REVIEW ARTICLE

Individual Monetary Incentives: A Review of Different Types of Arrangements Between Performance and Pay

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ABSTRACT. Studies in three thematic lines of research have manipulated parameters of individual monetary incentive systems to determine whether those parameters were functionally related to performance. Studies have examined: (a) the size of the percentage of total pay and base pay earned in incentive pay; (b) various ratio schedules of monetary reinforcement; and (c) linear, accelerating, and decelerating piece rate

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pay. The review revealed that individual monetary incentives plus feedback improved performance in comparison to hourly pay plus feedback in studies in all three thematic research lines. However, performance levels were not functionally related to (a) the size of the percentage of total pay or base pay earned in incentive pay for percentages that ranged from 3% to 100% of a person's total pay and base pay; (b) the per piece incentive amount; (c) the amount earned in total pay or total incentive pay; (d) the ratio schedule of delivery for CRF, FR3, VR2, VR3, and VR4 schedules; or (e) linear, accelerating, or decelerating piece rate pay. Taken together, the data suggest that, at least for the parameters investigated to date, the most critical determinant of performance is the ratio schedule contingency between performance and pay; that is, a relationship in which individuals earn a specified amount of money for the number of work units they complete. They also suggest that once a ratio relationship exists, variations in the parameters of individual monetary incentive systems may not greatly affect performance. Relatively few studies, however, have been conducted and further research is required.

KEYWORDS. Individual monetary incentives, literature review, performance-based monetary incentives, proportion of monetary incentive pay to wage-based pay

Beginning in the early 1980's, global market changes generated renewed interest in individual monetary incentive systems and other forms of variable pay plans (Blinder, 1990; Lawler, 1990). Organizations increasingly began to turn to alternative pay systems as a way to boost employee productivity in response to international competition and declines in the annual productivity growth rates of the United States (Blinder, 1990; Dickinson & Gillette, 1993; Lawler, 1990; McCoy, 1992; Peach & Wren, 1992; Schuster & Zingheim, 1992). In the 1990's, surveys conducted by a number of researchers and organizations (such as the Conference Board and the American Productivity Center in conjunction with the American Compensation Association) consistently revealed that about 35% of the respondents used individual incentives, 35% used profit sharing, 15% used small group incentives, and 10%-15% used gain sharing (Lawler, Ledford, & Mohrman, 1989; McAdams & Hawk, 1992; Milkovich & Stevens, 2000; O'Dell &

McAdams, 1987; Peck, 1990). Precise estimates of prevalence are problematic, however, because different surveyors adopted different definitions of various pay plans (Dickinson & Gillette, 1993; Mitchell, Lewin, & Lawler, 1990).

The popularity of variable pay plans in the US has waxed and waned over the past 100 years. In the early 1900's, piece rate pay plans based on Frederick Taylor's scientific management principles were seen as "best practices" (Milkovich & Stevens, 2000). "More than 60 percent of manufacturers responding to a 1920 National Industrial Conference Board survey reported using piece rates. Eighty percent of all workers were employed in plants where piece rates were used" (Milkovich & Stevens, 2000, p. 9). Few companies offered other forms of compensation such as profit sharing, health care benefits, and pensions (Milkovich & Stevens, 2000). Shortly thereafter, individual monetary incentive systems fell out of favor, although they never totally disappeared (Milkovich & Stevens, 2000; Peach & Wren, 1992). Reasons for their demise are complex but include the rise of the social sciences whose advocates disputed Taylor's "economic man," labor unrest caused by inappropriate administration of piece rate plans (such as constantly increasing performance standards upon which the incentives were based or reducing the work force when productivity increased), government regulation, and union negotiated compensation packages (Milkovich & Stevens, 2000; Mitchell, Lewin, & Lawler, 1990; Peach & Wren, 1992). Profit sharing and gain sharing plans co-existed with individual monetary incentive systems during the early 1900's, but were rare. And, while they were never as popular as individual monetary incentive plans, they were increasingly adopted during the 1930's and 1940's (Milkovich & Stevens, 2000; Mitchell et al., 1990). They, too, however, suffered from swings in popularity. Both plans all but disappeared during the Great Depression, increased in popularity until World War II, and declined in use again thereafter (Mitchell et al., 1990). According to Milkovich and Stevens (2000), "During the 1960's and 1970's, the use of all forms of pay-for-performance plans was eclipsed by a greater emphasis on seniority and cost-of-living pay adjustments" (p. 12). Then came the 1980's. Lawler (1990), a foremost expert in compensation strategies, stated:

> For someone like myself, who for decades has tried to encourage organizations to change their pay practices, the 1980's proved to be an exciting decade. Suddenly organizations were willing to try new practices. Their innovation gave me a chance to refine my

> thinking: it became possible to study issues that previously had been beyond my ability to research simply because there were no examples to study. (p. xv)

Milkovich and Stevens (2000) stated that one of the similarities between the beginning and the end of the 20th century was "individualized variable pay based on performance" (p. 10). They also pointed out differences between the beginning and end of the century. In addition to or perhaps because of external influences such as employment laws, tax laws, social welfare laws, interest rates, and international monetary exchange rates, performance based pay is now embedded in a total compensation package rather than existing in isolation.

In spite of the rich history of variable pay systems, research investigating their effects was rare until their renaissance in the 1980's, as implied in the above quote by Lawler (1990). In their classic 1966 article, "The Role of Financial Compensation in Industrial Motivation," Opsahl and Dunnette stated, "Strangely, in spite of the large amounts of money spent and the obvious relevance of behavioral theory for industrial compensation practices, there is probably less solid research in this area than in any other field related to worker performance" (p. 94). Although early case studies and the few existing experimental studies supported the effectiveness of pay-for-performance plans (e.g., Lincoln, 1946, 1951; Marriott, 1957), Opsahl and Dunnette appealed to researchers to conduct laboratory investigations so that their effects could be isolated from other changes that typically accompany their implementation. Readers are referred to Opsahl and Dunnette for a detailed review of the early literature and research. In 1986, Jenkins expressed surprise that was similar to Opsahl and Dunnette's with respect to how sparse "our scientific information is in its regard" (the impact of financial incentives on performance) (p. 167). He stated:

> It is no wonder that two decades ago, Opsahl and Dunnette (1966) and Grinyer and Kessler (1967) bemoaned the sorry state of experimental data on the role of money in improving performance. Opsahl and Dunnette went so far as to urge more laboratory investigations of the issue. It is surprising that the situation has still not improved much (Yetton, 1979). In some ways, it is amazing that we can be discussing the generalizability of laboratory findings to field settings, given that there are so few findings to generalize from or to. (pp. 167-168)

This review will focus on individual monetary incentive systems for two reasons. First, they are currently one of the two most prevalent types of variable pay systems in business and industry. Second, they provide the tightest link between performance and pay; a factor that compensation specialists have historically cited as the most important one when the goal of the pay plan is to increase employee productivity (Conrad, 1994; Kopelman, 1983; Lawler, 1990; McAdams & Hawk, 1992; McNally, 1988; Opsahl & Dunnette, 1966; Taylor, 1911). The tight link between performance and pay or, in Lawler's (1990, 1992) terms the clear "line of sight," results from four characteristics of individual incentive systems: First, incentives are based only on the employee's own performance; second, incentives are based on clearly specified behaviors or outputs; third, incentives are certain (that is, if the targeted performance occurs, the employee will receive the extra compensation); and fourth, incentives are paid as soon after the performance as possible as part of the employee's paycheck. Not only have compensation specialists identified these characteristics as important, but these same characteristics have been identified by behavior analysts as features of effective employee rewards and consequences (Braksick, 2000; Brown, 1982; Daniels, 1989; O'Brien & Dickinson, 1982).

In contrast, profit sharing bonuses are based on the performance of the organization, not the performance of individual employees (Abernathy, 1989; Honeywell-Johnson & Dickinson, 1999; Lawler, 1990). The profitability of the organization, in turn, is based on the aggregate performance of all of the employees in the organization as well as factors that are clearly outside the control of employees (mergers and acquisitions, investment of funds in research or new facilities, etc.). Moreover, profit sharing bonuses are usually distributed annually or placed in the employee's retirement account–temporally and physically far removed from the desired performances (Abernathy, 1989; Honeywell-Johnson & Dickinson, 1999; Lawler, 1990). Finally, plans based on economic measures, as opposed to operational measures, appear to weaken the link between performance and pay; that is, it is harder for employees to see the connection between their day-to-day performance and their pay. Hence, such plans do not fare as well (O'Dell & McAdams, 1992).

Gain sharing bonuses are based on the economic or operational performance of a department, unit or division, and are distributed monthly, quarterly or semiannually, or deposited in employee retirement accounts (Abernathy, 1989; Gowen, 1990; Honeywell-Johnson & Dickinson, 1999; Lawler, 1990). As with profit sharing bonuses, gain sharing bo-

nuses are based on the aggregate performance of a large number of individuals and only remotely linked to desired performances.

Group incentives have more features in common with individual incentives: They are (a) based on clearly specified outputs, (b) certain, and (c) distributed frequently. However, instead of being based on the employee's own performance, they are based on the performance of all of the members of the group, decreasing the extent to which the worker can influence his or her own pay.

The effectiveness of profit sharing and gain sharing has been evaluated almost exclusively through self-report questionnaires and case studies, while the effectiveness of individual and group monetary incentives has been assessed in well-controlled field and laboratory studies in addition to survey studies. This is not surprising because experimental studies of individual and small group incentives are easier to arrange and conduct. In addition, unbiased measures of performance are more readily available for such studies in both field and laboratory settings.

Many experts have argued that profit sharing plans have not lived up to their promise (Abernathy, 1996; Blinder, 1990; Card, 1990; Dickinson & Gillette, 1993; Honeywell-Johnson & Dickinson, 1999; McCoy, 1992), although there are certainly conflicting opinions (Mitchell et al., 1990; Weitzman & Kruse, 1990). As indicated earlier, evidence for the success of profit-sharing plans comes primarily from surveys and a relatively small number of case studies (Mitchell et al., 1990; Weitzman & Kruse, 1990). Weitzman and Kruse reported that "after an exhaustive search of the literature we found sixteen formal econometric studies on the relation between profit sharing and productivity, which used forty-two different samples of firms" (p. 126). Based on a review and statistical meta-analysis of the studies, the authors stated "It is fair to say that no one study yielded convincing evidence on the relation between profit sharing and productivity. However, the similar conclusions that emerge from all sixteen studies taken together provide fairly strong evidence of a consistent pattern" (that profit sharing leads to higher levels of productivity) (p. 127). Blinder (1990) and Card (1990) acknowledged the positive relationship between profit sharing and productivity reported by Weitzman and Krause (1990), however, they qualified their reaction to it. Blinder noted the poor quality of the studies included in the analysis, stating, "Many of these studies have flaws; none are beyond reproach; several obtain weak results. But the consistency of the disparate results is striking" (p. 7). He repeated this point later in his article: "The evidence on profit sharing and productiv-

ity is particularly persuasive if one accepts the view that a large number of weak, but consistent, studies add up to a strong statistical case" (pp. 12-13). Card stated: "The authors note that of 216 regressions reported, only 6 percent of the estimated profit-sharing coefficients are negative, and none are significantly negative at conventional levels. If these were unfiltered reports of 216 independent trials, that would be an impressive record. Unfortunately, there are important biases that can lead to a preponderance of positive coefficients even if the true coefficient is zero" (p. 141). He then stated that the data "lead to a presumption [emphasis added] of a positive effect" (p. 141).

A major obstacle to assessing the effects of profit sharing is isolating the effects of profit sharing from other organizational system variables that may influence productivity and/or the company's adoption of profit sharing plans (Ehrenberg, 1990; Strauss, 1990). Strauss (1990), for example, indicated that a major problem with studies of profit sharing is the inability to determine the direction of causality. "Do PS [profit sharing] companies perform better because they have PS or are exceptionally successful companies–those already performing better–more likely to share their good fortune with their employees?" (p. 30). The reasons for positive correlations between profit sharing and company productivity thus remain unclear.

In the absence of objective data, arguments that profit sharing does or does not motivate individual performance can only be supported by conceptual and theoretical analyses. Both Lawler (1990, 1992) and Blinder (1990) contend that profit sharing plans are not likely to influence individual performance due to the fact that individual employees have little influence over the productivity of the entire organization and hence little control over the size of the profit sharing bonuses they receive. Several other behavioral and compensation experts have made similar arguments (Abernathy, 1996; Dickinson & Gillette, 1993; Freund & Epstein, 1984; Henderson, 1989; McCoy, 1992; O'Dell, 1981; Panos, 1990).

Using a cost/benefit argument, Blinder (1990) also questioned whether profit sharing plans actually pay for themselves given (a) the small productivity increases associated with profit sharing and (b) data suggesting that individuals covered by profit sharing plans receive higher overall wages than individuals who are paid only hourly wages (Mitchell et al., 1990).

> For example, suppose workers on profit sharing earn, on average, 10 percent more than workers on straight wages. Then if a firm is to benefit from profit sharing, labor productivity must rise at least

> 10 percent. If it rises only 5 percent, the firm loses money despite the gain in productivity. Given the estimates of the productivity gain from profit sharing in this paper and the next (Mitchell et al., 1990, and Weitzman & Kruse, 1990), it is far from clear that profit sharing pays for itself. (Blinder, 1990, p. 4)

Gain sharing has been more positively reviewed (Gowen, 1990; Lawler, 1988, 1990; O'Dell & McAdams, 1987; Petty, Singleton, & Connell, 1992; Schuster, 1984), although, like profit sharing, support comes primarily from self reports, case studies, and conceptual justifications absent data (Blinder, 1990; Bullock & Lawler, 1984; Dickinson & Gillette, 1993; White, 1979). After reviewing several articles that discussed the effectiveness of profit sharing, employee stock option plans, and gain sharing, Blinder (1990) stated, "Gain sharing may be the best of all, but there are too few cases to support any strong judgments" (p. 12). Similarly, Lawler (1990) reported that "Gainsharing plans typically produce a number of positive results . . . We know somewhat less about the frequency with which these plans work, but there is evidence to suggest that they work about 75 percent of the time" (p. 116). Although supporting the effectiveness of gain sharing plans, Mitchell et al. (1990) also acknowledged the weakness of the data base stating, "Unfortunately, most of the studies do not meet rigorous methodological standards; they fall more in the realm of magazine reports than research studies . . . The possibility also remains of a tremendous underreporting of negative results, as is true with any literature that relies on case studies" (p. 68).

With respect to small group monetary incentives, while several researchers have found them to be as effective as individual incentives for groups of two to ten members (Honeywell-Johnson & Dickinson, 1999; Honeywell, Dickinson, & Poling, 1997), there are data to the contrary. Thurkow, Bailey and Stamper (2000) found individual incentives to be more effective than group incentives with telephone research company employees. In addition, the results of two studies suggest that top performers may decrease their performance when switched from individual to small group incentives (Dickinson & Honeywell-Johnson, 1999; London & Oldham, 1977).

Employee productivity, however, is only one reason that organizations adopt variable pay plans. Different pay plans yield different results, and organizations adopt them for different reasons (Lawler, 1990, 1992; Ledford & Hawk, 2000; McAdams & Hawk, 1992; O'Dell & McAdams, 1987). For example, O'Dell and McAdams (1987), based on a large-scale

survey, stated that profit sharing increases employee commitment and reduces turnover but does not affect productivity, quality, or cost reduction as much as other plans, whereas individual incentives increase productivity and information sharing but do not alter employee involvement or employment security. Strategically designed compensation systems, that is, alignment of compensation systems with business needs and organizational goals, is a feature that Milkovich and Stevens (2000) identified as a unique thrust in the 1990's. In an excellent article that addressed strategic design, Ledford and Hawk (2000) noted that "One reason that designing compensation systems is so difficult is that these systems can have many different and conflicting goals" (p. 32). They then identified a number of potential goals, specified how they conflict, clarified the questions that executives should ask themselves prior to implementing a compensation system, and provided helpful guidance. Certainly, individual monetary incentives are not always appropriate. Yet when priority goals include improving and maintaining high levels of individual performance, compensation experts advocate their use, either alone or in combination with other types of pay (Abernathy, 1989, 1996; Dierks & McNally, 1987; Lawler, 1990, 1992; Ledford & Hawk, 2000; McCoy, 1992).

Data support the recommendations of compensation experts. In both laboratory and field studies, individuals have consistently performed better when they have received individual incentives than when they have been paid hourly wages (e.g., Allison, Silverstein, & Galante, 1992; Farr, 1976; Frisch & Dickinson, 1990; George & Hopkins, 1989; LaMere, Dickinson, Henry, Henry, & Poling, 1996; London & Oldham, 1977; Nebeker & Neuberger, 1985; Orphen, 1982; Pritchard, Hollenbeck, & DeLeo, 1980; Pritchard, Leonard, Von Bergen, & Kirk, 1976; Riedel, Nebecker, & Cooper, 1988; Smoot & Duncan, 1997; Wagner & Bailey, 1997; Weiner, 1971). In 1998, Jenkins, Gupta, Mitra, and Shaw published a statistical meta-analysis of 39 experimental studies conducted between 1960 and 1996 and reported that individual incentives were statistically significantly correlated with improved performance quantity in laboratory experiments, laboratory simulations and field experiments. The effect size between financial incentives and increases in the quantity of performance was .34. This finding was similar to an analysis conducted earlier by Jenkins (1986) who reported that "In general, then, it is reasonable to conclude that linking pay to performance will lead to about a 30 percent increase in performance" (p. 176). Tasks have ranged from simple unitary tasks in laboratory investigations (e.g., coding questionnaires, sorting index cards, entering data into a computer,

assembling parts) to complex multiple tasks performed by roll-off truck drivers (LaMere et al., 1996), purchase buyers and supply clerks (Nebeker & Neuberger, 1985), servers in restaurants (George & Hopkins, 1989), factory workers (Orphen, 1982), human service workers (Allison et al., 1992), and mental health counselors (Wagner & Bailey, 1997). In their statistical meta-analysis study, Jenkins et al. classified tasks as "extrinsic" or "intrinsic." The type of task did not moderate the relationship between monetary incentives and the size of the improvement in performance. That is, monetary incentives affected both types of tasks similarly.

In many applied settings, performance and economic gains have been impressive. In some, performance has increased 15% to 300% and net profits have totaled $56,000 to $400,000 a year (Dickinson & Gillette, 1993). It should be noted, however, that neither Jenkins et al. (1998) nor Jenkins (1986) found that financial incentives improved the quality of performance as opposed to the quantity of performance, although some quantity measures did include measures of quality as well. However, Jenkins et al. advised readers to view the quality data with caution because they were based on only six studies.

