escape circular definitions because they cannot go beyond a functional description of behavior. They cannot explain *why* or *how* functional relationships occur; they can only document *that* they occur. One cannot ask the legitimate and reasonable question, “why is a reinforcer reinforcing”; or equivalently, “why do some stimuli alter behavior when presented contingently and others do not?” Citing any other functional relationship at the behavior-analytic level cannot adequately answer such questions. Functional relationships among other than behavioral (e.g., biological) processes and/or structural reasons must be cited in order to provide plausible proximal causal mechanisms for the documented functional behavioral-analytic relationships. Functional relationships among biological variables pertinent to synaptic function have already been provided to explain learning. They also explain why reinforcers are reinforcing. Functional theories are always incomplete because they provide incomplete explanations due to self-imposed restrictions on their explanatory base. We now consider structural explanations.

### Structure Determines Function

I use the term structure to refer to the physical structure of the brain, including the status of the trillion or so synapses, at any

particular instant in time and could extend this definition to include the entire organism if necessary. Response to the very next stimulus is completely determined by said structure, which reflects the cumulative reinforcement history of the organism, its genetic endowment, and all developmental factors leading to its current state at a particular instant in time. This configuration can be confidently said to determine the very next response because all variables with physical existence have been included up to that point in time leaving no room for any other variable to confound this explanation. PDP connectionism primarily characterizes this state in terms of a) neural architecture, and b) the activation (excitatory or inhibitory) status of all synapses entailed by this architecture.

Neural architecture refers to the physical interconnections of all neurons. Many brain structures are layered and impulses travel from one layer to another. Impulses also travel from one structure to another and back again. Both excitatory and inhibitory pathways are present. Some simplification of this enormously complex situation is presently required in order to advance inquiry. Parallel Distributed Processing Connectionist Neural Networks (PDP-CNNs) therefore presently entail a few layers of nodes that are frequently called neurons because their functioning is limited to important basic neural properties including some form of dendritic summation and a nonlinear activation function that determines if the neuron fires or not. Stimulus inputs are presented to the first layer in the form of a distributed representation that can be at any of several levels of abstraction ranging from global characteristics down to individual receptors. Neurons that fire propagate their impulses to subsequent layers. Neural architectures that implement recurrent networks feed impulses back to prior layers. Behavior is indicated by the status of output (response) neurons. These networks yield specific results based on the complex interaction of first principles. This level of mechanism specificity goes well beyond the black box and arrow models that characterize most of cognitive psychology.

An extensive literature now supports the view that brain damage alters behavior (Kalat, 2001; Kolb & Whishaw, 1996). Sach's (1985) colorful clinical description of patients with neurological deficits indicates that the brain is highly modularized and that damage to any module modifies behavior; often in bizarre ways.

Neural architecture is strongly influenced by our genetic material (DNA). Learning entails association and NMDA receptors have been shown to influence how well associations are formed. NMDA receptors are composed of NR2A and NR2B subunits. NR2B subunits stay open longer than NR2A subunits enabling them to better detect when two neurons are concurrently active and setting the occasion for the biochemical cascade that defines learning. Staying open longer allows more calcium ions to pass which makes the NR2B response more vigorous than the NR2A response. NR2B units predominate in young organisms while NR2A units predominate in old organisms. The superior functional properties of NR2B subunits promote better learning in young than old organisms.

Normal genetic expression entails a shift from NR2B to NR2A units over the organism's lifetime. Tang et al. (1999) created transgenic mice by linking a copy of the mouse NR2B gene to a promoter that is only active in the forebrain (hippocampus and amygdala) and injected it into fertilized mouse eggs. These additional genes, along with the mouse's own NR2B producing gene, produced an over expression of NR2B subunits in the forebrain of the resulting mice. These genetically altered mice excelled on six behavioral tests of learning compared to control subjects. These tasks included a novel-object recognition task, a retention test, contextual and cued fear conditioning tasks, a fear-extinction task, and a hidden-platform water maze. Genetic alteration was the independent variable with learning and memory measures as dependent variables. The resulting experimental evidence of the causal influence of genetics on behavior directly addresses the interactive issue posed by Hayes (1998) and avoids the problem

of biologism raised by Hayes (1998). See Tryon (2000b) for further details.

Without PDP connectionism there would be no understanding of how NMDA receptor properties could influence behavior. Only by understanding how multilayered networks give rise to behavior can one see how changing synaptic properties by modifying NMDA receptors causes behavioral changes. The PDP connectionist demand for mechanism answers drives the field of behavior genetics well beyond summary percentage of variance accounted for statements and pointless heredity vs. environment debates. Alternatively, selectionist explanations that impact NMDA subunit distributions are persuasive. PDP Connectionism advances our understanding of behavior genetics by explaining how the physical changes wrought by genetics influences the emergence of learning, memory, and behavior.