Jenkins et al. (1998) also classified studies according to the theoretical framework of the researchers. The classifications included: (a) expectancy-reinforcement, (b) goal setting, and (c) cognitive evaluation. According to the authors, expectancy theory and behavior analysis were combined because they make similar predictions and because the authors of several of the studies mentioned both frameworks when deriving their hypotheses. They found that the theoretical framework affected the strength of the relationship between monetary incentives and performance. The average correlations between incentives and performance were .52, .23 and .22 in studies conducted by researchers with expectancy-reinforcement, goal setting and cognitive evaluation theoretical frameworks, respectively. The authors suggested the following explanation for these results:

> It may be that the theoretical framework guides the design of the research, affecting the salience of different variables for subjects-respondents. For instance, expectancy and reinforcement theories mandate a clear tie between performance and rewards; goal setting and cognitive evaluation theories focus not so much on the performance-reward connection but rather on goals or tasks. This differential focus may mean a differential emphasis on financial incentives, and, consequently, differential effects. (p. 783)

The effectiveness of individual monetary incentive systems can be attributed to the fact that when employees are offered individual incentives, with or without guaranteed base pay, the amount they earn in incentive pay is dependent upon the number of units of work they complete. In hourly or salary wage systems, in contrast, pay is less dependent on the work that is accomplished. In their simplest form, most incentive pay systems represent ratio schedules of reinforcement where consequences are contingent upon the number of behaviors that are emitted. [Some incentive systems offer money contingent upon the passage of time and the emission of a specified response, thereby representing interval schedules of reinforcement, however, these types of systems are rare in business and industry. Neither have they been the focus of many research studies that have examined the effects of monetary incentives or the effects of schedules of reinforcement on work behavior (Dickinson & Gillette, 1993; Hantula, 2001; Jenkins et al., 1998). Hence, they will not be considered further in the present discussion.] Hourly and salary wage systems have commonly been called fixed interval schedules, in which the delivery of consequences is based on both the passage of time and the occurrence of a particular response (e.g., Ayllon & Kolko, 1982; Daniels, 1989; Gaetani et al., 1985; Latham & Huber, 1992). This designation is problematic, however, due to the fact that, among other reasons, in fixed interval schedules, reinforcement is based on both the passage of time and the occurrence of a particular response, unlike a pay check (see Mawhinney, 1975, and Malott, Whaley, & Malott, 1997 for additional reasons why a pay check does not meet the definition of a fixed interval schedule). In recognition that pay checks are delivered regardless of whether a specific response occurs, hourly and wage pay systems have also been referred to as fixed time schedules (e.g., Hantula, 2001), however, this designation is also problematic for reasons that will be discussed shortly.

Terminological issues aside for the moment, the effects of different types of schedules of reinforcement have been researched extensively (e.g., Ferster & Skinner, 1957; Morse, 1966; Morse & Kelleher, 1970; Skinner, 1938; Zeiler, 1977, 1984), constituting the core of basic behavior analytic research for many years (Zeiler, 1984). The results of these studies leave no doubt that schedules of reinforcement exert a powerful control over the rate and pattern of on-going behavior, resistance to extinction, and choice. The studies also demonstrate conclusively that ratio schedules of reinforcement generate relatively high rates of responding while fixed time schedules generate low rates of responding. Thus, based on this body of research, it is not surprising that ratio

based individual incentive systems typically result in higher levels of performance than hourly pay in the work place.

In an excellent recent article, Hantula (2001) reviewed studies, conducted between 1971 and 1994, that examined the effects of schedules of reinforcement on organizational behavior. His comprehensive review included studies that examined nonmonetary reinforcers as well as monetary reinforcers in both applied and laboratory settings. As in studies conducted in operant laboratories, ratio schedules of reinforcement resulted in higher rates of responding than schedules that were wholly or primarily time based.

It is important to point out that the schedules of reinforcement that operate in the work environment are typically much more complex than the ratio and fixed time schedules of reinforcement that have been examined in the laboratory. It is often difficult, if not impossible, to identify the schedule of reinforcement that is in effect for a particular behavior in complex organizations and, more often than not, erroneous to refer to schedules in the work place in terms of the basic schedules of reinforcement that have been researched in the operant laboratory (Dickinson & Poling, 1996; Poling & Braatz, 2001). For example, in many monetary incentive systems, employees receive a guaranteed base pay and are offered a per piece incentive for each part produced above a specified performance standard. While this pay arrangement is often referred to as a continuous reinforcement schedule or a fixed ratio one schedule of reinforcement, the like-named schedule studied in the laboratory does not include "base pay" (more technically, a maintenance schedule) over which the schedule of interest is superimposed. Dickinson and Poling (1996) identified several other differences between the schedules of monetary reinforcement that have been implemented in organizations and their like-named laboratory counterparts. Among them, conditioned reinforcers were used in contrast to unconditioned reinforcers, complex response sequences were arranged as operants, instructions were provided and clearly affected the sensitivity to programmed contingencies in some of the applications, and delays to reinforcement were substantial (Dickinson & Poling, 1996; Poling, Dickinson, Austin, & Normand, 2000). Although some ignore these differences or believe them to be irrelevant, others consider them to be critical, warning that the assumption of equivalence can mislead individuals into thinking that they know why people behave as they do and to stop seeking further explanations which, in turn, impedes scientific progress (Michael, 1993; Poling et al., 2000).

As indicated previously, just as many incentive systems are referred to as "simple ratio schedules of reinforcement," hourly and weekly pay are often called fixed interval or fixed time schedules of reinforcement but neither do they represent the "simple" interval or time based reinforcement schedules examined in the laboratory. Although Hantula (2001) referred to salary and hourly wage plans as analogous to fixed time or variable time schedules of reinforcement, he recognized that other contingencies are operating as well, stating that "If any contingency [between behavior and pay] is operating in this context, it is one of a compound schedule, in which fulfilling the requirements of one schedule (e.g., regular attendance) gives the employee access to the FT or VT salary schedule" (p. 145). Even this analysis, however, is incomplete and does not capture the complexity of salary and hourly pay systems. When analyzing pay contingencies in the work place, Skinner (1969) stated:

> No one works on Monday morning because he is reinforced by a paycheck on Friday afternoon. The employee who is paid by the week works during the week to avoid losing the standard of living which depends on a weekly wage. A supervisor who can discharge him is an essential part of the system. Rate of work is determined by the supervisor . . . and special aversive contingencies maintain quality. The pattern is therefore still aversive. (p. 18)

Skinner also discussed the role of automatic reinforcement when explaining differences that may arise between the work behavior of the production-line worker and a craftsman who are both paid hourly. "One explanation is that the craftsman is reinforced by more than monetary consequences, but another important difference is that when a craftsman spends a week in completing a given object, each of the parts produced during the week is likely to be automatically reinforcing because of its place in the completed object" (p. 18). While Skinner was specifically referring to performance differences that may occur when individuals are paid hourly wages, this additional source of reinforcement may exist regardless of the type of pay system. If present, it introduces yet another difference between the schedules of reinforcement in the work place and those examined in the operant laboratory.

Not only are organizational contingencies exceedingly complex, but their effects can be altered by other environmental events as well. In their sophisticated treatment of the principles of learning that affect organizational behavior, Poling and Braatz (2001) identified several factors that

can moderate and even override the effects of direct exposure to schedules of reinforcement. They include verbal behavior, momentary motivative variables, concurrent response options and their schedules of reinforcement, the learning history of an individual, and physiological variables.

In spite of the complexities, Skinner (1969) recognized the power of ratio based pay systems. He stated: "Somewhat better contingencies [than hourly pay systems] are available under schedules of reinforcement based on counters rather than clocks. In piece-rate pay, the worker is paid for each item he produces. This is a so-called fixed ratio schedule, and it generates a high level of activity. Piece-rate reinforcement is, indeed, so powerful that it has often been misused" (Skinner, 1969, p. 19). While repeatedly and candidly acknowledging the misuse and potential misuse of ratio based pay systems (Skinner, 1953, 1969, 1974), Skinner also stated that "Incentive wages . . . need to be investigated as promising alternatives to aversive control" (Skinner, 1969, p. 19). He maintained that incentive systems, similar to other schedules of reinforcement that provide relatively frequent reinforcement, may evoke feelings of confidence, certainty of success, enjoyment arising from a sense of mastery and effectiveness, and interest in the job (Skinner, 1974).

To summarize, the results from laboratory investigations of the basic schedules of reinforcement can be used to support the general contention that individual monetary incentive pay systems, similar to other ratio based schedules, will increase performance in contrast to hourly and salary pay; however, it would be erroneous to conclude that the results from the laboratory investigations can be directly extrapolated to the work environment or, vice versa, that investigations of pay systems are investigations of the basic schedules of reinforcement that have been examined in the laboratory. Nonetheless, taken together, the basic laboratory studies, studies of the effects of schedules of reinforcement on work performance and studies of incentive pay provide a strong scientific base for concluding that ratio based pay systems effectively control work performance. Moreover, because in most of the incentive systems that have been examined, incentive pay has been contingent upon the number of units of work completed, the results of these studies also imply that the ratio arrangement between performance and pay is the primary reason for the observed increases in performance when individual monetary incentive pay systems have been compared to hourly and salary pay systems.

STUDIES OF VARIATIONS IN INDIVIDUAL MONETARY INCENTIVES: THEMATIC LINES OF RESEARCH

In the mid 1970's and early 1980's when reported successes of individual monetary incentive systems were mounting, a number of researchers began to examine different variations in individual monetary incentive systems to determine the most effective arrangements between individual incentives and performance. Three thematic lines of research emerged: Investigations of (a) the percentage of total pay or base pay earned in incentive pay, (b) incentive pay delivered according to different ratio schedules of reinforcement (i.e., continuous reinforcement schedules, fixed ratio schedules, and variable ratio schedules), and (c) linear, accelerating, and decelerating per piece incentive pay. Studies of the percentage of total pay and base pay earned in incentive pay (Duncan & Smoot, 2001) and studies of ratio reinforcement schedules have been critiqued previously (Ayllon & Kolko, 1982; Dickinson & Poling, 1996; Latham & Huber, 1992) but the results of the studies in all three thematic lines of research have not been examined in conjunction with each other. Moreover, this review includes studies that were published after Duncan and Smoot (2001) wrote their review. In the sections that follow, these three lines of research and their rationales are described, the results of the relevant studies are presented, the strengths and limitations of the research are identified, and future research is suggested.

PERCENTAGE OF TOTAL WAGES OR BASE PAY EARNED IN INCENTIVE PAY

Rationale and Results

During the late 1980's and 1990's, five studies examined whether the percentage of total pay or base pay earned in incentive pay influenced productivity (Dickinson & Gillette, 1993; Frisch & Dickinson, 1990; LaMere et al., 1996; Matthews & Dickinson, 2000; Riedel et al., 1988). Two of the studies examined the effects of different percentages of base pay earned in incentive pay (Frisch & Dickinson, 1990; Riedel et al., 1988) while the other three examined the effects of different percentages of total pay earned in incentive pay (Dickinson & Gillette, 1993; LaMere et al., 1996; Matthews & Dickinson, 2000). Four of the studies were conducted

by Dickinson and her colleagues. These studies were generated by questions that arose from the successful application of individual monetary incentive systems at Union National Bank in Little Rock, AR (Duncan & Smoot, 2001; Poling et al., 2000). The incentive systems were designed and championed by four individuals, two behavior analysts, and two bank executives: William Abernathy, a Memphis-based consultant, Kathleen McNally, a behavioral psychologist employed by the bank, H. Hall McAdams, III, Executive Vice President, and Wayne Dierks, Vice President and Personnel Director (McAdams, 1983). By the early 1980's, 75 individualized monetary incentive programs had been installed. In 1987, Dierks and McNally described the success of their pay systems:

> In 1985, $1 million was paid in incentive payments on a $9 million annual payroll. But it's more than worth it. Using these principles, we have increased productivity 200-300 percent. Our net profit per employee is $11,000 per year while other Little Rock banks show $5,700 and $4,200. (p. 61)

While the incentive systems were well received by employees and clearly profitable (Dierks & McNally, 1987), the executives at Union National Bank wanted to refine them. They could not, however, find any guidance from existing research. Most of the Union National Bank plans offered employees a guaranteed base pay and incentives when performance exceeded specified goals. Thus, one question that emerged was whether the percentage of incentive pay to base pay or total pay affected performance, and if so, whether an optimal percentage or range of percentages existed.

There are at least four reasons why studies that examine the relationship between worker performance and the size of the percentage of total pay or base pay earned in incentive pay are worthwhile. First, today, many organizations combine individual incentives with base pay as Union National Bank did. Instead of offering employees piece rate pay, where 100% of their wages are earned in incentives, organizations offer employees the opportunity to earn incentives in addition to a guaranteed wage when performance exceeds a performance standard. Although the relative prevalence of the two types of pay systems is not known, both are currently used in business and industry (Blinder, 1990). Therefore, from a performance standpoint, it is important to determine whether one is more effective than the other.

A second reason for conducting research on different percentages of total pay or base pay earned in incentive pay is to determine whether

particular percentages, or ranges of percentages, are more effective than others. Historically, compensation experts have argued that employees should be given the opportunity to earn 30% of their base pay in incentives (e.g., Fein, 1970; Henderson, 1985). Fein (1970) claimed that performance would not be significantly affected by incentives that were less than 30% of base pay, nor would performance increase further if incentives were greater than 30%. As noted by Frisch and Dickinson (1990), however, the 30% figure has been based on tradition, not data. During World War II, new incentive plans and changes to existing ones had to be approved by the War Labor Board, which decreed that a 30% incentive to base pay potential was fair and equitable. Based on this declaration, many companies adopted a 30% incentive to base pay potential. Abernathy (2001) recently analyzed data from twelve companies that adopted a performance management system consisting of objective measures of performance included on performance scorecards and incentive pay systems. The twelve companies employed a total of 4,289 employees. A total of 2,195 different objective performance measures were included on the performance scorecards of the employees. Eleven of the twelve organizations implemented a monetary incentive system along with the performance scorecard measurement system. Abernathy excluded data from the first three months that followed the implementation of the performance management system in each organization. He did this because of inaccuracies in data reporting and changes in measures that typically accompany the initial introduction of the system. Data from the following twelve months of implementation were included for each organization. In the eleven companies that implemented a monetary incentive system, employees received a guaranteed base salary and could earn additional money in incentive pay when their performance met targeted performance goals. Using regression trend analyses, Abernathy analyzed the effects of a number of different system variables, addressing questions such as (a) does the type of performance measure affect the size of the performance improvement, (b) does the number and complexity of the measures included on the performance scorecard affect the size of the performance improvement and (c) do individual and team measures of performance affect the size of the performance improvement differently? Two of his analyses examined how the percentage of incentive pay to base pay affected the performance measures across the companies. He first examined whether the percentage of "incentive opportunity" affected performance. The percentage of incentive opportunity is the ratio between the total amount of incentive pay that employees can earn for maximum

productivity and the amount they earn in base pay. He found no relationship between performance and the percentage of incentive opportunity to base pay for percentages that ranged from 1% to 22%. He then examined the percentage of the actual incentive payout to base pay. The percentage of actual incentive payout is the ratio between the actual amount of incentive pay that the employees earned to the base pay they earned. He examined percentages ranging from 1% to 33%. (The maximum percentage is higher than in the preceding analysis because in some companies, employees received incentive pay based on the profitability of the organization in addition to the incentive pay they earned for their own performance. The profit-indexed incentive pay was not included in the analysis of the percentage of "incentive opportunity" because this money–and the amount–is dependent upon the profitability of the organization and thus may or may not be available to employees.) The analysis of the percentage of actual incentive earnings to base pay earnings suggested that "the level of [incentive] pay out affects performance trend only when pay outs were [sic] above 20% of base pay or higher" (Abernathy, 2001, p. 267). As Abernathy stated, "This finding has significant implications since most discussions of the effects of incentive pay do not consider the actual amount paid" (Abernathy, 2001, p. 267). As implied by Abernathy, compensation experts typically offer advice based on the ratio between the total amount of incentive pay that employees can earn for maximum performance and the amount they earn in base pay. In addition, Abernathy's applied data suggest that employees must receive a minimum of 20% of their base pay in incentive pay or their performance will not be affected. Given the historical tradition and the recent analyses conducted by Abernathy, research that clarifies the relation between performance and the size of the percentage of total pay and base pay earned in incentive pay is justified so that it can be used to guide the design of monetary incentive systems in organizations.

Although compensation experts have indicated that performance is not likely to be affected by small monetary incentives, small monetary as well as nonmonetary reinforcers have appreciably increased employee performance in many applied behavior analytic studies (for reviews, see Frederiksen & Johnson, 1981; Hopkins & Sears, 1982; Komaki, Coombs, Redding, & Schepman, 2000; O'Hara, Johnson, & Beehr, 1985; Stajkovic & Luthans, 1997). In a recent book chapter, Komaki et al. (2000) reviewed the effectiveness of 126 applied behavior analytic studies that were conducted in work settings between the late 1960's and 1998. Only methodologically rigorous studies were included in the review. The review is particularly enlightening because

the authors provided performance means by condition for each study in the review. In the studies that examined the effects of financial incentives and lotteries with cash prizes, the size of the incentives and prizes were often quite small, but nonetheless effective. There are a number of examples, only a few of which will be mentioned here. Orphen (1978) reduced the absenteeism of factory workers in South Africa by offering a weekly bonus of $0.50 for perfect attendance. The mean difference in the rate of absenteeism for the experimental group (2.56%) and the control group (3.70%) was statistically significant. In addition, when the monetary bonus was withdrawn for workers in the experimental group, absenteeism increased to baseline levels. When the bonus was reinstated, its effect was replicated. Similarly, Hermann, de Montes, Dominquez, Montes, and Hopkins (1973) decreased the tardiness of six chronically late workers at a Mexican industrial company by offering them $0.16 per day for on-time arrival. Incidents of tardiness decreased from an average of 16% during baseline to an average of approximately 2% during the incentive phases. The average daily pay of the workers was $4.00; therefore the incentive represented 4% of their base wages. Pedalino and Gamboa (1974) reduced absenteeism by 18% using a weekly lottery prize of $20.00, which, as discussed by Mawhinney (1975), had an expected value of only $1.40 at most for each employee each week. Kreitner and Golab (1978) increased the frequency with which field sales staff called the home office by reimbursing them half of the daily cost of the telephone calls, which was $0.30 per day. Gaetani and Johnson (1983) decreased cash shortages in a retail beverage chain by providing store managers with weekly feedback, praise, and two state lottery tickets, worth $1.00 a piece. In each of the preceding examples, small incentives, well below an amount equaling 30% of the employee's base pay, affected performance. Furthermore, many effective interventions have used nonmonetary reinforcers such as feedback, social reinforcers, and access to preferred activities, etc., that had little or no cash value to employees (Alvero, Bucklin, & Austin, 2001; Balcazar, Hopkins, & Suarez, 1985/86; Frederiksen & Johnson, 1981; Grindle, Dickinson, & Boettcher, 2000; Hopkins & Sears, 1982; Komaki et al., 2000; O'Hara et al., 1985; Stajkovic & Luthans, 1997). Thus, the results of studies of monetary and nonmonetary reinforcers in the behavior analytic literature suggest that small financial incentives, if scheduled appropriately, may well lead to appreciable improvements in performance.

A third reason for conducting research on the relationship between performance and the percentage of incentive pay earned in total pay or

base pay is because certain percentages may be unfair or perceived to be unfair by employees. Employee preference as well as the perceived fairness of the percentage between incentive pay and total pay or base pay is no doubt dependent upon the extent to which the incented performance is under control of the performer (Dickinson & Gillette, 1993). If employees do not have considerable control over their performance, with high incentive percentages a sizable portion of their earnings will be based on factors they cannot influence. High percentages of incentive pay to base or total pay, thus, are likely to be perceived as less fair than lower percentages. Additionally, if the uncontrollable factors fluctuate, high percentages of incentives will increase the unpredictability of earnings. Alternatively, when employees do have considerable control over the relevant performance, higher percentages of incentive pay may be viewed as more fair than lower percentages because the amount of money earned by different performers more closely reflects differences in performance. That is, there will be a greater difference in the total pay of high and low performers. If performance is comparable when employees earn different percentages of their total pay or base pay in incentive pay, the percentage preferred by the employees could be adopted without concern that another percentage would result in higher performance and profitability. That fact might encourage organizations to seek employee participation when developing incentive systems, a factor that has been correlated with the effectiveness of such pay plans as well as with employee satisfaction with them (Blinder, 1990; Bowey, 1980; Jenkins & Lawler, 1981; Lawler & Hackman, 1969).

Fourth, from the organization's perspective, low percentages of incentive pay make personnel costs easier to budget because a larger proportion of wages is fixed rather than variable. Administrative complexity is an impediment to the adoption of incentive systems (Dickinson & Gillette, 1993) and while labor cost prediction is only one factor that contributes to administrative complexity, lower percentages of incentives to total labor costs would at least reduce this concern.

Although they did not state it as such, Frisch and Dickinson (1990) used a balance of consequences analysis (Braksick, 2000; Brethower & Rummler, 1966; Brown, 1982; Daniels, 1989; Petrock, 1978) for work and nonwork activities as a general rationale for why performance might be affected by the percentage of total pay or base pay earned in incentive pay. Their rationale will be expanded here to include an analysis of the effects of schedules of reinforcement as well. The work environment provides numerous sources of reinforcement for work and nonwork related behaviors. Each behavior is maintained by its own re-

inforcers and their schedules of reinforcement. Thus, the work environment can be viewed as analogous to a behavioral choice situation where multiple concurrent schedules of reinforcement exist. Within this context, each behavior is regulated by its particular schedule of reinforcement as well as by competing behaviors and the interaction of all existing schedules of reinforcement. The monetary incentives for the incented tasks are available according to one schedule of reinforcement, typically a ratio schedule of reinforcement, while the consequences for other tasks and activities are available according to other schedules of reinforcement. Due to the complexity of the work environment, the competing tasks, their schedules of reinforcement and the reinforcing value of their consequences relative to money cannot be precisely specified or quantified. The monetary incentive contingencies, however, can be more precisely specified and their possible effects on the balance of consequences for work and nonwork activities analyzed. With monetary incentive systems, the total amount of money that a person can earn is constrained. In many incentive systems, the total amount of money workers can earn in incentives is capped in order to control expenses (Abernathy, 1989, 2000). In addition, the total amount of money workers can earn in incentives is constrained by the maximum performance possible on the task. Given these constraints on the total amount of money that workers can earn, as the percentage of total pay or base pay earned in incentive pay increases, a greater proportion of a person's pay becomes dependent upon his or her performance. To illustrate, if a person can earn only 10% of his or her wages in incentives, then only that 10% is dependent upon performance, whereas if a person can earn 50% of his or her wages in incentives, then a much greater proportion of the person's pay is dependent upon performance. Off-task performance would result in less pay in the latter case than in the former case. When the percentage of total pay or base pay earned in incentive pay is low, the amount of money available in incentive pay may not compete as effectively with other sources of reinforcement that are available in the work setting. That is, the extra amount of money available in incentives may not be sufficient to evoke higher levels of responding because higher levels of responding result in costs. Those costs would arise from the additional effort expended and the loss of reinforcements that would have been generated by other activity and behavior rates that were reduced in order to increase the incented performance. When the percentage of total pay or base pay earned in incentive pay is high, on the other hand, the amount of money available in incentives may compete more effectively with other activities in the work environment, and thus indi-

viduals may perform better. Higher percentages of incentives, however, would only be expected to increase performance if the consequences derived from the nonincented tasks were (a) not more reinforcing than the money available in incentives and (b) not delivered according to a reinforcement schedule that would favorably compete with the incentive delivery schedule (e.g., Catania, 1992; Herrnstein, 1961, 1970; Mazur, 1991). Unfortunately, as stated earlier, the number of alternative reinforcers, their reinforcing value, and their schedule of delivery often cannot be precisely specified in work settings.

An alternative analysis, predicting different results, however, is possible. As discussed earlier, monetary incentives are typically delivered on ratio schedules of reinforcement. Also, as discussed earlier, ratio schedules of reinforcement generate high levels of responding. Given that money is highly reinforcing relative to other sources of reinforcement and the other sources of reinforcement are delivered according to schedules that do not control behavior as effectively, individuals may perform the incented tasks at high rates even when the amount of incentive pay is small in order to maximize their earnings and, hence, their reinforcement. This analysis, in contrast to the previous one, would predict that performance would be comparable under different percentages of incentive pay earned to total or base pay earned. Moreover, maximization of performance would be predicted if alternative sources of reinforcement did not exist and, in addition, would be likely if alternative sources of reinforcement were weak (Mawhinney, 1975, 1982, 1984).

The results of a study conducted by Mawhinney (1982) support the preceding analysis. Mawhinney argued that in concurrent schedule situations where matching and maximization of reinforcement conflict, some humans, if they are capable of doing so given the complexity of the environmental contingencies, are likely to formally analyze reinforcement contingencies and develop verbal rules that will maximize reinforcement. He further argued that because of the verbal rules they develop, such individuals are likely to maximize reinforcement in situations where nonhuman animals may not. In an exploratory study, Mawhinney compared the performance of a human subject under a series of three different FR schedules and three concurrent FR/VI schedules. Mawhinney reasoned that if individuals are exposed to a single fixed ratio schedule of reinforcement, they will work as hard as possible in order to maximize their earnings, regardless of what the ratio requirement is. Mawhinney also maintained that if individuals were able to develop accurate rules in the FR/VI concurrent schedule situation, they would allocate their responses in a manner that would maximize their

reinforcement. A major objective of the study was, thus, to determine whether an individual with an extensive history of developing rules for maximizing income, could "maximize reinforcements returned to behavior in a concurrent VI/FR schedule situation" (Mawhinney, 1982, p. 272); a concurrent schedule situation to which humans had not been exposed to before and where neither matching nor maximization had been found with pigeons (Staddon & Motheral, 1978). The subject was a college junior majoring in financial management and had participated in a prior experiment that had similar features. Thus, the subject had a history of training with respect to maximizing his monetary income. Responses consisted of squeezing the trigger on either of two joy sticks; one associated with the FR schedules and one associated with the VI schedule. Points that could be traded for money served as the reinforcers. In addition to the reinforcers available for completion of the schedule requirements, the subject received fixed time pay, which consisted of two cents every thirty seconds. Panels associated with each schedule provided feedback regarding the subject's performance, rewards associated with each alternative, the fixed time pay and time in thirty second intervals. Each work-day consisted of seven 10-minute work periods with about a minute or two in between. The subject was paid in coin during the breaks. During the first work-day, the three concurrent FR/VI schedules (FR20/VI-10 sec, FR40/VI-10 sec, and FR80-10 sec) were presented one after the other, then the three FR schedules (FR20, FR40, and FR80) were presented alone one after the other. The next day, the series were reversed with the FR alone series preceding the concurrent FR/VI series. The orders of these series were alternated day after day for seven days. The subject was exposed to the FR/VI series followed by the FR schedule alone series for four work days and to the FR alone series followed by the concurrent FR/VI schedule series for three days. The results of the study confirmed Mawhinney's prediction. During the three single FR schedules (FR20, FR40 and FR80) the subject developed the rule "Pull like hell." During the FR/VI concurrent schedules (FR20/VI-10 sec, FR40/VI-10 sec, and FR80-10 sec), the subject eventually developed precise rules for switching from the FR to the VI in terms of the number of responses; for example switch to the VI after "every 50th time," "every 20th" or "every 10th" trigger squeeze on the FR. Quantitative analyses of the subject's behavior indicated that he maximized performance under the single FR schedules and the concurrent FR/VI schedules. With respect to the concurrent schedules, "The rules which CB established and employed to guide allocations of behavior to the concurrent schedules were precisely those required to maximize two of the

choices while the other was in error by about 20%" (Mawhinney, 1982, p. 276). The results of this study suggest that if humans have been trained how to maximize their economic income, they are, indeed, likely to maximize their earnings due to the formal rules they develop. Mawhinney noted the limitations of the study. It examined the performance of only one subject. It differed from the typical laboratory experiment with nonhumans. At the same time, he suggested the potential significance of the results to the work place and monetary incentive systems, stating, " . . . the study is more true to the economic conditions facing people at work who must earn money by the hour from job attendance and from bonus pay systems which connect pay to performance" (p. 280).

The results of Mawhinney's (1982) study clearly suggest that at least some individuals are likely to respond in ways that maximize their reinforcement and thus are likely to perform at maximum rates under incentive ratio schedules of reinforcement, regardless of the percentage of total pay or base pay earned in incentive pay if alternative sources of reinforcement do not exist or are weak. The results of this study also predict that some individuals will maximize their reinforcement in concurrent schedule situations, given that they are capable of and take the time to extract accurate rules from the contingencies as they interact with them.

Additional studies, built on Mawhinney's (1982) work, could refine predictions of performance when individuals are faced with behavioral choices in the work setting. They would be valuable contributions to the literature. At the current time, however, due to the complexity of the work environment, it remains difficult to predict how individuals will allocate their behaviors when faced with the variety of concurrent schedules that exist in work settings. For example, in work settings: (a) the behaviors controlled by different reinforcers are different and hence the amount of effort required to perform them may differ, which in turn may affect response allocation; (b) the number of different reinforcers affecting one behavior or different behaviors is difficult to determine; (c) the reinforcers that are available are qualitatively different (e.g., social reinforcement for talking with coworkers, points/success associated with computer games, monetary incentives for working); (d) the schedules of reinforcement for different reinforcers are difficult to specify; (e) individuals bring different histories of reinforcement to the work setting. Prediction becomes problematic due to the number of unknown variables and the way those variables interact with each other. It may well be that the results of the current studies on concurrent schedules can be directly and successfully extrapolated to

complex applied settings (e.g., Mace, McCurdy, & Quigley, 1990; Mawhinney, 1975; Mawhinney & Ford, 1977; Mawhinney & Gowen, 1990; McDowell, 1981, 1982, 1988; Myerson & Hale, 1984; Pierce & Epling, 1983, 1995; Rachlin, 1989; Redmon & Lockwood, 1986); on the other hand, it is possible that they cannot be (Fuqua, 1984; Poling et al., 2000; Poling & Foster, 1993). Whether they can or not, of course, is a question that will not be answered by debating the subject in the absence of data. The data from the experimental studies reviewed below were collected in the tradition that holds that progress can be made even when it is not possible to make extrapolations directly from quantitative laws of behavior to analyses of contingencies observed in field settings or manipulated in laboratory experiments.

The general features of the five studies (Dickinson & Gillette, 1993; Frisch & Dickinson, 1990; LaMere et al., 1996; Matthews & Dickinson, 2000; Riedel et al., 1988) that have examined different percentages of total pay or base pay earned in incentive pay are summarized in Table 1. Table 2 displays (a) the specific pay contingencies, (b) the average total pay and base pay earned by participants, (c) the actual, rather than planned, percentages of incentive pay based on earnings during the studies, and (d) the average performance of participants exposed to the various pay conditions in each of these studies.

In a study designed to investigate how monetary incentives affect goal choice, goal commitment, and task performance, Riedel et al. (1988) assessed the effects of incentive payment when subjects could earn a "share rate" of 0%, 25%, 50%, 75%, 100% or 125% of their base pay in incentives. Subjects in the 0% group were paid an hourly wage of $4.40. Subjects in the incentive groups received the hourly pay and could earn incentives when they performed above a specified performance standard. The dollar values of the incentive share rates for subjects in the 25%, 50%, 75%, 100% and 125% groups were $1.10, $2.20, $3.30, $4.40 and $5.50, respectively. Subjects received the incentive for each "Incentive Hour," they earned. Incentive Hours were calculated as follows: [((Units of Work Produced per Hour/Hourly Performance Standard) × (Hours Worked)) – (Hours Worked)]. The formula used to calculate the incentive pay was: [(Incentive Hours) × (Share Rate) × (Hourly Pay of $4.40)].

High school and college students worked four hours a day for five days transferring data from hand written questionnaires to computer mark sense forms. Each morning subjects were told the number of questionnaires they coded the previous day. Thus, the effects of hourly pay with feedback were compared with the effects of base pay plus incen-

TABLE 1. General Features and Summary of the Results of Studies of the Percentage of Total Pay and Base Pay Earned in Incentive Pay

Authors	Subjects	Independent Variable: % of Total/Base Pay Earned in Incentives	Performance Measure	Experimental Design	Summary of the Results[a]
Dickinson & Gillette (1993)	Experiment 1: College students N = 6	30% of total pay 100% of total pay	Check values entered on the computer	Within subject/ Reversal	Performance was comparable when subjects earned 30% and 100% of their total pay in incentive pay.
	Experiment 2: College students N = 6	30% of total pay 100% of total pay	Check values entered on the computer	Within subject/ Reversal	Performance was comparable when subjects earned 30% and 100% of their total pay in incentive pay.
Frisch & Dickinson (1990)	College students N = 75	0% of base pay 10% of base pay 30% of base pay 60% of base pay 100% of base pay	Parts assembled	Between group	Performance was significantly higher when subjects earned incentives than when they received base pay only. $p < .01$
					Performance was comparable when subjects earned incentives, regardless of the percentage of base pay earned in incentive pay.
LaMere et al. (1996)	Truck drivers N = 22	0% of total pay 3% of total pay 6% of total pay 9% of total pay	Job points earned	Within subject/ Multiple-baseline	Performance was significantly higher when subjects earned incentives than when they received base pay only. $p < .05$
					Performance was comparable when subjects earned incentives, regardless of the percentage of total pay earned in incentive pay. $p > .05$

Matthews & Dickinson (2000)	College students N = 106	0% of total pay 10% of total pay 100% of total pay	Computer screens inspected for defective figures	Between group	Performance was comparable when subjects received base pay only and when they earned 10% or 100% of their total pay in incentives. $p > .05$
					Performance was comparable when subjects earned 10% and 100% of their total pay in incentive pay. $p > .05$
Riedel et al. (1988)	High school and college students N = 130	0% of base pay 25% of base pay 75% of base pay 100% of base pay 125% of base pay	Questionnaires coded	Between group	Performance was significantly higher when subjects earned incentives than when they received base pay only. $p < .001$
					Performance was comparable when subjects earned incentives, regardless of the percentage of base pay earned in incentive pay. $p > .05$

[a] p values are presented when statistical analyses were conducted. They are absent when visual analyses were conducted.

tives with feedback. Close by was a break area where participants could socialize and consume refreshments. Eighteen to twenty subjects were assigned to each of the pay conditions. Subjects in the five incentive groups performed statistically significantly better than those who did not receive incentives, but there were no significant differences in performance among subjects in the five incentive groups. Neither the raw nor mean performance data were provided in the article. The amount of pay that subjects actually earned was also not reported in the article, thus, it is not possible to determine the actual percentages of base pay subjects earned in incentive pay.

Shortly thereafter, Frisch and Dickinson (1990) examined the effects of five different percentages of incentive pay to base pay on worker performance. In a between group study, 75 college students were randomly assigned to one of five pay conditions. Subjects in the 0% incentive pay group received a guaranteed base pay of $4.00. Subjects in the remaining four groups received a base pay and, in addition, were able to earn 10%, 30%, 60% or 100% of their base pay in incentives. The incentive pay systems were designed so that subjects in the four incentive groups could earn a total of $4.00 per session if they performed at the estimated maximum level of performance on the task. Table 2 provides the amount of base pay and the per piece incentive pay that subjects in each group were offered. The task consisted of assembling parts made from bolts, nuts, and washers. Subjects in the incentive groups earned the per piece incentive when their performance exceeded a performance standard. Each subject participated in fifteen 45-minute sessions. A number of off-task activities were available in an adjacent room, and subjects were able to take work breaks whenever they desired. At the end of each session, the experimenter counted the number of correctly assembled parts, plotted it on a graph in the presence of the subject, and paid the subject. Thus, feedback was provided in both the base pay and incentive pay conditions. In order to earn the total amount of incentives that were available, subjects in the four incentive groups had to assemble 120 parts per session, which was considered to be maximum performance based on a pilot study. Subjects did so only rarely and thus the percentages of incentive earnings to base pay earnings that subjects actually received were lower than the planned percentages. Table 2 displays the average total pay and the average total incentive pay earned per session by subjects in each group. Subjects in the incentive groups actually earned an average of 3%, 13%, 25% or 54% of their base pay in incentives, rather than 10%, 30%, 60% or 100%, respectively. Subjects who received incentives assembled statistically significantly more parts than

subjects who were paid hourly, however, subjects in the four incentive groups performed comparably. As can be seen in Table 2, subjects in the 0%, 3%, 13%, 25%, and 54% groups assembled an average of 68.7, 87.2, 84.5, 88.7 and 87.4 parts per session, respectively. When the data for the four incentive groups are collapsed, subjects who were paid incentives assembled an average of about 18 more parts per session than subjects who were paid hourly, which represents a 26% increase in the number of parts assembled.

In order to determine whether the total amount of money earned by subjects influenced their performance, Frisch and Dickinson (1990) compared the total amount of money earned by subjects in each group. Subjects in the 0%, 3%, 13%, 25% and 54% groups earned an average of $3.81, $3.74, $3.46, $3.13, and $3.08 per session, respectively. As can be seen, there was an inverse parametric relationship between the size of the incentive percentage and the total amount of money the subjects earned per session, with subjects in the 0% group (base pay only group) earning the most amount of money and subjects in the 54% group earning the least. Because (a) subjects in the 0% group assembled the fewest parts and subjects in the four incentive groups assembled a statistically significantly greater number of parts and (b) subjects in the four incentive groups assembled a comparable number of parts, performance could not have been due to the total amount of money earned. The performance of subjects in the incentive groups was not a function of the per piece incentive amount either. As indicated earlier, subjects in the four incentive groups received the base pay and a per piece incentive for each part produced in excess of a performance standard. The per piece incentive varied across the incentive groups. It was $.005, $.013, $.021, and $.029 for subjects in the 3%, 13%, 25%, and 54% groups, respectively, as indicated in Table 2. Yet, subjects in the four groups performed comparably. Therefore, the amount of the per piece incentive did not differentially affect performance. Thus, in this study, performance was not influenced by either the total amount of money earned by subjects or by the per piece incentive earned by subjects in the four incentive groups.

The results of the Frisch and Dickinson study (1990) were particularly interesting for two reasons. First, subjects who earned an average of only 3% of their base pay in incentives, $0.11 per 45-minute session, performed both statistically and practically significantly better than those who were paid hourly. Second, as in Riedel et al. (1988), subjects who earned different percentages of their base pay in incentives performed comparably.