#### **Function Alters Structure**

Skinner rejected what he called the metaphor of storage and maintained that experience simply changes the organism and how it behaves. Frey (1997), Kalat (2001, pp. 385-388), and Kandel (1989, 1991), Rolls and Treves (1998, pp. 322-325), and Spitzer (1993, pp. 42-51) present empirical evidence showing that learning entails changes in synaptic function called Long-term Potentiation (LTP) and Long-term Depression (LTD) (Kalat, 2001; Kolb, & Whishaw, 1996; Singer, 1997). These changes include genetic expression through RNA transcription of DNA segments that result in new protein synthesis. Some structural changes also occur. Reinforcement and all other forms of learning entail these basic processes.

The PDP connectionist approach to learning is phylogenetically general (Tryon, 1995b). The same vocabulary and set of basic concepts apply equally well to humans as to animals. Laboratory research with animals that supports PDP connectionism is accepted much more readily than is laboratory research on behavior analysis. Gluck and Bower (1988) place the divorce between human and animal



learning in psychology at around 1968. PDP connectionism provides a contemporary platform for making animal research relevant to human behavior.

### Theory Construction Values

This section attempts to clarify the important theoretical values that behaviorism and PDP connectionism share. This is important because behavior analytic proponents rightfully do not want to broaden their explanatory base by compromising important theory construction values (cf. Tryon, 1995a, 1996).

**Explanation by selection.** Discussion above and below this section articulates the role of selection in PDP connectionist neural networks. Donahoe (1997), Donahoe, Burgos, and Palmer (1993), and Donahoe and Palmer (1989) further document this point.

**Absence of homunculus.** Skinner (1977, 1989) criticized explanations based on an inner process or being that made decisions. He correctly observed that such explanations merely redescribe behavior in psychological terms that beg the question of how the homunculus arrived at the decision cited as the causal explanation for the observed behavior. To say that I behaved in some way because I chose to do so explains nothing until the reasons for my choice have been identified. PDP connectionism does not appeal to homunculi. Choice is an emergent network property that is computed iteratively from first principles. Computer simulations are conducted to implement and document every step in a sequence resulting in choice. Each neuron knows only what it learns from its neighbors yet the network settles into a final state that is associated with one response or another. Choice is a holistic emergent property of network function; not the action of a homunculus.

**No rules.** Skinner (1977) maintained, “Rules are widely used as mental surrogates of behavior...” (p. 8). To explain behavior as an instance of rule following begs the explanatory question until one explains how the behavior from which the rule is inferred was shaped.

Asserting that behavior is rule governed begs the explanatory question of how this is possible. How does reading, verbalizing, or thinking about a rule lead to behavior? Rule learning suffers from the same circular logic that once characterized learning. Rules are inferred from behavioral regularities and these regularities are then explained as instances of rule following. PDP connectionism does not explain behavior in terms of rule following. Moreover, Allan (1993) reported that human contingency judgments are better accounted for by connectionist models than by rule-based models.

**No copy theory of perception.** Skinner (1977, 1989) properly objected to the copy theory of perception because it begs the question of how the copy is perceived inside the organism. PDP-CNN investigators such as Finkel and Sajda (1992, 1994) have simulated the perception of visual illusions using an artificial 128 x 128 pixel “retina” and a ten layer neural network. No copy theory of perception was used.

**Experience changes the organism.** We have already discussed above how contingent consequences set the occasion for a biochemical cascade that alters synaptic properties that change behavior.

**Learning.** This term is defined by biochemical and physical changes that have been independently and objectively observed and quantified under laboratory conditions. Learning is no longer defined in a circular way.

**Determinism.** Synaptic changes are deterministically produced by contingent consequences. Neural processing leading to emergent behavior is frequently modeled in a deterministic way.

### EMPIRICAL EVIDENCE

The work of John W. Donahoe provides clear evidence of the fundamental compatibility of PDP connectionism and the experimental analysis of behavior. His writings (Donahoe, 1991, 1997; Donahoe, Burgos, & Palmer, 1993; Donahoe & Palmer, 1989; Donahoe, Palmer & Burgos, 1997a; 1997b) and his web page

[\[http://www.umass.edu/neuro/faculty/donahoe.html\]](http://www.umass.edu/neuro/faculty/donahoe.html) detail a biobehavioral approach to the experimental analysis of behavior that embraces PDP connectionism and neural network simulations in order to better understand the role of selection in reinforcement and stimulus control. His leadership in this field is exemplary and points to a viable future.