Dickinson and Gillette (1993) extended this research by comparing the effects of a pay system in which subjects earned 100% of their wages in incentives with a pay system in which subjects earned 30% of their total wages in incentives. The 100% incentive pay system was a piece rate pay system without any guaranteed pay, and thus represents the maximum percentage of total wages that a person can earn in incentive pay. Dickinson and Gillette conducted two experiments. Experimental sessions were three hours in Experiment 1 and four hours in Experiment 2 rather than 45 minutes as they were in Frisch and Dickinson (1990). Dickinson and Gillette increased the length of the sessions because they believed that the results of Frisch and Dickinson (1990) may have been due to the short sessions. Dickinson and Gillette posited that monetary incentives may improve performance primarily by increasing the time that workers spend performing the incented task in contrast to alternative activities. Support for this position was provided by a study conducted by Pritchard et al. (1980), a study that will be reviewed in more detail in the next section of this paper. Pritchard et al. recorded the percentage of time that subjects spent performing the experimental task (passing tests based on instructional units) when subjects received hourly wages or monetary incentives. Subjects worked five hours a day for four days. Pritchard et al. recorded the time they spent working using a video camera. They found that subjects who received per piece incentives spent 78.7% of their time working while subjects who received hourly wages spent only 60.6% of their time working. The difference was both statistically and practically significant. In Frisch and Dickinson's study, the experimental sessions were only 45 minutes. With the 45-minute sessions, regardless of how effortful the experimental task was, reinforcement from alternative activities could easily have been delayed until after the session or completely forfeited in order to maximize earnings. Although off-task performance was not formally assessed, Frisch and Dickinson noted that subjects rarely took work breaks. Thus, Dickinson and Gillette conducted longer sessions to increase the likelihood that subjects would take work breaks, permitting performance differences to emerge when they earned different percentages of their total pay in incentives. Two studies were conducted with six college students serving as subjects in each experiment. A reversal design was used, thus each subject was exposed to both pay systems. Simulated bank checks, with differing cash values, were displayed on the computer screen and subjects entered the cash value of the checks using the computer keyboard. At any time during the session, subjects could use the computer mouse to "click" on a

box labeled "Number" and see the number of checks they had entered correctly at that point in the session. The computer displayed the total number of correctly entered checks at the end of the session. In addition, the experimenter plotted the total number of correctly entered checks on a graph in the presence of the subjects at the end of the session. As in previous studies, alternative activities were available in a lounge area and subjects were free to take breaks whenever they wanted. In Experiment 1, during the 100% incentive pay conditions, subjects earned a per check incentive of $.0039 and were able to earn a total of $5.00 per hour if they completed 1300 checks, which was estimated to be average performance on the task. During the base pay plus incentive conditions, subjects earned $3.50 in hourly wages and $.005 for each check completed above a 1000-check performance standard. If subjects completed the average number of checks, 1300, they earned a total of $5.00 per hour which was the same pay they could earn for completing 1300 checks during the piece rate pay conditions. In both conditions, subjects earned more than $5.00 if they completed more than 1300 checks per hour. Experiment 2 differed from Experiment 1 in that the amount of pay offered to subjects was individualized based on their performance during the first phase of the study. Three subjects were exposed to the pay systems in an ABA sequence while the other three were exposed to the pay systems in a BAB sequence, where A = 100% of total pay earned in incentives and B = 30% of total pay earned in incentives. For the three subjects exposed to the ABA sequence, the per piece incentive was $.0036. Subjects could earn a total of $4.50 if they completed 1250 checks, which was the average performance of subjects in Experiment 1. Because the total amount of money subjects earned was based on their performance, subjects in Experiment 1 did not always earn the total amount of money that was available, hence altering the planned percentage of incentive during the 30% incentive condition. In Experiment 2, in an attempt to equalize the amount of money subjects actually earned during the two conditions, during the base pay plus incentive phase, the amount of base pay and incentive pay that a subject could earn was based on the amount of money the subject actually earned during the preceding phase. For example, in Experiment 2, one subject completed a mean of 1034 checks during the first piece rate pay condition, earning an average of $3.72 per session. During the following 30% incentive condition, the pay scale was constructed so that the subject would also earn $3.72 if he completed 1034 checks. Thus, for this particular subject, the amount he could earn in base pay was $2.60 (.70 $\times$ $3.72) and the total amount of money he could earn in incentives for

completing 1034 checks was $1.12 (.30 × $3.72). The subject started earning incentives when his performance exceeded 922 checks (which was one standard deviation below his mean performance during the piece rate pay condition, that is, 112 checks lower than his mean performance). His per piece incentive was thus $.01 ($1.12 total incentive pay divided by the 112 check difference between the performance standard of 922 checks and his average performance during the piece rate pay condition of 1034 checks). The three subjects exposed to the BAB sequence were able to earn a total of $4.50 for completing an average of 1250 checks during the base pay plus incentive condition. Thus, they earned $3.15 in base pay (.70 × $4.50) and could earn an additional $1.35 in incentives (.30 × $4.50) if they completed 1250 checks. Similar to the subjects exposed to the ABA sequence, the pay that subjects exposed to the BAB sequence were able to earn during the second condition (the piece rate pay condition) was individualized based on their performance during the initial phase–in this case, the base pay plus incentive condition. The per check incentive amount for these subjects during the piece rate pay condition was determined as follows: (Average pay per hour during the initial 30% incentive phase/Average performance per hour during the initial 30% incentive phase). For example, one subject averaged 1246 checks per hour during the initial base pay plus incentive pay condition, earning an average of $4.44 per hour. During the piece rate pay condition, she earned $.00356 per check ($4.44 average pay per hour during the base pay plus incentive phase divided by 1246 checks). The average base pay and average per piece incentive earned by the six subjects are displayed in Table 2. During the piece rate pay conditions, the six subjects earned an average of $.0035 per check, with the per check amount ranging from $.0029 to $.0036 across the subjects. During the base pay plus incentive condition, the six subjects earned an average of $3.02 (with a range of $2.60 to $3.15 across subjects) in base pay and an average per piece incentive of $.018 (with a range of $.01 to $.03 across subjects). Readers are referred to the original article for the specific amounts of base pay and incentive pay offered to each of the six subjects during the two pay conditions (Dickinson & Gillette, 1993).

As in the previous studies, the actual total amount of money earned per hour under both pay systems and the actual percentage of total wages earned in incentives during the base pay plus incentive pay phases depended upon how many checks the subjects completed. These data are provided in Table 2. In Experiment 1, subjects earned an average of $4.72 per hour during the piece rate conditions and an average of

$4.53 per hour during the base pay plus incentive pay phases. During the base pay plus incentive pay conditions, subjects earned an average of 23% of their total pay in incentives, which was less than the 30% that was intended. In Experiment 2, subjects earned an average of $4.25 per hour during the piece rate pay conditions and an average of $4.61 per hour during base pay plus incentive pay conditions. During the latter condition, subjects earned an average of 34% of their total wages in incentive pay.

In both experiments, the performance of each subject was displayed graphically. A visual analysis of the graphed data revealed that performance was not systematically affected by the percentage of total wages earned in incentive pay in either experiment. The mean performance of subjects for each condition in each experiment is summarized in Table 2. In Experiment 1, subjects averaged 1228.25 checks per hour during the piece rate pay phases and 1224.63 checks per hour during the base pay plus incentive pay phases, an average difference of fewer than four checks per hour. In Experiment 2, the six subjects completed an average of 1214.50 checks during the piece rate pay phases and an average of 1219.8 checks during the base pay plus incentive pay phases, an average difference of fewer than six checks per hour. Given the total number of checks completed per hour, the performance differences between the piece rate pay conditions and the base pay plus incentive pay conditions in the two experiments are not practically significant.

Using a multicomponent intervention package, LaMere et al. (1996) examined the performance of 22 roll-off truck drivers employed by a waste disposal firm when the drivers earned an average of 0%, 3%, 6% and 9% of their total wages in incentive pay. Drivers earned $10.00 an hour in base pay throughout the study and could earn incentive pay when the number of job points they earned exceeded a specified performance standard. The per job point incentive varied depending upon the number of miles driven by the drivers to reflect the fact that if two drivers completed the same number of job points, the driver that was required to drive more miles performed better. The increases in the percentage of incentive pay to total pay were achieved by increasing the per job point incentive; thus, as the percentage increased during the study from 3% to 6% and 9%, the total amount of money earned per hour by the drivers also increased. Table 2 displays the incentive rates for the three phases of the study. As indicated earlier, the per job point incentive varied depending upon the number of miles driven by the drivers. There were 14 different mileage categories with 14 different per job point incentive amounts. When drivers earned an average of 3%

TABLE 2. Pay Contingencies, Average Amount Earned and Average Performance of Participants in Studies of the Percentage of Total Pay and Base Pay Earned in Incentive Pay

	Pay Contingencies		Average Pay Earned		Incentive %	Average Performance
Experiment and Experimental Condition	Base Pay Amount	Per Piece Incentive	Total Pay per Hour or Session	Total Incentive Pay per Hour or Session	Actual Percentage of Incentive Pay	Performance per Hour or Session
Dickinson & Gillette (1993)						
Experiment 1						
30% of total pay	$3.50	$.005	$4.53	$1.04	23%	1224.63 checks
100% of total pay		$.004	$4.72	$4.72	100%	1228.25 checks
Experiment 2						
30% of total pay	$3.02[a]	$.018[a]	$4.61	$1.57	34%	1219.80 checks
100% of total pay		$.004[a]	$4.25	$4.25	100%	1214.50 checks
Frisch & Dickinson (1990)						
0% of base pay	$4.00		$3.81		0%	68.70 parts
10% of base pay	$3.63	$.005	$3.74	$0.11	3%	87.20 parts
30% of base pay	$3.07	$.013	$3.46	$0.39	13%	84.50 parts
60% of base pay	$2.50	$.021	$3.13	$0.63	25%	88.70 parts
100% of base pay	$2.00	$.029	$3.08	$1.08	54%	87.40 parts
LaMere et al. (1996)[b]						
0% of total pay	$10.00		$10.00		0%	0.49 job points
3% of total pay	$10.00	$0.47[c]	$10.28[d]	$0.28[d]	3%	0.59 job points
6% of total pay	$10.00	$1.10[c]	$10.61[d]	$0.61[d]	6%	0.55 job points
9% of total pay	$10.00	$1.75[c]	$11.00[d]	$1.00[d]	9%	0.57 job points

Matthews & Dickinson (2000)						
0% of total pay	$7.00		$7.00		0%	51.00 screens
10% of total pay	$3.60	$0.01	$6.95	$0.65	9%	65.00 screens
100% of total pay		$0.10	$5.91	$5.91	100%	59.00 screens
Riedel et al. (1988)						
0% of base pay	$4.40					
25% of base pay	$4.40	$1.10	–	–	–	–
50% of base pay	$4.40	$2.20	–	–	–	–
75% of base pay	$4.40	$3.30	–	–	–	–
100% of base pay	$4.40	$4.40	–	–	–	–
125% of base pay	$4.40	$5.50	–	–	–	–

Note. Dashes indicate that the data were not presented in the article.

[a] In Experiment 2, the base pay amount and the per piece incentive differed across participants; the amounts were averaged across the six participants.

[b] Data from Groups 1 and 2 are averaged.

[c] The per piece incentive amounts varied depending upon the number of miles driven by the truck drivers. These figures are the average per piece incentive based on actual earnings which were provided in LaMere (1993).

[d] These data are taken from LaMere (1993).

of their total wages in incentives, the per job point incentives ranged from $0.28 to $2.08, when drivers earned an average of 6% of their total wages in incentives, the per job point incentives ranged from $0.54 to $3.99, and when drivers earned an average of 9% of their total wages in incentives, the per job point incentives ranged from $0.85 to $6.26. The per job point incentives listed in Table 2 are the average per job point incentives that the drivers actually earned during the study. These data were not included in LaMere et al. (1996) but were obtained from LaMere (1993). The pay tables are provided in LaMere et al. and readers who would like more detail about the incentive system are referred to that article.

The 22 drivers were divided into two groups and a multiple-baseline across groups design was used to assess the initial impact of the incentive system. Prior to the study, all drivers had self-recorded the number and types of jobs they completed daily. They continued to do so during baseline and the incentive pay interventions. During the incentive pay interventions, they also determined whether their performance exceeded the standard. If it did, they calculated the amount they earned in incentives that day. In addition to this daily individual feedback, a line graph displaying weekly average group performance was posted in a communal area. All drivers received hourly pay during baseline and, as indicated above, self-recorded the jobs they completed daily. Baseline lasted 20 weeks for drivers in Group 1 and 34 weeks for drivers in Group 2. During the first phase of the incentive plan, which lasted 28 weeks for Group 1 and 15 weeks for Group 2, drivers earned an average of 3% of their total pay in incentives. Incentive pay was increased in two subsequent phases and averaged 6% and 9% of the drivers' total pay, respectively. These raises were introduced to both groups of drivers at the same time due to a management decision to maintain pay equity. Because of that, both groups of drivers were exposed to these two phases for the same number of weeks. They earned an average of 6% of their total pay in incentives for 39 weeks and an average of 9% of their total pay in incentives for 107 weeks. Table 2 displays the average total pay per hour and the average total incentive pay per hour that the drivers earned for all phases of the study. The data were averaged across both groups of drivers. Once again, the pay data were not reported in the published article, but were obtained from LaMere's (1993) dissertation.

Drivers in Group 1 completed an average of 0.45, 0.55, 0.52, and 0.54 job points per hour during baseline, and the 3%, 6%, and 9% incentive phases, respectively. Drivers in Group 2 completed an average of 0.53, 0.63, 0.59, and 0.60 job points per hour during baseline, and the

3%, 6%, and 9% incentive phases. Table 2 displays the performance data averaged across both groups of drivers for the four phases of the study, although LaMere et al. (1996) appropriately analyzed the performance data for the two groups separately. For drivers in both groups, performance during each of the three incentive phases was statistically significantly better than performance during baseline, however, performance during the three incentive phases was comparable. Although the differences between the average number of job points earned by the drivers during baseline and the incentive conditions appear small, they were practically, as well as statistically, significant. During the initial incentive intervention, which lasted 28 weeks for Group 1 and 15 weeks for Group 2, net labor cost savings were $17,631 and the return on investment (net labor cost savings divided by the total amount paid out in incentives) was approximately 4:1. During the 10 month period when drivers earned 6% of their total pay incentives, net labor cost savings were $58,724 and the return on investment was about 3:1. (The decreased return on investment reflects the fact that the company doubled the amount of the per job point incentive during the second incentive phase and thus paid drivers more money than it had during the initial incentive phase.) In summary, both groups of drivers increased their performance when the initial incentive system was implemented even though the drivers earned an average of only 3% of their total pay in incentive pay. Subsequent increases in the percentage of total pay earned in incentives, however, did not result in further increases in performance. That is, performance was comparable when drivers earned an average 3%, 6% and 9% of their total wages in incentive pay and when the amount of the per job point incentives differed.

The results of this study are consistent with those of laboratory investigations; that is, with the exception of the change from 0% to 3% of total wages earned in incentive pay, increases in the percentage of total wages earned in incentive pay did not result in further increases in performance. However, only a small range of percentages was examined. The differences between earning 3%, 6%, and 9% of total wages in incentive pay may not have been sufficient to affect the drivers' performance. Additionally, because the two incentive increases were introduced simultaneously, the data must be interpreted cautiously. While not likely due to the extended length of the phases, it is possible that some environmental event, such as inclement weather or longer driving distances suppressed performance during the last two incentive phases.

Matthews and Dickinson (2000) conducted a study to examine a larger range of percentages of incentive earnings to total wages, refining experimental procedures so that their laboratory simulation would be more realistic than previous ones. Work settings offer a vast array of attractive off-task activities that compete, often effectively, with work tasks and their related consequences, including pay and supervisory consequences. As discussed earlier, the consequences derived from the various work and non-work activities are delivered on various concurrent schedules of reinforcement. As demonstrated by behavioral choice studies, the relative reinforcing value of the task outcomes will determine how performance is allocated among them (e.g., Herrnstein, 1970). Although off-task activities were available to participants in other laboratory studies they may not have been as attractive as those in a work setting. Without attractive alternatives (that is, without competing sources of reinforcement), participants are likely to spend all of their time engaging in the experimental task regardless of the specific arrangement between the incentives and performance (Dickinson & Gillette, 1993; Mawhinney, 1975, 1982, 1984). When realistic alternatives are available, participants may distribute their performance differently than when they are not present, and higher percentages of incentive pay to total pay may compete more effectively with the alternative activities than lower percentages. The presence of the experimenter may also have unrealistically restricted the extent to which the participants engaged in off-task activities in laboratory studies (Matthews & Dickinson, 2000). In actual work settings, performers have the opportunity to engage in off-task activities when the supervisor is not present, thereby avoiding potential reprimand. Within the laboratory, subtle social contingencies, such as potential disapproval by the experimenter, may have prevented participants from performing non-work tasks. In response to these concerns, Matthews and Dickinson revised their experimental procedures (a) to insure that alternative tasks were indeed compelling, and (b) to enable subjects to perform them without observation by the experimenter.

Matthews and Dickinson (2000) examined three percentages of incentive pay: 0%, 10%, and 100% of a person's total pay. Opportunities to play highly rated computer games were provided either two or four times during a 70-minute session. Each participant participated in one session. A 3×2 between group factorial design was used, with 16 to 20 subjects randomly assigned to each of the six groups. Sessions were computer-driven and experimenters were not present during the sessions. The task was a quality inspection task. Computer screens display-

ing 126 examples of a simple geometric figure were presented and subjects used the computer mouse to "click" defective examples. The dependent variable was the number of correctly completed screens. No feedback was provided to subjects during the session. Two or four times during the session, the computer offered subjects the opportunity to play a computer game for up to five minutes. Subjects could continue to work or play the computer game. If they elected to play the computer game, they could return to the work task any time during the 5-minute period. The computer recorded the amount of time spent performing the work task and the computer games; thus for the first time in this line of research, the time spent on and off task was directly measured. Under the 100% incentive condition, subjects earned $.10 for each correctly completed computer screen of figures. Under the 10% condition, subjects received a base pay of $6.30 for the 70-minute session and $.01 for each correctly completed computer screen. Subjects in both conditions who performed at the average rate of one screen per minute (derived from pilot work) thus had the opportunity to earn $7.00. Subjects who performed above the average rate earned more due to the per screen incentives. Under the 0% incentive condition, subjects received $7.00 for the 70-minute work session regardless of the number of screens they completed. As in previous studies, the actual amount of money earned by subjects in the incentive groups depended upon their performance. The average amount of pay subjects in the 0%, 10%, and 100% incentive groups earned per session was $7.00, $6.95, and $5.91, respectively (Matthews, 1997). Subjects in the 10% incentive group earned 9.4% of their total wages in incentives, which is close to the planned percentage of 10%. The pay contingencies and pay data are summarized in Table 2.

Subjects who received incentive pay spent statistically significantly more time working per session than subjects who received hourly pay (61 minutes versus 52.50 minutes), which is consistent with data reported by Pritchard et al. (1980). Subjects who earned 10%, or 100% of their total pay in incentive pay, however, spent a comparable number of minutes working (60.5 minutes versus 61.5 minutes). To determine whether the time spent working influenced performance, the authors correlated the time spent working with performance. Time spent working was statistically significantly related to performance. Even though incented subjects spent more time performing the task and time spent working was statistically significantly correlated with performance, however, the performance of incented subjects did not differ from the performance of subjects who were paid hourly. That is, the number of correctly completed screens did not differ statistically across the three

pay conditions. Subjects in the 0%, 10%, and 100% groups completed an average of 51 screens (SD = 35), 65 screens (SD = 25) and 59 screens (SD = 31), respectively. Thus, although this was the first study in this series of studies to demonstrate a relationship between incentives and time spent working, the extra time spent working by incented subjects did not lead to better performance in comparison to subjects who were paid hourly. These latter data conflict with the results reported by Pritchard et al. (1980). In their study, subjects who received per piece incentives spent statistically significantly more time performing the task and also performed statistically significantly better than subjects who were paid hourly wages.

To summarize, the results of all five studies (Dickinson & Gillette, 1993; Frisch & Dickinson, 1990; LaMere et al., 1996; Matthews & Dickinson, 2000; Riedel et al., 1988) were consistent: When participants were exposed to incentive systems in which they could earn different percentages of their total pay or base pay in incentives, their performance was comparable. In contrast to statements made by compensation experts (Fein, 1970; Henderson, 1985), small percentages of incentives, as low as 3% of a person's total pay, increased performance appreciably in comparison to hourly wages (Frisch & Dickinson, 1990; LaMere et al., 1996). Moreover, the differences were both statistically and practically significant. The effectiveness of relatively low incentive percentages was demonstrated in LaMere et al.'s (1996) field study as well as in two laboratory studies (Frisch & Dickinson, 1990; Riedel et al., 1988). These data have led researchers to propose that the contingent ratio relationship between performance and pay is the critical determinant of productivity, rather than (a) the percentage of total pay or base pay that can be earned in incentives, (b) the total amount of pay that can be earned in incentives, or (c) the amount of the per piece incentive (Dickinson & Gillette, 1993; LaMere et al., 1996). In their review of studies that examined financial incentives, Duncan and Smoot (2001) arrived at similar conclusions:

> First, it seems clear that pay procedures that are linked directly to performance lead to increased performance compared to procedures that are not strongly linked. Next, it appears that the actual amount of incentive pay as a proportion of base pay can be quite small and still be effective. (p. 263)

The findings of the five studies appear to be generally consistent with the results of other behavior analytic studies that have found that small monetary and nonmonetary reinforcers can have an appreciable impact

on employee performance (for recent reviews, see Komaki et al., 2000, and Stajkovic & Luthans, 1997). They do not, however, appear to be consistent with the results reported by Abernathy (2001). When Abernathy analyzed performance data for employees across eleven organizations, he found that performance was affected only when the percentage of base pay earned in incentive pay was 20% or above. There are several potential reasons why his data differ from those reported in the five experimental studies reviewed here. Other analyses of the same data conducted by Abernathy suggested that a number of pay system variables affected the extent to which performance improved. Based on these analyses, Abernathy concluded that "The most important implication of the study was the influence of the level of control employees had over their assigned performance measures. Individual measures produced more improvement than team measures, hourly employees improved more than salaried, more controllable measure types displayed more improvement, and a low number of changes in scorecard parameters increased performance" (p. 271). One variable related to controllability was the number of measures included on the performance scorecard–for hourly employees, as the number of scorecard measures increased, improvements in productivity decreased. In contrast to the performance measures examined in Abernathy's analysis, in all of the experimental studies reviewed here, the performance measures were highly controllable by participants: that is, they (a) were unitary measures, (b) were based on individual not group performance, and (c) were not changed during the study. There were two other notable differences between Abernathy's incentive system and the incentive systems examined in the research studies. In Abernathy's system, employees received their performance scorecards and incentive payments once a month. Subjects in the research studies received performance feedback and incentive pay much more frequently. In three of the four laboratory studies (Dickinson & Gillette, 1993; Frisch & Dickinson, 1990; Riedel et al., 1988), participants received performance feedback after each experimental session or before the beginning of the next session. Similarly, they were paid immediately after each session (Frisch & Dickinson, 1990), before the beginning of the next session (Dickinson & Gillette, 1993) or after the completion of the five-day study (Riedel et al., 1998). In Riedel et al.'s study although subjects were not paid until after the study was over, subjects received a daily summary of their incentive earnings. In LaMere et al.'s field study (1996), the drivers self-recorded their performance daily, and group performance was graphed weekly. In addition, the drivers were paid weekly. The differ-

ences in the measures used in Abernathy's study, differences in the frequency of performance feedback, and differences in the frequency of incentive pay could readily account for the fact that higher percentages of total pay and base pay earned in incentive pay were necessary in order to affect performance in the organizations examined by Abernathy. There is one more issue that needs to be addressed with respect to Abernathy's analyses. While Abernathy's study provides the most extensive analysis of the effects of different parameters of incentive pay systems on objective measures of performance in applied settings, and hence is highly laudable, it is subject to the same criticism as many other applied observational studies–the lack of experimental control. When regressing the percentage of base pay earned in incentive pay on performance improvement, scorecard measures were categorized based on the percentage of base pay earned in incentive pay. The number of measures included in each of the six categories varied widely, from 6 to 1,386 measures, and the other variables found to affect performance improvement were not controlled. Nonetheless, his data make a very valuable contribution to the incentive pay literature and, in addition, provide a rich source of independent variables that can be experimentally examined in future studies.

Even though the results of the five studies that have examined the effects of different percentages of total pay or base pay earned in incentive pay are consistent, the results are not definitive. The strengths and weaknesses of the five studies will be considered next.

Strengths and Limitations

Four of the five studies compared the effects of hourly pay to incentive pay (Frisch & Dickinson, 1990; LaMere et al., 1996; Matthews & Dickinson, 2000; Riedel et al., 1988). Of these four, three compared the effects of hourly pay plus feedback with incentive pay plus feedback (Frisch & Dickinson, 1990; LaMere et al., 1996; Riedel et al., 1988), while the fourth compared the effects of hourly pay without feedback with incentive pay without feedback (Matthews & Dickinson, 2000). In all three studies that compared hourly pay plus feedback with incentive pay plus feedback (Frisch & Dickinson, 1990; LaMere et al., 1996; Riedel et al., 1988), including the field study (LaMere et al., 1996), performance was appreciably higher when subjects received incentives plus feedback than when they received hourly pay plus feedback. Because performance feedback was provided during both the hourly pay conditions and the incentive pay conditions in these three studies, the

performance increases during the incentive pay conditions cannot be attributed to performance feedback, although one could argue that the monetary incentives themselves provided a more salient type of feedback than the performance feedback that was delivered with the hourly pay. The results of these three studies replicate the results of prior research (see Duncan & Smoot, 2001; Jenkins et al., 1998; and Dickinson & Gillette, 1993 for reviews). The three studies add to the financial incentive literature because in all three small percentages of total pay or base pay earned in incentive pay improved performance. In addition, in LaMere et al. (1996) small incentive percentages, ranging from 3% to 9% of the worker's total pay, sustained high levels of performance for over three years, providing the first demonstration of the long-term effectiveness of low levels of incentive percentages in an actual work setting. In spite of the consistency of the results, researchers should continue to examine the size of the percentage of total or base pay earned in incentives that is necessary to influence performance, particularly in applied settings where performance measures may be more complex (Abernathy, 2001). In addition, due to economic constraints, laboratory investigators have not been able to offer "real world wages," and the effectiveness of various proportions of incentive pay to total wages or base wages may well depend upon the absolute amount of the base wages earned and/or the total compensation earned (Duncan & Smoot, 2001; Lawler, 1990; Matthews & Dickinson, 2000). The financial information required to accurately calculate the percentage of incentive has not been provided in the field and case studies where incentives have improved performance (e.g., Abernathy, Duffy, & O'Brien, 1982; Allison et al., 1992; Bushhouse, Feeney, Dickinson, & O'Brien, 1982; Gaetani, Hoxeng, & Austin, 1985; George & Hopkins, 1989; Nebeker & Neuberger, 1985; Orphen, 1982; Wagner & Bailey, 1997). Even though studies may not be designed to assess the influence of a particular percentage of total wages or base wages earned in incentive pay, future researchers are encouraged to provide these data.

In the first study in this thematic line of research to directly measure the amount of time spent on and off task, Matthews and Dickinson (2000) found that subjects who received incentives spent more time working than subjects who were paid hourly wages. In addition, the time spent working was significantly correlated with task performance. Performance, measured by the number of correctly completed screens, however, was the same for subjects who were paid incentives and those who were paid hourly wages, even though performance tended to be higher for the incented subjects. Nonetheless, because of the statistical

equivalence of performance for incented and non-incented subjects, Matthews and Dickinson were not able to fulfill one of their primary research objectives–determination of whether incentives increase performance primarily by altering the time spent on task. In the study, the variability between subjects was considerable, reducing the likelihood of detecting treatment effects. The researchers attributed this variability to the type of task they used, a quality inspection task, which commonly generates such variability (e.g., Badalamente & Ayoub, 1960; Holland, 1958; Mackworth, 1948; Methot, Phillips-Grant, & Darr, 1999). In spite of this problem, the study was meritorious in that it was only the second study to demonstrate a relationship between time spent working and incentive pay (Pritchard et al., 1980, being the first). In addition, Matthews and Dickinson's break procedures increased the realism of the simulation by more closely approximating the multiple sources of reinforcement that are present in actual work settings. The break procedures did generate off-task behavior; the first time such off-task behavior has been documented in this particular line of research. Researchers should continue to explore the relationship between time on task and performance in order to determine whether incentives primarily affect performance by altering the way workers allocate their time to various tasks and whether time-on-task is functionally related to the percentage of total or base pay wages earned in incentive pay. In addition to measuring the overall time spent on and off task, researchers should measure local rates of performance over time in an effort to ascertain whether any observed performance increases are due to increases in skill level, increases in the speed of responding, and/or increases in the overall amount of time spent performing the incented task. Moreover, when conducting studies in the laboratory, researchers should incorporate break procedures similar to those developed by Matthews and Dickinson so that participants are faced with "real," rather than illusionary, choices between the experimental and alternative tasks.

With respect to the comparisons of different percentages of incentive pay earned to total pay and base pay earned, the major strengths of this line of research relate to the generality of the results given the small number of investigations. The studies have examined a wide range of incentive percentages, ranging from 3% to 100% of a person's total pay and from 3% to 125% of a person's base pay. And, although only one field study has been conducted (LaMere et al., 1996), the results of that study were consistent with the results from the laboratory studies (Dickinson & Gillette, 1993; Frisch & Dickinson, 1990; Riedel et al., 1988). [For reasons that will be discussed shortly, the results of

Matthews and Dickinson (2000) cannot be used to support the argument that different percentages of total pay earned in incentive pay result in comparable performance, and hence that study will be excluded from the present analysis.] Findings were also the same regardless of whether researchers used a between group experimental design (Frisch & Dickinson, 1990; Riedel et al., 1988) or a within-subject design (Dickinson & Gillette, 1993; LaMere et al., 1996), suggesting that the results may generalize to individuals who have been exposed to only one proportion of incentive earnings to total or base pay earnings and to those who have been exposed to different proportions. The experimental tasks and session lengths have also varied across studies. Laboratory tasks have included marking computer sense sheets (Riedel et al., 1988), assembling parts (Frisch & Dickinson, 1990), and entering numerical data into the computer (Dickinson & Gillette, 1993). In LaMere et al.'s field study, truck drivers performed a number of different driving tasks. Session lengths have ranged from 45 minutes (Frisch & Dickinson, 1990) to an eight-hour work day (LaMere et al., 1996). Thus, as indicated earlier, the similarity of findings across different percentages of incentive pay earned to total pay and base pay earned, settings, experimental designs, tasks, and session lengths constitutes the major strength of this line of research.

In spite of the above, limitations do exist. As noted earlier, the results of LaMere et al. (1996), while suggestive, must be interpreted cautiously due to the quasi-experimental design. Additional research in naturalistic settings is certainly needed. And, although Matthews and Dickinson (2000) found performance to be comparable when subjects earned 10% and 100% of their total wages in incentives, these results cannot be used to bolster the argument that different incentive percentages control performance equally. As indicated earlier, in their study, subjects who received incentives and those who were paid hourly wages performed comparably. Thus, the incentives did not effectively control performance. Such control must be established before one can assess the effects of different proportions, levels, or amounts of incentives. Dickinson and Gillette (1993) did not include an hourly pay control condition, which weakens their study accordingly as well, although incentives did effectively control the performance of pilot subjects who performed the same task used in the study. Nevertheless, such control should ideally be demonstrated for participants within a particular study. Thus, future researchers are encouraged to include a control condition of hourly pay to insure the internal validity of the results.

The major question with respect to this line of research is whether feedback sustained performance under the various percentages of total pay and base pay earned in incentive pay. As indicated earlier, in four of the five studies, relatively immediate performance feedback was provided along with the incentives (Dickinson & Gillette, 1993; Frisch & Dickinson, 1990; LaMere et al., 1996; Riedel et al., 1988). In the three laboratory studies, feedback was given either at the end of the session or at the beginning of the next session (Dickinson & Gillette, 1993; Frisch & Dickinson, 1990; Riedel et al., 1988). In the one field study (LaMere et al., 1996), drivers self-recorded their daily performance and group performance was graphed weekly. Failure to find performance differences as a function of the incentive percentage, thus, may have been due to feedback. In order to isolate the effects of the percentages of total pay earned in incentives from feedback, Matthews and Dickinson (2000) did not provide feedback to participants. Additionally, because subjects participated in only one session, the incentives themselves could not have functioned as feedback. However, the results of this study cannot be used to answer the question about feedback because, as indicated earlier, the incentives did not control performance when they were compared to hourly wages.

No well-controlled studies have examined the effects of various percentages of total pay or base pay earned in incentive pay with and without feedback, however, data from Parsons (1974) and Gruenberg and Hyten (1993) suggest that feedback may augment the effects of monetary incentives. If true, then feedback may sustain performance under varying incentive percentages, eliminating performance differences that might otherwise occur (C. Hyten, personal communication, January, 1993; Matthews & Dickinson, 2000).

Parsons (1974) reanalyzed data from two studies conducted in the Relay Assembly Test Room during the Hawthorne studies. In the first study, immediate and daily feedback were provided as a component of a small group monetary incentive system. In the second, small group incentives were provided, but feedback was not. Although performance increased in both studies, performance increased considerably more in the first when workers received immediate and daily feedback on their performance. Parsons concluded that while the performance increases in the first study were due to both the incentives and the feedback, the feedback was responsible for the increasing performance trends and the ultimate size of the performance increase. Similarly, Gruenberg and Hyten (Gruenberg, 1992; Gruenberg & Hyten, 1993), in an unpublished study, concluded that feedback was responsible for increasing perfor-

mance trends across two different percentages of incentive pay to base pay. Using a data entry task modeled after the one used by Dickinson and Gillette (1993), Gruenberg and Hyten exposed 12 subjects to different percentages of incentive pay to base pay (0%, 10% or 100%) or different amounts of hourly pay using reversal designs. Three subjects were exposed to the 0%, 10%, and 100% incentive to base pay, conditions in an ABAC sequence and two subjects were exposed to an ACAB sequence where A = hourly pay, B = 10% incentive pay, and C = 100% incentive pay. Subjects entered financial data from simulated bank checks into the computer. In the hourly pay condition, subjects received $3.00 for completing 50 checks during a 1/2 hour session. In the 10% incentive pay to base pay condition, subjects received the base pay, of $3.00 for completing 50 checks and could earn a per piece incentive of $.0023 for each check completed above the 50-check standard. If subjects performed at the estimated maximum level of performance they could earn a total of $.30 in incentive pay, bringing their total earnings to $3.30 per 1/2 session ($3.00 base pay plus $.30 incentive pay). In the 100% incentive pay to base pay condition, subjects received the base pay of $3.00 for completing 50 checks and could earn a per piece incentive of $.023 for each check completed above 50. If subjects performed at the estimated maximum level of performance they could earn a total of $3.00 in incentive pay, bringing their total earnings to $6.00 per session ($3.00 base pay plus $3.00 incentive pay). One subject was exposed to three differing amounts of base pay in an AB'AC' sequence and two to an AC'AB' sequence, where A = hourly pay of $3.00, B' = hourly pay of $3.30, and C' = base pay of $6.00. Frequent feedback was provided under all conditions. Performance increased across all conditions for most of the subjects, regardless of whether they were exposed to different incentive to base pay percentages or to different amounts of base pay. Moreover, the increasing trends persisted as long as 65 days for some subjects. To examine the possibility that the feedback had been responsible for the performance trends, three subjects were exposed to the various pay conditions with and without feedback. Based on the comparative data from these subjects, Gruenberg and Hyten (1993) concluded that the feedback may have been the major cause of the trends and advised that "Feedback on productivity should be removed to isolate the effects of pay in future studies" (p. 3).

The preceding data suggest that feedback may well augment the effects of incentives and sustain performance under various pay arrangements. Given those data, the next logical steps in this line of research are to conduct well-controlled studies to determine (a) whether feedback

enhances the effectiveness of incentives and (b) whether different percentages of total or base pay earned in incentive pay result in equivalent performances absent feedback.

SCHEDULES OF MONETARY REINFORCEMENT

Rationale and Results

A series of pioneering studies, conducted from 1972 to 1982, examined performance under various ratio schedules of monetary reinforcement (Berger, Cummings, & Heneman, 1975; Latham & Dossett, 1978; Pritchard et al., 1980; Pritchard et al., 1976; Saari & Latham, 1982; Yukl & Latham, 1975; Yukl, Latham, & Pursell, 1976; Yukl, Wexley, & Seymore, 1972). A major objective of the studies was to compare conflicting predictions from expectancy theory and behavior analysis about human performance under various schedules of reinforcement. When developing their hypotheses, the authors assumed that humans would display the same performance patterns as nonhuman animals when exposed to the basic reinforcement schedules (i.e., continuous reinforcement schedule, fixed ratio reinforcement schedule, and variable ratio reinforcement schedule). Although many of the researchers recognized that the schedules they implemented in their studies differed from the like-named schedules examined in the operant laboratory (Latham & Dossett, 1978; Pritchard et al., 1980; Pritchard et al., 1976; Yukl & Latham, 1975), they also assumed that they were similar enough to generate the typical performance patterns observed in the laboratory.

Of the eight studies of schedules of monetary reinforcement, four were laboratory investigations (Berger et al., 1975; Pritchard et al., 1980; Pritchard et al., 1976; Yukl et al., 1972) and four were field studies (Latham & Dossett, 1978; Saari & Latham, 1982; Yukl & Latham, 1975; Yukl et al., 1976). Table 3 displays the general features of these studies along with a summary of their results.