### NEURAL NETWORK LEARNING THEORY

I coined the term Neural Network Learning Theory to refer to Parallel Distributed Processing Connectionist Neural Networks for four reasons. First, learning, which implies memory or else it cannot be cumulative, is arguably the primary psychological principle in that so much of development is influenced by what we learn. PDP connectionism makes clear that learning is involved in all that we do; e.g., perception is learned, memories are learned, etc... I have argued elsewhere that behavior therapy should be defined in terms of applied learning theory (Tryon, 2000a). I want to emphasize that PDP connectionism greatly informs us about the learning process and the biological mechanisms that support it.

Second, PDP connectionism occurs in a network context. While it is possible to discuss learning in terms of network nodes, these nodes have been given important properties of real neurons. Neuroscience has informed and continues to inform these learning models. I chose to recognize these interdisciplinary contributions by referring directly to neural networks. I limit this reference to the PDP versions of neural network models, as other forms of connectionism are not as compatible with behaviorism as is this form.

Third, I did not want to substitute one ism for another. I did not want to appear to be against behaviorism by being for connectionism. I now realize that PDP connectionism is a superset of behaviorism in that the former fully contains the latter. This is the logical basis for arguing that embracing the broader explanatory

base associated with PDP connectionism does not require any compromise of behaviorist principle. This is a “no cost” explanatory extension.

Fourth, concerns parsimony. NNLT entails four words whereas PDP-CNN entails six.

### RELATIONAL FRAME THEORY

Hayes, Barnes-Holmes and Roche (2001) present Relational Frame Theory (RFT) as a post-Skinnerian account of human language and cognition that they would like to see supplant contemporary psychological approaches to cognition and language. By post-Skinnerian they mean more than a theory that is presented after Skinner’s death. They mean a theory that goes beyond the explanatory bounds Skinner would permit. They view this extension as desirable and if successful would provide an alternative to the PDP connectionist approach discussed above. The next few paragraphs identify several fatal flaws in this proposal.

Equivalence classes are fundamental to RFT but they are acknowledged to be a behavioral paradox in that conditional discriminations are not expected to either reverse or combine (Hayes, et al., 2001, p. 18). Training to select stimulus B given stimulus A should not also produce selecting stimulus A given stimulus B but that is what occurs with stimulus equivalence. Stimulus equivalence contradicts behavioral theory and cannot be used to support or extend it. Hayes et al. (2001, p. 19) noted the relevance of equivalence classes to language but did not recognize their obligation to explain the phenomena of stimulus equivalence prior to speculating on how it helps explain human cognition and language. Citing an unexplained behavioral paradox does not provide an adequate explanation of anything.

Hayes et al. (2001, p. 21) referred to “derived relational responding” as the kernel of their behavioral analysis of language and cognition. These authors further asserted, “Relational Frame Theory embraces the simple idea that deriving stimulus relations is learned

behavior” (p. 22). Learning in this context is circularly defined and therefore cannot be used as a behavioral explanation. Observing instances of relational responding occasions inferences about learning which, are used to explain relational framing. The author’s state, “Verbal behavior is the action of framing events relationally, and verbal stimuli are stimuli that have their effects because they participate in relational frames” (p. 144). Deriving stimulus relations, relational frames, and relational responding are inferences based on behavior and cannot be used to explain anything else without engaging in the same circular reasoning and hypothetical constructs that cognitive psychologists are criticized for using. To say that verbal stimuli have their effects because they participate in relational frames is circular because relational framing was inferred from the verbal behaviors used to certify the presence of the relational frame. Using circularly defined hypothetical constructs to explain cognition and language truly constitutes a post-Skinnerian theory but not in the positive way intended by the authors.

Absent the above criticisms, RFT would be a partial explanation at best because it remains a functional analysis. No plausible proximal causal mechanisms are provided to explain the many presumed processes entailed in learning relational frames and how they change behavior. It remains a black box and arrow model with new names for the boxes<sup>13</sup>.

Hayes et al. (2001) promote RFT as a self-contained theory. This might be a virtue if mature sciences were all independent of each other. On the contrary, Wilson’s (1998) book entitled *Consilience* is subtitled *The Unity of Knowledge* because mature sciences are interrelated and form an interwoven tapestry of knowledge. RFT’s avoidance of interlevel theory stands in opposition to the community of natural science and therefore constitutes an impediment to greater acceptance of the

experimental analysis of behavior within the larger scientific community.

PDP-Connectionism on the other hand is extraordinarily consilient. Its fundamental compatibility with radical behaviorism, neuroscience, and cognitive psychology provides a heuristic link to the mature sciences that will advance the experimental analysis of behavior. Donahoe (1997) further articulates the benefits of PDP-connectionism for the experimental analysis of behavior in his chapter entitled “The *Necessity* of Neural Networks” (emphasis added).