Most of these studies examined performance under continuous reinforcement (CRF) and variable ratio (VR) reinforcement schedules. When exposed to CRF schedules, workers received an incentive for every unit of work completed. For example, Yukl and Latham (1975) paid workers $2.00 for every bag of tree seedlings planted and Latham and Dossett (1978) paid workers $1.00 for every beaver trapped. In the variable schedule conditions, a larger amount of incentive was delivered to equalize the total amount of money participants would earn when ex-

TABLE 3. General Features and Summary of the Results of Studies of Schedules of Monetary Reinforcement

Authors	Subjects	Independent Variable: Schedule of Monetary Reinforcement	Performance Measure	Experimental Design	Summary of the Results[a]
Berger et al. (1975)	College students N = 15	Base pay of $1.60 Base pay, $1.60, plus: CRF-25c VR2-25c VR2-50c	Question-naires coded	Split-plot/Within subject analysis of base pay and incentive pay	Performance was significantly higher when subjects earned incentives than when they received base pay only. $p < .001$
				Between group comparisons of schedules	Performance was comparable when subjects earned incentives, regardless of the schedule of reinforcement. $p > .05$
Latham & Dossett (1978)	Beaver trappers N = 14	Base pay, $5.00, plus: CRF-$1.00 VR4-$4.00	Beavers trapped	Within subject/ A/B comparison	Performance was higher when subjects earned CRF-$1.00 than when they earned VR4-$4.00
Pritchard[b] et al. (1980)	Males & Females, 17-19 yrs old N = 60	Base pay of $2.00 CRF/VA VR/VA	Instructional units, tests passed	Between group	Performance was significantly higher when subjects earned incentives than when they received base pay only. $p < .05$
					Performance was comparable when subjects earned incentives, regardless of the schedule of reinforcement. $p > .05$
Pritchard[c] et al. (1976)	Males, 15-20 yrs old N = 16	Base pay of $2.00 FR3-$3.00 VR3-$3.00 VR3/VA-$3.00	Instructional units, tests passed	Within subject/ Latin Square	Performance was significantly higher when subjects earned incentives than when they received base pay only. $p < .01$

TABLE 3 (continued)

Authors	Subjects	Independent Variable: Schedule of Monetary Reinforcement	Performance Measure	Experimental Design	Summary of the Results[a]
					Performance was comparable when subjects earned incentives regardless of the schedule of reinforcement. $p > .05$
Saari & Latham (1982)	Beaver trappers N = 12	Base pay of $7.00 Base pay, $7.00, plus: CRF-$1.00 VR4-$4.00	Beavers trapped	Within subject/ Reversal	Performance was significantly higher when subjects earned incentives than when they received base pay only. $p < .05$
					Performance was significantly higher when subjects earned VR4-$4.00 than when they earned CRF-$1.00. $p < .05$
Yukl & Latham (1975)	Tree planters N = 38	Base pay, $2.00, plus: CRF-$2.00 VR2-$4.00 VR4-$8.00	Bags of 1000 trees planted	Between group/ In-tact groups	Bags of trees planted per man hour: Performance was significantly higher when subjects earned CRF-$2.00 than when they earned VR2-$4.00. $p < .05$
			% change in bags of trees planted from when Ss were paid $2.00 an hour and when they were exposed to one of the three schedules		Performance was comparable when subjects earned CRF-$2.00 and when they earned VR4-$8.00. $p > .05$ Performance was comparable when subjects earned VR2-$4.00 and when they earned VR4-$8.00. $p > .05$ % change in bags planted: % change was significantly higher when subjects earned CRF-$2.00 than when they earned VR2-$4.00 or VR4-$8.00. $p < .05$

					% change was significantly higher when subjects earned VR4-$8.00 than when they earned VR2-$2.00. $p < .05$
Yukl[d] et al. (1976)	Tree planters N = 28	Base pay of $2.00 Base pay, $2.00, plus: CRF-$2.00 VR2-$4.00 VR4-$8.00	Trees planted	Within subject/ Reversal	Performance was comparable when subjects earned base pay and CRF-$2.00, VR2-$4.00, and VR4-$8.00. $p > .05$ Performance was comparable when subjects earned VR2-$4.00 and VR4-$8.00. $p > .05$ Gain scores were significantly higher when subjects earned VR2-50c than when they earned CRF-25c and VR2-25c. $p < .01$ Gain scores were comparable when subjects earned CRF-25c and VR2-25c. $p > .05$
Yukl[e] et al. (1972)	College students N = 15	Base pay, $1.50, plus: CRF-25c VR2-25c VR2-50c	Exam answer cards scored; Gain scores from when Ss were paid $1.50 an hour and when they were exposed to one of the three schedules	Between group	

[a] p values are provided when statistical analyses were conducted. They are absent when visual analyses were conducted.

TABLE 3 (continued)

[b] The instructional units took different amounts of time to complete. The CRF per test incentive amount varied depending upon the average time it took to complete an instructional unit. The amount was calculated so that subjects would average $2.00 per hour if they completed the units in the average time. The range of the incentive amounts was not provided. The per test incentive amounts for the Variable Ratio/Variable Amount schedule were also calculated so that subjects would average $2.00 per hour if they completed the units in the average time. The incentive amounts ranged from $0.00 to $12.00 per test. The rate of reinforcement was not specified for the VR/VA schedule.

[c] Each instructional unit took an average of 1/2 hour to complete. If subjects performed at average rates, they would earn $2.00 per hour when they were exposed to each pay condition. The per test incentive amounts for the Variable Ratio 3/Variable Amount (VR3/VA-$3.00) varied, but averaged $3.00. The incentive values ranged from $.50 to $10.00.

[d] The incentives were based on the number of bags of tree seedlings planted. There were approximately 1,000 seedlings per bag. The performance measure was the number of trees planted, not the number of bags planted.

[e] The incentives were based on the number of batches of exam answer cards scored. There were 60 exam cards per batch. The performance measure was the gain scores based on the number of answer cards scored, not the number of batches completed.

posed to the different conditions, and the incentive was provided after the completion of a variable number of units rather than after one unit. For example, in the VR2 and VR4 schedules used by Yukl and Latham, workers were paid $4.00 or $8.00 for planting a bag of tree seedlings and correctly guessing the outcome of one or two coin tosses. In the VR4 schedule used by Latham and Dossett, workers were paid $4.00 for trapping a beaver and correctly guessing the color of one of four marbles drawn from a bag. In addition to comparing the effects of CRF and VR schedules, two of the laboratory studies (Berger et al., 1975; Yukl et al., 1972) compared the effects of two VR2 schedules with different incentive amounts. Both sets of authors compared VR2-25c with VR2-50c schedules. The studies in this series have been reviewed previously, and readers are referred to Dickinson and Poling (1996) or Latham and Huber (1992) for detailed descriptions of them.

In three of the studies (Berger et al., 1975; Pritchard et al., 1980; Pritchard et al., 1976), the variable ratio schedules were programmed and thus the actual rate of reinforcement was the same as was planned. In the remaining five studies, however, the actual rate of reinforcement for the variable ratio schedules was probabilistic and differed from the planned schedules. For example, Yukl et al. (1976) compared the effects of CRF-$2.00, VR2-$4.00, and VR4-$8.00. When working under the VR2-$4.00 and the VR4-$8.00 schedules, tree planters received the incentive for planting a bag of trees and correctly guessing the color of a marble held in the hand of a supervisor once or twice, respectively. The overall rate of reinforcement was substantially higher than intended under both conditions, which also altered the incentive earned per bag of trees planted. The VR2-$4.00 schedule was actually a VR1.47-$2.72 schedule while the VR4-$8.00 was actually a VR1.96-$4.08 schedule. Table 4 displays the actual reinforcement schedules, the average pay earned, and the average performance of participants in each of the eight studies. It should be noted that in two of the studies, the unit of work for which the incentives were provided differed from the performance measure used to analyze the results. Yukl et al. (1976) provided incentives for bags of approximately 1,000 tree seedlings that were planted; however, the performance data were reported in terms of the average number of trees planted per man hour. Similarly, Yukl et al. (1972) provided incentives for batches of 60 answer cards that were scored. The performance measure, however, was the average number of cards scored. It should also be noted that during Yukl et al.'s (1976) study, more than 50 planters participated over the course of the study, which lasted about 14 weeks. However, due to high turnover and absenteeism, only eight

TABLE 4. Actual Schedule, Average Incentive per Work Unit, Average Incentive Earned per Hour, and Average Performance of Participants in Studies of Schedules of Monetary Reinforcement

	Schedule		Average Pay Earned		Average Performance	
Experiment/Experimental Condition	Actual Schedule[a]	Hourly Pay	Incentive per Work Unit	Incentive Pay per Hour or Week[b]	Performance per Hour or Week	Gain per Hour: Hourly to Incentive
Berger et al. (1975)						
$1.60 base pay		$1.60			–	–
$1.60 base pay plus:						
CRF-25c	CRF	$1.60	$0.25	–	–	–
VR2-25c	VR 2	$1.60	$0.25	–	–	–
VR2-50c	VR 2	$1.60	$0.25	–	–	–
Latham & Dossett (1978)						
$5.00 base pay (premeasure)		$5.00			0.44 beavers/hr	
$5.00 base pay plus:						
CRF-$1.00	CRF	$5.00	$1.00	$0.67/hr	0.67 beavers/hr	0.23 beavers
VR4-$4.00	VR 3.57	$5.00	$1.18	$0.68/hr	0.58 beavers/hr	0.14 beavers
Pritchard et al. (1980)[c]						
$2.00 base pay		$2.00			9.70 tests/wk[d]	
CRF/VA	CRF		–	–	17.30 tests/wk[d]	7.60 tests
VR/VA	–		–	–	16.80 tests/wk[d]	7.10 tests
Pritchard et al. (1976)						
$2.00 base pay		$2.00			41.80 tests/wk	
FR3-$3.00	VR 3.00		$0.99	$58.50/wk	59.30 tests/wk	17.50 tests
VR3-$3.00	VR 3.00		$0.98	$58.19/wk	59.20 tests/wk	17.40 tests

VR3/VA-$3.00	VR 3.00		$0.97	$62.81/wk	64.80 tests/wk	23.00 tests
Saari & Latham (1982)						
$7.00 base pay		$7.00			0.52 beavers/hr	
$7.00 base pay plus:						
CRF-$1.00	CRF	$7.00	$1.00	$0.78/hr	0.78 beavers/hr	0.26 beavers
VR4-$4.00	–	$7.00	–	–	1.08 beavers/hr	0.56 beavers
Yukl & Latham (1975)						
$2.00 base pay plus:						
CRF-$2.00	CRF	$2.00	$2.00	$0.22/hr	0.108 bags of trees/hr	33%[e]
VR2-$4.00	VR 1.75	$2.00	$2.28	$0.21/hr	0.093 bags of trees/hr	– 8%[e]
VR4-$8.00	VR 2.94	$2.00	$2.72	$0.28/hr	0.104 bags of trees/hr	18%[e]
Yukl et al. (1976)[f]						
$2.00 base pay		$2.00			117.10 trees/hr	
$2.00 base pay plus:						
CRF-$2.00	CRF	$2.00	$2.00	$0.24/hr	120.50 trees/hr	3.40 trees
$2.00 base pay		$2.00			–	–
$2.00 base pay plus:						
VR2-$4.00	VR 1.47	$2.00	$2.72	–	–	–
$2.00 base pay		$2.00			119.00 trees/hr	

TABLE 4 (continued)

Experiment and Experimental Condition	Schedule: Actual Schedule[a]	Hourly Pay	Average Pay Earned: Incentive per Work Unit	Average Pay Earned: Incentive Pay per Hour or Week[b]	Average Performance: Performance per Hour or Week	Average Performance: Gain per Hour: Hourly to Incentive
$2.00 base pay plus:						
VR4-$8.00	VR 1.96	$2.00	$4.08	$0.47/hr	116.60 trees/hr	–2.40 trees
Yukl et al. (1976), continued						
$2.00 base pay plus:						
CRF-$2.00	CRF	$2.00	$2.00	$0.24/hr	121.80 trees/hr	
VR2-$4.00	VR 1.47	$2.00	$2.72	$0.33/hr	121.90 trees/hr	
$2.00 base pay plus:						
CRF-$2.00	CRF	$2.00	$2.00	$0.23/hr	117.20 trees/hr	
VR4-$8.00	VR 1.96	$2.00	$4.08	$0.46/hr	111.70 trees/hr	
$2.00 base pay plus:						
VR2-$4.00	VR 1.47	$2.00	$2.72	$0.33/hr	121.90 trees/hr	
VR4-$8.00	VR 1.96	$2.00	$4.08	$0.46/hr	111.60 trees/hr	
Yukl et al. (1972)						
$1.50 base pay plus:						
CRF-25c	CRF	$1.50	$0.25	$1.12/hr	269.00 cards/hr	72.00 cards
VR2-25c	VR 2.33	$1.50	$0.11	$0.59/hr	320.00 cards/hr	76.00 cards
VR2-50c	VR 1.96	$1.50	$0.25	$1.51/hr	362.00 cards/hr	112.00 cards

Note. Dashes indicate that the data were not provided in the article.

[a] In Berger et al. (1972), Pritchard et al. (1980), and Pritchard et al. (1976), the variable ratio schedules were programmed and thus the actual schedules were the same as the planned schedules. In the other five studies, however, the variable ratio schedules were probabilistic, and thus the actual schedules differed from the planned schedules.

[b] Pritchard et al. (1976) were the only authors who provided the total amount of pay or incentive pay subjects earned. They did not, however, indicate the number of hours subjects worked, and thus we reported the average earnings per week of subjects as presented by the authors. For the remaining studies, we calculated the average incentive per hour based on the incentive per work unit and the average performance per hour. In Yukl et al. (1976) the incentives were based on bags of approximately 1000 tree seedlings per bag, so the trees/hr were first divided by 1000 and then multiplied by the per bag incentive. In Yukl et al. (1972), the incentives were based on batches of 60 cards, so the cards/hr were first divided by 60 and then multiplied by the per piece incentive.

[c] The instructional units took different amounts of time to complete. The CRF per test incentive amount varied depending upon the average time to complete an instructional unit. The amount was calculated so that subjects would average $2.00 per hour if they completed the units in the average time. The range of the incentive amounts was not provided. The per test incentive amounts for the Variable Ratio/Variable Amount schedule were also calculated so that subjects would average $2.00 per hour if they completed the units in the average time. The incentive amounts ranged from $0.00 to $12.00 per test. The rate of reinforcement was not specified for the VR/VA schedule.

[d] It is not clear whether these are the average number of tests completed daily or weekly.

[e] The percent gain data were calculated on a different subsample than the bags planted per hour and only percentage data were reported.

[f] Due to the high turnover of participants during the study, different subsamples were used to make comparisons between conditions; thus the average performance for each condition varies depending upon the comparison. The data for the relevant comparisons are presented together because those data were the basis for the statistical analyses and also so that readers can more easily react to them.

planters worked during the study's five pay phases. Thus, the researchers made comparisons between the pay conditions using different subsamples of planters who worked the majority of time when two of the pay conditions were in effect. These pairs of comparisons are presented together in the table because the data, as presented in Table 4, formed the basis for the statistical comparisons and conclusions made by the researchers.

In their critical review of these studies, Dickinson and Poling (1996) concluded that the results of these studies were ambiguous. The reviewers summarized the findings as follows:

1. Fixed and variable pay arrangements resulted in higher performances than hourly pay in seven of the eight studies (Berger et al., 1975; Latham & Dossett, 1978; Pritchard et al., 1980; Pritchard et al., 1976; Saari & Latham, 1982; Yukl & Latham, 1975; Yukl et al., 1972), although in Yukl and Latham (1975) performance was lower in one of the three incentive schedules (VR 2);
2. Fixed and variable pay arrangements resulted in comparable performances in three of the four laboratory studies (Berger et al., 1975; Pritchard et al., 1980; Pritchard et al., 1976);
3. VR schedules resulted in higher performances than CRF schedules in one laboratory and one field study (Saari & Latham, 1982; Yukl et al., 1972);
4. CRF schedules resulted in equal or higher performance than VR schedules in three field studies (Latham & Dossett, 1978; Yukl & Latham, 1975; Yukl et al., 1976), although: (a) in Yukl and Latham (1975), CRF performance was higher than VR 2 performance, while in Yukl et al. (1976) CRF performance was equal to VR 2 performance and higher than VR 4 performance; and (b) in Latham and Dossett (1978) inexperienced workers performed better under the CRF schedule while experienced workers performed better under the VR 4 schedule. (Dickinson & Poling, 1996, p. 82)

In this series of studies, incentive pay resulted in higher performance than hourly pay in seven of the eight studies (the exception is Yukl et al., 1976), although in Yukl and Latham (1975) one of the three incentive groups (VR2) performed worse than they did when they were paid hourly. Confounding events could account for these exceptions. In Yukl and Latham's applied study, some of the participants objected to the coin toss used to determine the VR2 schedule because they thought

that it was a form of gambling. Also, in that condition, one of the workers found an error in her tax deductions and, as a result, she and several of her coworkers thought that they were being cheated. By the time this problem was discovered and resolved, the workers had been transferred to a different job task and no further data could be collected. Performance during the VR2 incentive condition could well have been affected by these events. Although performance during the VR4 incentive condition was higher than during the hourly pay condition, performance during this condition may have been suppressed as well. During this condition, the supervisor was a part-time minister who also believed the coin toss was a form of gambling. And, although he recorded the results of the coin toss accurately, he did not give the workers the tokens that were later exchanged for the incentives. The supervisor was eventually replaced, but as the authors stated, "the initial supervisor may have left the crew with a negative impression of the program" (Yukl & Latham, 1975, p. 297). Similarly, in Yukl et al. (1976), when participants were asked about the VR2 and VR4 schedules, they indicated that they did not like the uncertainty of the schedule (e.g., "the odds were too great," "unfair," "too much of a risk") and were disappointed when they did not correctly guess the outcome of the coin tosses (e.g., "it's a let down to lose after you've planted 1,000 trees"). It is less clear why the CRF incentives did not significantly improve performance in comparison to hourly pay; however, performance was higher with the CRF incentives (120.5 trees per hour vs. 117.1 trees per hour), but not statistically so. The implementation problems that occurred in these studies were discussed and analyzed behaviorally by Mawhinney (1975) and Dickinson and Poling (1996) in earlier articles. Readers who would like more detail about them are referred to those articles.

Although incentive pay improved performance in seven of the eight studies when compared to hourly pay, no uniform differences emerged as a function of the ratio schedule of delivery. Even though these studies were not designed to determine whether the amount of the per piece incentive affected performance, or to examine the effectiveness of different percentages of total pay or base pay earned in incentive pay, the data from several of the studies are relevant. Moreover, they support two conclusions made from the results of the studies reviewed in the previous section; namely, that (a) performance does not appear to be functionally related to the amount of the per piece incentive (Dickinson & Gillette, 1993; Frisch & Dickinson, 1990; LaMere et al., 1996; Riedel et al., 1988), and (b) performance can increase appreciably when less than 30% of a person's base pay is earned in incentive pay in comparison to

hourly pay (Frisch & Dickinson, 1990; Riedel et al., 1988). For example, with respect to the former conclusion, Berger et al.'s (1975) subjects performed comparably when incentives were delivered on a VR2 schedule and the per piece incentive was 25c and 50c. In Yukl and Latham (1975) the average number of bags of trees planted was comparable when participants earned a per piece incentive of $2.00 on a CRF schedule and a per piece incentive of $2.72 on a VR2.94 schedule (the planned VR4-$8.00 condition). In that same study, the percentage gain in performance when subjects were paid hourly and when they were paid incentives was statistically significantly higher when participants were exposed to the CRF schedule than to the VR2.94 schedule. Thus, performance increases were greater when the per piece incentive was $2.00 than when it was $2.72. Similar conclusions can be drawn from Yukl et al. (1976) (see Table 4; the comparisons of CRF with VR2, CRF with VR4, and VR2 with VR4) and Yukl et al. (1972) (see Table 4; the comparison between CRF and VR2). With respect to the conclusion that performance can be appreciably affected when the proportion between incentive pay earned and base pay earned is less than .30, incentive pay increased the performance of (a) beaver trappers in Latham and Dossett when the per hour incentive pay to base pay ratios were .13 and .14 (CRF trappers: $0.67 per hour incentive pay/$5.00 base pay; VR4 trappers: $0.68 per hour incentive pay/$5.00 base pay); (b) beaver trappers in Saari and Latham when the ratio was .11 (CRF trappers: $0.78 per hour incentive pay/$7.00 base pay); and (c) tree planters in Yukl and Latham (1975) when the ratios were .11 and .14 (CRF planters: $0.22 per hour incentive pay/$2.00 base pay; VR4 planters: $0.28 per hour incentive pay/$2.00 base pay). Base pay plus incentive pay also increased the performance of the participants in the laboratory studies conducted by Berger et al. (1975) and Yukl et al. (1972); however, Berger et al. (1975) did not provide the information that was necessary to calculate the ratios, and in Yukl et al. (1972), the ratios for the three incentive groups were greater than .30 (the ratios were .75, .39, and 1.01 for the CRF-25c subjects, the VR2-25c subjects, and the VR2-50c subjects, respectively). Results from one study, Yukl et al. (1976), conflict with the results from the aforementioned studies and do not support the position that ratios of incentive pay to base pay of less than .30 affect performance. In that study, tree planters performed comparably when they earned an hourly wage of $2.00 and when they earned 12% and 24% of their hourly pay in incentive pay during the CRF-$2.00 and VR4-$8.00 conditions, respectively (even though Yukl et al. also examined VR2-$4.00 incentive pay, the information needed to calculate the per-

centage of incentive pay was not provided). In light of the results of numerous other studies showing the superiority of incentive pay over hourly pay, the data from Yukl et al. (1976) appear to be an anomaly. The data from the two remaining studies in this thematic line of research are not relevant to assess the effectiveness of low ratios of incentive pay because subjects in the incentive conditions did not receive base pay (Pritchard et al., 1980; Pritchard et al., 1976).

In summary, as pointed out by Dickinson and Poling (1996) in their earlier review, the results of the eight studies that have compared the effects of different schedules of monetary reinforcement are mixed. Results may vary, particularly in applied settings, depending upon the social contingencies and rules related to the administration of the schedules. Nonetheless, in three of the four laboratory studies that were well-controlled and absent the implementation problems that occurred in the field studies, participants performed comparably regardless of the ratio schedule of reinforcement (Berger et al., 1975; Pritchard et al., 1980; Pritchard et al., 1976). In the fourth (Yukl et al., 1972), subjects performed comparably under two of the three schedules. Thus, taking experimental control issues into account, the preponderance of data suggests that different ratio schedules of monetary reinforcement do not affect performance differently, at least for the ratio schedules that were examined in the eight studies. Hantula (2001) arrived at a similar conclusion based on his review of studies that have examined the effects of schedules of reinforcement using monetary and nonmonetary reinforcers, stating, "In general, it may be concluded from these studies that . . . differences in schedule parameters have mixed effects, although the presence or absence of a schedule of contingent reinforcement accounts for the largest effects" (p. 148).

The results of the eight studies, taken together, also provide additional support for the contention that monetary incentives appreciably improve performance in comparison to hourly wages in both laboratory and work settings. They further support earlier conclusions advanced in this manuscript that (a) the amount of the per piece incentive does not appear to be functionally related to performance levels, and (b) percentages of total pay and base pay earned in incentive pay that are less than 30% can appreciably increase performance.

Strengths and Limitations

The above studies differed with respect to the type of setting, task, reinforcement schedule, and experimental design, suggesting generality

of the results. The laboratory simulations conducted by Pritchard and his colleagues (Pritchard et al., 1980; Pritchard et al., 1976) are particularly commendable because of their rigorous experimental methodology, and the field studies (Latham & Dossett, 1978; Saari & Latham, 1982; Yukl & Latham, 1975; Yukl, Latham, & Pursell, 1976), in spite of implementation problems, add considerably to assurances that the results have relevance for actual work settings. The results of Hantula's (2001) more general review of the effects of schedules of reinforcement on organizational performance supports the conclusion that the results of these studies have broad generality. It is also important to note that the four field studies reviewed above are noteworthy because of, not in spite of, implementation problems. That is, they suggest that monetary incentives can appreciably improve performance in complex organizational settings where extraneous factors cannot be completely controlled. Finally, because these studies were conducted in actual work settings, natural competing contingencies existed, yet, performance across the various ratio reinforcement schedules was, in general, similar.

Feedback was not specifically programmed in the eight studies, however, it was readily available due to the nature of the tasks during the hourly pay conditions as well as during the incentive conditions. For example, in the laboratory study conducted by Yukl et al. (1972), subjects coded multiple-choice exam answers onto answer cards. In the hourly pay condition and all incentive conditions, subjects were given a batch of 60 cards to complete and, upon completion, took them to the experimenter who gave them another batch of 60 cards. In the study conducted by Berger et al. (1975), subjects coded responses from a 214-item attitude questionnaire onto a coding sheet. After they completed each questionnaire, they took it to the experimenter who gave them another one to code. In the studies conducted by Pritchard and his colleagues (Pritchard et al., 1980; Pritchard et al., 1976), subjects completed self-instructional units that took about 1/2 hour to complete and then were examined over their understanding. In the field studies, tree planters planted seedlings from a bag that contained approximately 1,000 seedlings (Yukl & Latham, 1975; Yukl et al., 1976) or trapped beavers (Latham & Dossett, 1978; Saari & Latham, 1982). Thus, in each case, while feedback was not explicitly programmed during the hourly or incentive pay conditions, subjects could readily keep track of their own performance. Moreover, additional feedback was available during the incentive conditions due to the receipt of the incentives or a form indicating that the participant had earned the incentive. Nonetheless, because performance feedback was not as explicitly programmed

as it was in the studies that were reviewed previously in this paper, it is less clear whether feedback was as much of a confound. As with other pay arrangements that have been examined, research that specifically manipulates the presence and absence of feedback under various ratio schedules of reinforcement would be beneficial.

While arguable, at this point it appears that further inquiry with respect to schedules of monetary reinforcement would lead to similar data. That is, differences in performance may result from different ratio schedules of reinforcement, but those differences may be highly dependent upon idiosyncratic factors that are present in the setting. Those factors certainly include social contingencies and rule statements regarding the pay contingencies, as evidenced in Yukl and Latham (1975) where participants believed that the coin toss procedure used to determine the VR2 and VR4 schedules was a form of gambling (Dickinson & Poling, 1996; Mawhinney, 1975). As mentioned earlier, this factor may well account for the fact that the VR2-$4.00 monetary incentives did not increase performance in comparison to hourly pay. It may also have suppressed performance during the VR4-$8.00 condition. In contrast, in Latham and Dossett (1978) where the VR4 schedule was determined by guessing the color of a marble, supervisors and workers responded very positively to the schedule when interviewed. For example, one supervisor stated "The guys want to get on the variable schedule–not the continuous schedule. The men are inspired by the variable schedule. They get a real kick out of it" (Latham & Dossett, 1978, p. 58). Similarly, workers stated, "Guys really get psyched out by it [the VR4 schedule], man. Like it. Adds something to it. There is real excitement. The guys who are on the continuous schedule all stand around and cheer for the guys on the variable schedule when they are pulling the marble" (Latham & Dossett, 1978, p. 58). Certainly, differences in the types of social contingencies and rules observed in the two studies (Latham & Dossett, 1978; Yukl & Latham, 1975) could lead to very different performances under the same or similar schedules, a point well-analyzed and argued by Mawhinney in 1975. For a more detailed analysis and treatment of the effects of rules on organizational behavior, readers are referred to Johnson, Mawhinney, and Redmon (2001), Agnew and Redmon (1992), and Malott (1992). The issue regarding the effects of rules and social contingencies aside, the general results of studies that have examined schedules of monetary reinforcement suggest that the contingent ratio relationship between performance and pay is a stronger determinant of performance than are variations in the rate of reinforcement or the amount of the per piece incentive.

The one major criticism of this line of research relates not to methodological concerns, but use of the names of the basic schedules of reinforcement to refer to the schedules of incentive delivery (Dickinson & Poling, 1996). As mentioned in the introduction of this paper, Dickinson and Poling (1996) argued that the schedules of delivery in the aforementioned studies had little in common with the like-named basic schedules of reinforcement examined in operant research laboratories. Hence, they challenged any conclusions of the authors based on that premise. Similarly, Mawhinney (1975) noted that in the studies conducted by Berger et al. (1975) and Yukl et al. (1972), subjects did not receive the money until after the experiments were over, and thus "could not have been conditioned directly by money reinforcements" (p. 707). Rather, the subjects were responding to descriptions of the contingencies. Although the authors of some of these studies (Pritchard et al., 1980; Pritchard et al., 1976; Yukl & Latham, 1975; Yukl et al., 1976) noted the differences between their procedures and the basic schedules of reinforcement, they did not attach import to them. Nonetheless, this controversy notwithstanding, this series of studies has considerable value when reviewed in the present context; that is, in the context of assessing whether different ratio schedules of monetary reinforcement affect performance levels.

LINEAR, ACCELERATING, AND DECELERATING RELATIONSHIPS BETWEEN PERFORMANCE AND THE AMOUNT OF THE PER PIECE INCENTIVE

Rationale and Results

Two experiments examined the relationship between performance and linear, accelerating, or decelerating amounts of per piece incentive pay (Oah & Dickinson, 1992; Smoot & Duncan, 1997). These studies are summarized in Table 5. In linear relationships, the amount of the per piece incentive remains constant regardless of how many pieces the worker produces. In accelerating relationships, the amount of the per piece incentive increases as performance increases; that is, the more parts that are produced, the more each part is worth. Conversely, in decelerating relationships, the amount of the per piece incentive decreases as performance increases. Oah and Dickinson (1992) explained the rationale for the accelerating relationship as follows: " . . . the more a worker produces, the more difficult it is to produce more, and therefore workers

TABLE 5. General Features and Summary of the Results of Studies of Linear, Accelerating, and Decelerating Piece Rate Pay.

Authors	Subjects	Independent Variable: Linear, Accelerating, or Decelerating Piece Rate	Performance Measure	Experimental Design	Summary of the Results[a]
Oah & Dickinson (1992)	College students N = 40	Linear piece rate Accelerating piece rate	Check values entered into the computer	Between group	Performance was comparable when subjects earned linear and accelerating piece rate pay. $p > .05$
Smoot & Duncan[b] (1997)	Experiments 1 & 2 College students E1, N = 25 E2, N = 27	Base pay Linear piece rate Accelerating piece rate Decelerating piece rate	Parts assembled	Within subject/ Multiple baseline for base pay and one incentive system; Between group for the three piece rate pay systems	Performance was higher when subjects were paid incentives than when they received base pay only. Researchers concluded performance was highest when subjects were paid linear piece rate pay than when they were paid accelerating or decelerating piece rate pay, but results are variable.
	Experiments 3 & 4 College students E3, N = 28 E4, N = 20	Base pay Linear piece rate Accelerating piece rate Decelerating piece rate	Parts assembled	Within subject/ Multiple baseline for base pay and one incentive system; Between group for the three piece rate pay systems	Performance was higher when subjects were paid incentives than when they received base pay only. Researchers concluded performance was highest when subjects were paid accelerating piece rate pay than when they were paid linear or decelerating piece rate pay, but results are highly variable.

[a] values are presented when statistical analyses were conducted. They are absent when visual analyses were conducted.

[b] The general features of the four experiments conducted by Smoot and Duncan are the same. The results of Experiments 1 & 2 were similar and thus these two experiments are presented together. Similarly, the results of Experiments 3 & 4 were similar.

should be paid increasingly more per piece as productivity increases" (p. 88). This rationale is not only based on the assumption that higher levels of incentives may result in higher levels of performance but also on the pragmatic concern for maintaining compensation equity among workers based on their performance, a concern raised and discussed by Mawhinney (1984). If workers evaluate compensation systems by judging effort/reward ratios against an equity criterion, then accelerating relationships between pay and performance may well be judged to be fairer (and may well be fairer) than linear relationships (Oah & Dickinson, 1992, based on a personal communication with T. C. Mawhinney, June, 1991). Some organizations adopted accelerating piece rate plans based on the preceding rationale, giving impetus to this research (Abernathy, Dierks, & McNally, 1983; McAdams, 1983). Decelerating relationships were examined to compare their effects with those of linear and accelerating relationships as well as to compare the cost-effectiveness of the differing systems (Smoot & Duncan, 1997).

Basically, studies that compare the effects of linear, accelerating, and decelerating arrangements are examining the effects of reward magnitude on performance. Few studies have investigated the effects of reward magnitude on human performance (Dickinson & Poling, 1996; Oah & Dickinson, 1992). Even fewer have specifically examined the effects of differing amounts of incentive pay (Jenkins et al., 1998). In two rare exceptions, as presented in the previous section of this paper, Berger et al. (1975) and Yukl et al. (1972) compared the effects of two VR2 schedules of reinforcement, one with an incentive payout of $.25 and one with an incentive payout of $.50. In one (Berger et al., 1975), performance was comparable under the two schedules while in the other (Yukl et al., 1972) subjects improved their performance statistically significantly more when the per piece incentive was $.50 than when it was $.25. The conflicting results of these studies notwithstanding, the results of two early studies by Toppen (1965a, 1965b) suggest that a functional relation might exist between the level of pay and performance. Further, although Jenkins et al. (1998) did not explore the effects of incentive size in their statistical meta-analysis of the effects of monetary incentives, they stated "Larger incentives probably influence performance more than do smaller incentives" (p. 784).

Linear and exponential (accelerating) pay systems were compared in a study conducted by Oah and Dickinson (1992). Forty college students were assigned to either a linear or a 1.5 exponentially accelerating piece rate pay condition. Each subject participated in 15 forty-five minute sessions. The task, which was the same one used by Dickinson and

Gillette (1993), was a computerized simulation of a proof operator's job at a bank. Checks of differing cash values were presented on the screen and subjects entered the values of the checks using the computer keyboard. Subjects could "click" on a box labeled "Number" at any time during the session to see the number of checks they had correctly entered. At the end of the session, the computer automatically displayed the total number of checks they had entered correctly. In addition, the experimenter plotted the total number of correctly entered checks on a graph in the presence of the subjects at the end of each session. Subjects exposed to the linear and accelerating piece rate pay systems earned $2.00 in base pay and could earn per piece incentives once they had completed 490 checks. In the linear pay condition, the per piece incentive was $.0004. If subjects completed 590 checks, the estimated average performance for the task, they earned a total of $2.42 per session, $2.00 in base pay and $.42 in incentive pay. If subjects completed 860 checks, the estimated maximum performance, they earned a total of $3.50 per session, $2.00 in base pay and $1.50 in incentive pay. In the 1.5 exponentially increasing accelerating pay condition, the per piece incentive increased as the number of checks completed increased. For example, if subjects completed 510, 610, 710, or 810 checks, they earned an average of $.00008, $.0009, $.002, or $.005 per check, respectively. Subjects who completed the estimated average number of checks (590) earned the same total amount of money as subjects who were exposed to the linear piece rate pay system and completed 590 checks–$2.00 in base pay and $.42 in incentive pay. However, if subjects in the accelerating pay condition completed more than 590 checks, they earned more money than subjects in the linear pay condition for completing the same number of checks. For example, if subjects in the accelerating pay condition completed 735 checks, they earned $1.62 in incentive pay whereas subjects in the linear pay condition who completed 735 checks earned only $.99 in incentive pay. If subjects in the accelerating pay condition completed the maximum of 860 checks, they earned a total of $5.00 a session, $2.00 in base pay and $3.00 in incentive pay. Readers are referred to the original article if they are interested in viewing the entire pay scales for both conditions. Subjects in the accelerating pay condition earned statistically significantly more money than subjects in the linear pay condition, an average of $3.65 versus $2.86 per session. The performance of subjects in the two groups was not, however, statistically significantly different. Subjects in the accelerating piece rate pay group completed an average of 777 checks per

session (SD = 80) and subjects in the linear piece rate pay group completed an average of 736 checks per session (SD = 66).

Smoot and Duncan (1997) compared the effects of base pay, linear piece rate pay, accelerating piece rate pay, and decelerating piece rate pay in a series of four experiments. In each experiment, 25 to 30 college students were randomly assigned to one of six experimental groups. Two of the groups were exposed to base pay and linear piece rate pay, two groups were exposed to base pay and accelerating piece rate pay and two groups were exposed to base pay and decelerating piece rate pay. A multiple-baseline across groups design was used. The task consisted of assembling parts made from pop beads. Sessions were 15 minutes and the number of sessions per phase varied from 6 to 14. At the end of the session, the experimenter recorded the number of correctly assembled parts on a daily performance record in the presence of the subject. These feedback procedures were used in all pay conditions in Experiments 1, 3, and 4. In Experiment 2, an immediate feedback procedure was added during the incentive phase whereby subjects self-recorded each part they made during the session. This self-recording procedure was then withdrawn in the last phase of the study for one of each of the two groups exposed to the linear, accelerating, and decelerating piece rate pay systems. In addition, in Experiments 3 and 4, all groups were exposed to the piece rate pay condition when they worked alone and when they worked with other members of their group.

The amount of pay that could be earned by subjects exposed to the four pay systems (base pay, linear piece rate pay, accelerating piece rate pay, and decelerating piece rate pay) remained constant across the four experiments, with the exception that in the first experiment, the base pay was $2.00 per session while in the remaining three experiments, the base pay was $1.50 per session (Smoot & Duncan, 1997). During all four pay conditions (base pay, linear piece rate pay, accelerating piece rate pay, and decelerating piece rate pay), subjects had to complete a minimum of 10 parts or they would not receive any pay. In each of the three piece rate pay conditions, subjects earned $2.00 if they completed 20 parts per session. In the linear piece rate pay conditions subjects received $.10 per part regardless of how many parts they assembled. In contrast, during the accelerating and decelerating piece rate pay conditions, the amount of the per piece incentive varied depending upon how many parts subjects completed, increasing exponentially in the accelerating piece rate pay conditions and decreasing exponentially in the decelerating piece rate pay conditions. For example, during the accelerating piece rate pay condition, if subjects completed 10, 20, or 30 parts, they

received $.055, $.10, or $.123 per part, respectively, and thus their total pay equaled $.55, $2.00 or $3.69, respectively. During the decelerating piece rate pay condition, if subjects completed 10, 20, or 30 parts, they received $.143, $.10, or $.079 per part, respectively and their total pay equaled $1.43, $2.00, or $2.36, respectively. Readers are referred to the original article if they are interested in viewing the entire pay scales for the three piece rate pay conditions. Although the researchers did not report the average pay earned by subjects when they were exposed to the four pay conditions (base pay, and linear, accelerating and decelerating, piece rate pay), the authors of the current paper calculated the amounts by multiplying the average performance of the subjects during the various conditions by the appropriate amount of pay indicated in the pay scales that Smoot and Duncan (1997) provided in the article. Table 6 displays the average amount of pay subjects in each group earned per session for the pay systems to which they were exposed. As indicated earlier, in Experiment 2, participants self-recorded the number of parts they assembled during the piece rate pay condition. This self-recording procedure was withdrawn for one of each of the two groups exposed to the linear, accelerating, or decelerating piece rate pay during the final phase of the experiment. This self-recording procedure was not used during the base pay condition and decreased the amount of time available to assemble parts. Because the self-recording procedure may have suppressed responding, the amount of money earned in the piece rate pay conditions with self-recording is reported separately in Table 6, in parentheses. In addition, in Experiments 3 and 4, the money subjects in each group earned when they were working alone and when they were working with others was averaged together. Table 7 displays the performance data for the six groups in each experiment. Included in the table are: (a) the average number of parts assembled by subjects in each group during the base pay condition and the piece rate pay system to which they were exposed; (b) the average change in the number of parts assembled during the base pay condition and the piece rate pay condition; and (c) the average percentage change in the number of parts assembled during the base pay condition and the piece rate pay condition. Similar to Table 6, for Experiment 2, the data for the piece rate pay conditions with self-recording are presented in parentheses and for Experiments 3 and 4, the data for the piece rate conditions when subjects worked alone and with others were averaged.