### CONCLUSIONS

The first section of this article summarized the selectionist approach that underlies the experimental analysis of behavior and its behavior therapeutic applications in order to emphasize the importance and value of this explanatory approach and to demonstrate my commitment to this perspective so that my subsequent comments could not be dismissed as a someone who was not sympathetic to the experimental analysis of behavior. I have personally witnessed the marginalization of behavior analysis for over 30 years since starting graduate school in 1966. I believe that PDP connectionism provides a way to reverse this trend because: 1) it entails explanation by selection rather than design, 2) it entails a superset of behaviorism that is consilient with both contemporary cognitive psychology and neuroscience, and 3) its growth is exponential. I am not the first person to promote PDP connectionism within the experimental analysis of behavior (cf. Donahoe’s work). I believe that the strong substantive and historical parallels between Darwin and Skinner clearly point to the necessity for a consilient extension of the explanatory base underlying behavioral selection and predict a bright future for the experimental analysis of behavior only if these historical lessons are heeded.

The fundamental theoretical similarity that unites both PDP connectionism and radical behaviorism is that they are both *selectionist* explanations. Donahoe and Palmer (1989)

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<sup>13</sup> No personal criticism is intended by this seemingly harsh remark. We clearly have different views and I could not find a more delicate way of presenting the truth as I see it.

reviewed Rumelhart and McClelland's (1986) seminal work on PDP connectionism for readers of the *Journal of the Experimental Analysis of Behavior*. They stated "These (PDP connectionist) models are fundamentally different from typical models of cognitive psychology in that they are selectionist rather than essentialist in flavor. That is, the functionality of connections among the units is the result of selection by the environment rather than design by the theorist" (p. 399). Donahoe and Palmer emphasized the fundamental theoretical compatibility of radical behaviorism and PDP connectionism. They wrote, "It is clear, then, that adaptive networks simulate complex behavior through a selection process (i.e., "learning") and that the selection process is a function of the consequences scheduled for the output of the network. In behavior-analytic terms, complex environment-behavior relations in adaptive networks are the product of selection by reinforcement" (p. 404). Later on they wrote "The accounts of differential conditioning provided by adaptive networks and experimental-analytic findings are strikingly and persuasively congenial" (p. 408).

The subtitle of this article "Selectionism as a Common Explanatory Core" emphasizes that behaviorism and PDP connectionism share explanation by selection. Succinctly stated, Darwin replaced creationism with phylogenetic selection and Skinner similarly replaced what he described as creationist cognitive psychology with ontogenetic selection. PDP connectionism extends selection to neuroscience in a way that encompasses both Darwin's and Skinner's explanations. PDP connectionism is a superset of behaviorism that includes both Skinner and Darwin.

### Explanation

But what are the benefits of an expanded explanatory base? Why should we make such an effort? One benefit is that the resulting theoretical synthesis is a major scientific achievement on its own; one that helps repair the corrosive disunity that continues to characterize psychology (cf. Staats, 1983). Explanation is a fundamental goal of science. Disciplines such

as astronomy rely entirely on explanation and prediction because they cannot control astrophysical phenomena. A related benefit is to promote consilience with neuroscience in particular and other natural sciences more generally for that is the hallmark of a mature science (cf. Wilson, 1998).

These benefits may not motivate psychologists who neither value explanation beyond functional analysis nor see themselves in interdisciplinary terms or who do not wish to learn about a field they chose to forgo in favor of psychology. For those readers who are motivated more by practical than scientific values, a final "bottom line" benefit for endorsing PDP connectionism is that it effectively promotes explanation by selection among psychologists and thereby reverse the marginalization of applied behavior analysis. PDP connectionism is a major marketing strategy for making selectionism relevant to mainstream psychology in a way that classic radical behaviorism has not.

### Consilience

The extraordinary interdisciplinary and consilient nature of PDP connectionism is very reassuring and exciting. How could so many intelligent people in so many disciplines be wrong about the perceived benefits of this approach? Psychologists, all branches of neuroscience, mathematicians, physicists, engineers, and philosophers are working together in this field. Participating in such a large intellectual consortium is stimulating and supportive. It feels good to be part of an expanding and vibrant future especially when one has observed the progressive marginalization of their core discipline over the past 30+ years.

On the other hand, interdisciplinary study is daunting. I find that I cannot understand many articles written by mathematicians and physicists because they presume doctoral study in these areas that I have not had. I read their introductions and conclusions with interest and rely on my colleagues in those disciplines to evaluate the

adequacy of the technical merits. One need not work in all areas of PDP connectionism in order to endorse it. Any degree of participation is welcome. Those who do not have and/or cannot develop the requisite skills can support others who wish to expand their explanatory base. I have learned to accept my limitations and make contributions where I can. I am pleased that my Bidirectional Memory Model of PTSD satisfies all published standards for what a complete theory must accomplish including making novel predictions (cf. Tryon, 1998, 1999). I am also pleased with the theoretical integration that this interdisciplinary perspective affords (cf. Tryon, 1993, 1995a, 1995b, 1996, 2000a, 2000b).

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