With only one exception (Experiment 1, Decelerating Pay Group 6), piece rate pay plus feedback resulted in higher levels of performance than base pay plus feedback, regardless of whether the piece rate pay

TABLE 6. Average Amount of Money Earned per Session by Groups Exposed to Base Pay and Linear, Accelerating, or Decelerating Piece Rate Pay in Smoot and Duncan (1997)

		Pay System Condition		
Experiment/ Piece Rate Pay Group	Base Pay	Linear Piece Rate	Accelerating Piece Rate	Decelerating Piece Rate
Experiment 1				
Linear, G1	$2.00	$2.41		
Linear G2	$2.00	$3.03		
Accelerating, G3	$2.00		$3.18	
Accelerating, G4	$2.00		$2.75	
Decelerating, G5	$2.00			$2.24
Decelerating, G6	$2.00			$1.86
Experiment 2[a]				
Linear, G1	$1.50	$2.95 ($2.63)		
Linear G2	$1.50	($1.93)		
Accelerating, G3	$1.50		$3.60 ($3.14)	
Accelerating, G4	$1.50		($3.16)	
Decelerating, G5	$1.50			$2.03 ($2.00)
Decelerating, G6	$1.50			$2.14
Experiment 3[b]				
Linear, G1	$1.50	$2.58		
Linear G2	$1.50	$2.54		
Accelerating, G3	$1.50		$3.79	
Accelerating, G4	$1.50		$3.77	
Decelerating, G5	$1.50			$2.25
Decelerating, G6	$1.50			$2.33
Experiment 4[b]				
Linear, G1	$1.50	$2.17		
Linear G2	$1.50	$3.32		
Accelerating, G3	$1.50		$4.13	
Accelerating, G4	$1.50		$3.18	

TABLE 6 (continued)

Experiment/ Piece Rate Pay Group	Base Pay	Pay System Condition: Linear Piece Rate	Pay System Condition: Accelerating Piece Rate	Pay System Condition: Decelerating Piece Rate
Decelerating, G5	$1.50			$2.05
Decelerating, G6	$1.50			$2.33

[a] In Experiment 2, Groups 1, 3, and 5 were exposed to piece rate pay with self recording and without self-recording. Groups 2, 4, and 6 were exposed only to piece rate pay with self-recording. Because the self-recording procedure decreased the time available to assemble parts and may have suppressed performance, data during piece rate piece with self-recording conditions are presented in parentheses.
[b] In Experiments 3 and 4, all groups were exposed to the piece rate pay condition when they were working alone and when they were working with other participants. The data from the two piece rate pay conditions were averaged together.

was linear, accelerating, or decelerating. Results, however, were mixed with respect to performance under the linear piece rate pay, accelerating piece rate pay, and decelerating piece rate pay systems. Based on the average percentage change in performance from base pay to piece rate pay, Smoot and Duncan (1997) concluded that the linear piece rate pay system was more effective in two experiments (Experiments 1 and 2) while the accelerating piece rate pay system was more effective in the other two (Experiments 3 and 4). Although arguable, Smoot and Duncan also concluded that linear and accelerating piece rate pay increased performance more than decelerating piece rate pay. In addition, in general, the decelerating pay system resulted in the lowest cost per part (the average amount paid to participants divided by the mean number of parts produced).

The results of these two studies appear inconsistent. Smoot and Duncan (1997) concluded that the three incentive arrangements resulted in different levels of performance while Oah and Dickinson (1992) concluded that linear and accelerating pay arrangements resulted in comparable levels. Adding to the inconsistency is the fact that in Smoot and Duncan (1997) linear piece rate pay resulted in the highest levels of performance in two experiments while accelerating piece rate pay was more effective in the other two. The results are, thus, inconsistent across studies as well as within the Smoot and Duncan study. Given the results, conclusions about the relative effectiveness of the three incentive pay arrangements based on these two studies are premature.

TABLE 7. Average Number of Parts Assembled by Groups Exposed to Base Pay and Linear, Accelerating, or Decelerating Piece Rate Pay in Smoot and Duncan (1997)

	Pay System				Change from Base Pay to Piece Rate Pay	
Experiment/ Piece Rate Pay Group	Base Pay	Linear Piece Rate	Accelerating Piece Rate	Decelerating Piece Rate	Absolute Change Base Pay to Piece Rate	Percent Change Base Pay to Piece Rate
Experiment 1						
Linear, G1	21.1	24.1			+ 3.0	+ 14.2
Linear G2	20.3	30.3			+ 7.0	+ 49.3
Accelerating, G3	21.8		27.3		+ 5.5	+ 29.2
Accelerating, G4	21.0		24.4		+ 3.4	+ 16.2
Decelerating, G5	22.1			26.3	+ 4.2	+ 19.0
Decelerating, G6	17.8			17.0	– 0.8	– 4.5
Experiment 2[a]						
Linear, G1	22.3	29.5 (26.3)			+ 7.2 (+ 4.0)	+ 32.3 (+ 17.9)
Linear, G2	13.8	(19.3)			(+ 5.5)	(+ 39.9)
Accelerating, G3	25.0		29.5 (27.1)		+ 4.5 (+ 2.1)	+ 18.0 (+ 8.4)
Accelerating, G4	22.6		(27.2)		(+ 4.6)	(+ 20.4)
Decelerating, G5	14.8			20.7 (20.0)	+ 5.9 (+ 5.2)	+ 40.0 (+ 35.1)
Decelerating, G6	20.2			(23.6)	(+3.4)	(+ 16.8)
Experiment 3[b]						
Linear, G1	21.6	25.8			+ 4.2	+ 19.4

Linear, G2	21.3	25.4			+ 4.1	+ 19.2
Accelerating, G3	22.1		30.5		+ 8.4	+ 38.0
Accelerating, G4	21.8		30.4		+ 8.6	+ 39.4
Decelerating, G5	18.7			26.6	+ 7.9	+ 42.2
Decelerating, G6	24.1			29.0	+ 4.9	+ 20.3
Experiment 4[b]						
Linear, G1	17.3	21.7			+ 4.4	+ 25.4
Linear, G2	27.9	33.2			+ 5.3	+ 19.0
Accelerating, G3	22.4		32.2		+ 9.8	+ 43.8
Accelerating, G4	20.1		27.3		+ 7.2	+ 35.8
Decelerating, G5	14.6			21.3	+ 6.7	+ 45.9
Decelerating, G6	24.6			29.1	+ 4.5	+ 18.3

[a] In Experiment 2, Groups 1, 3, and 5 were exposed to piece rate pay with self recording and without self-recording. Groups 2, 4, and 6 were exposed only to piece rate pay with self-recording. Because the self-recording procedure decreased the time available to assemble parts and may have suppressed performance, data during piece rate piece with self-recording conditions are presented in parentheses.

[b] In Experiments 3 and 4, all groups were exposed to the piece rate pay condition when they were working alone and when they were working with other participants. The data from the two piece rate pay conditions were averaged together.

Strengths and Limitations

Both of the preceding studies contribute to the literature in that they are the only studies that have experimentally compared linear, accelerating, and decelerating piece rate pay. However, in both studies, sessions were short (15 minutes in Duncan & Smoot, 1997, and 45 minutes in Oah & Dickinson, 1992) and alternative tasks were not available, although Oah and Dickinson's subjects were able to take work breaks whenever they wanted. The lack of strongly competitive alternative tasks, a problem discussed previously, may have influenced the results.

Moreover, the results of Smoot and Duncan (1997) must be interpreted cautiously. Only one group in the four experiments (Group 6, Experiment 1) was exposed to two of the incentive pay arrangements in addition to base pay. Rather, groups were exposed to base pay and then to one of the three types of incentive pay arrangements (linear, accelerating, or decelerating piece rate pay). Conclusions about the relative effectiveness of the three incentive pay arrangements were not drawn from within subject comparisons but from across group comparisons. No doubt due to the small number of subjects per group, these comparisons were made without standard statistical analyses. The average number of parts assembled per session was highly variable during the base pay condition, ranging from an average of about 14 to 25 across groups, indicating that individual variability was high. In addition, both the absolute number of parts assembled and the percentage change in the number of parts assembled from base pay to incentive pay varied widely for groups that were exposed to the same piece rate pay system. For example, average increases in the number of parts assembled from base pay to linear piece rate pay ranged from about 4 to 7 parts, representing average percentage increases of 14% to 49%. Average increases in performance from base pay to accelerating piece rate pay ranged from about 3 to 10 parts, representing average percentage increases of 16% to 44%. Similarly, average changes in performance from base pay to decelerating piece rate pay ranged from about −1 to +8 parts, representing average percentage changes of −4.5% to +46%. Finally, none of the piece rate pay systems uniformly resulted in better performance than the other two. Based on the preceding data, it is not clear that differences between the various piece rate pay conditions would have emerged if individual variability had been taken into account and statistically controlled. In Oah and Dickinson (1992) subjects exposed to the accelerating piece rate pay scale did perform better on the average than subjects exposed to

linear piece rate pay scale, however, the mean performance difference was not statistically significant due to individual variability.

In addition to this potential interpretation problem, Smoot and Duncan (1997) discussed several problems that interfered with planned experimental procedures, such as (a) small numbers of subjects in some of the groups due to subjects who withdrew from the study, (b) short experimental phases, (c) forced abandonment of staggered interventions due to time constraints and (d) violation of research protocol by research assistants who socialized with subjects and provided comparative feedback to subjects about the performance of other groups of subjects. While these problems may not be fatal, they need to be taken into account when considering the results.

It should also be mentioned that both studies suffered from other typical limitations of laboratory studies that may restrict generality to actual work settings. One of these has been mentioned previously in relation to other laboratory studies: the amount of pay used in laboratory studies is often considerably less than "real world wages." Both studies examined only one accelerating or decelerating pay arrangement and the differences in the amount earned under the various arrangements may not have been sufficient to result in performance differences. For example, Oah and Dickinson (1992) compared a linear pay scale with a 1.5 exponential accelerating pay scale. The difference between the linear and 1.5 exponential scale may not have been sufficient to generate different levels of performance.

In Oah and Dickinson (1992) as in the four experiments conducted by Smoot and Duncan (1997), feedback was a component of the incentive pay systems. In all of these experiments, subjects received feedback on their performance immediately after the session was over. Thus, as with the studies that examined the percentage of total pay and base pay earned in incentive pay, feedback may have influenced the results. Smoot and Duncan (1997) manipulated the presence and absence of immediate, self-recorded performance feedback in one of their four experiments (Experiment 2). In that experiment, all participants were first exposed to a baseline condition with base pay. Following baseline, two groups were exposed to linear pay with self-recorded feedback, two groups were exposed to accelerating pay with self-recorded feedback, and two groups were exposed to decelerating pay with self-recorded feedback. As the final phase for one group under each incentive system (i.e., three of the six groups), the self-recorded feedback was removed from the incentive system to examine whether it supplemented the effects of the incentives. Performance improved when the self-recorded

feedback was removed, suggesting that the feedback had a negative effect on productivity. The feedback procedure, however, required participants to physically check off the number of parts produced. When this feedback activity was removed, more time was available for participants to perform the task. As noted by Smoot and Duncan (1997), the additional work time probably accounted for the fact that performance was higher in the absence of feedback.

In summary, the results of the two studies that examined linear, accelerating, and decelerating piece rate pay are inconclusive. While these studies are worthy initial investigations, additional studies are needed to determine whether these pay arrangements affect performance differently. Smoot and Duncan (1997, p. 66) originally concluded that the "three incentive systems differentially affected performance levels," however, in a more recent review of these studies, they stated that "it appears that the slope of the payoff curve does not have a differential effect on productivity" (Duncan & Smoot, 2001, pp. 263, 267). Certainly, at the current time, there are no compelling data indicating that linear, accelerating, and decelerating piece rate pay generate different levels of performance.

WORKER SATISFACTION AND PREFERENCE

Satisfaction or preference measures were collected in (a) two of the five studies that examined the effects of the percentage of total pay or base pay earned in incentive pay, (b) five of the eight studies that compared the effects of different ratio schedules of monetary reinforcement, and (c) neither of the studies that examined linear, accelerating, and decelerating piece rate pay. In their field experiment, LaMere et al. (1996) administered a structured job satisfaction questionnaire, the Job Description Index (Smith, Kendall, & Hulin, 1969), during baseline (hourly pay) and the first incentive condition where drivers earned 3% of their total pay in incentive pay. Satisfaction with pay and work were comparable for the two pay systems. The mean scores for satisfaction with work were 26.10 (SD = 9.94) and 24.21 (SD = 13.45) for baseline and the 3% incentive condition, respectively, and for satisfaction with work, 32.47 (SD = 6.06) and 30.37 (SD = 9.09), respectively. The differences between the mean scores were not statistically significant for either satisfaction measure. The authors did not compare satisfaction with the various incentive percentages (when workers earned 3%, 6%, or 9% of their total wages in incentive pay), although at the end of the study drivers

were asked whether they would like to have the percentage of incentives increased or decreased (A. M. Dickinson, personal communication, September, 2000). The drivers elected to keep their incentive earnings at 9% of their total wages, implying a preference for that percentage. Dickinson and Gillette (1993) administered a post-experimental questionnaire in their second experiment and found that four of six subjects preferred the pay system during which they earned 30% of their total pay in incentive pay to the piece rate pay system. As noted by the authors, however, this preference must be interpreted cautiously because all four subjects earned more money when they received 30% of their total pay in incentive pay. Not surprisingly, higher pay has been found to correlate with higher levels of satisfaction (e.g., Lawler & Porter, 1963; Miceli, Jung, Near, & Greenberger, 1991; Orphen & Bonnici, 1990).

In their laboratory simulation studies, Pritchard and his colleagues (Pritchard et al., 1980; Pritchard et al., 1976) assessed participant satisfaction with hourly pay, fixed ratio incentive pay, and variable ratio incentive pay. When subjects were exposed to all of the pay systems, overall ratings of satisfaction were comparable for the all of the pay systems (hourly pay, FR3-$3.00, VR3-$3.00, and VR3/VA-$3.00), however, satisfaction with pay was statistically significantly higher for the three incentive pay conditions than it was for the hourly pay condition (Pritchard et al., 1976). Satisfaction with pay was comparable for the three incentive pay systems. On a 5-point scale, with 5 as the most favorable rating, the average ratings were 3.6, 4.4, 4.0, and 3.9 for hourly pay, the FR3-$3.00 incentive pay, the VR3-$3.00 incentive pay and the VR3/VA-$3.00 incentive pay, respectively. Subjects also rank ordered the pay systems in terms of preference, with 1 indicating their most preferred pay system and 4 their least preferred. The fixed ratio pay schedule was ranked first with an average ranking of 1.4 and hourly pay was ranked last with an average ranking of 3.9. The VR3-$3.00 schedule and the VR3/VA-$3.00 each had an average ranking of 2.3. In their follow-up study (Pritchard et al., 1980) when subjects were exposed to only one pay system in a between group design, ratings were equivalent for hourly pay, fixed ratio pay (CRF/VA) and variable ratio pay (VR/VA). However, hourly pay was generally rated as more satisfying than the two incentive pay systems. Satisfaction was assessed using a modified version (16 items) of the Minnesota Satisfaction Questionnaire (Weiss, Dawis, England, & Lofquist, 1967). Each item was rated on a 5-point Likert scale and the maximum satisfaction rating was 80. Overall ratings averaged 66.6, 64.3, and 62.3 for the hourly pay, the CRF/VA incentive pay and the VR/VA incentive pay, respectively.

Subscale ratings of satisfaction with pay, equity, control, interestingness, and valence of pay generally favored the hourly pay, although the differences did not reach statistical significance. When addressing the fact that subjects in the first study preferred the incentive pay but subjects in the second study preferred the hourly pay, Pritchard et al. (1980) stated:

> The most obvious explanation for the differences in the findings is related to the repeated measures nature of the previous study. In the earlier study, for example, it was obvious to the subjects that they made less money in the hourly condition than under the other schedules. The subjects in the hourly condition in the present study had no such comparison object. (p. 351)

As in Dickinson and Gillette (1993), differences in satisfaction with the pay systems might well have been due to differences in the amount of money earned.

Preference data were reported in three of the four field studies that examined ratio schedules of monetary reinforcement. Yukl et al. (1976) assessed preference for hourly pay, CRF-$2.00 pay, VR2-$4.00 pay, and VR4-$8.00 pay. In this study, tree planters preferred hourly pay over incentive pay. Eighteen of the 22 workers expressed a preference for hourly pay in comparison to incentive pay. A binomial statistical analysis indicated that this proportion was significantly higher than that which would be expected by chance. When asked to choose between the three types of incentive pay systems, 17 of 22 planters preferred the CRF pay, citing its predictability in comparison to the VR2 and VR4 pay systems. Once again, this proportion was statistically significant. Interestingly, even though the workers earned more money per hour and more money per bag of trees planted during the VR4-$8.00 incentive pay condition than during the other three pay conditions (hourly pay, CRF-$2.00, and VR2-$4.00), 17 of 22 workers indicated that they least preferred the VR4 pay system. The workers earned $2.00 per hour during the base pay only condition and $2.00 plus incentives during the three incentive pay conditions. The per bag incentive amounts for the CRF-$2.00, VR2-$4.00, and VR4-$8.00 pay conditions were $2.00, $2.72, and $4.08 respectively. The per hour incentive pay for the CRF-$2.00 and VR4-$8.00 pay conditions was $0.24 and $0.47, respectively (it was not possible to calculate the per hour incentive for the VR2-$4.00 condition from the data provided in the study). Thus, for these workers, the predictability of pay appeared to be more important

than the additional incentive pay they earned. It should be noted that due to the length of the study and high turnover, only eight of the 22 participants who completed the questionnaire at the end of the study were exposed to all four pay systems. Most of the preference data are from individuals who entered the study after the hourly pay condition and who were exposed only to one or two of the incentive pay conditions. Preference data may have differed if respondents had been exposed to all pay systems as they were in Pritchard et al. (1976) and Pritchard et al. (1980).

Latham and Dossett (1978) examined preference for CRF-$1.00 pay and VR4-$4.00 pay. They did not include an assessment of hourly pay. In contrast to the preceding study, Latham and Dossett's beaver trappers preferred the VR4 pay over CRF pay, even though they earned approximately the same amount of money during both conditions (see Table 4). As discussed earlier, during structured interviews, these workers responded very positively to the VR4 schedule, saying things such as "We enjoy it. We'd hate to see it quit . . . Everybody is turned on by this program"; "It builds our interest over and beyond the regular day-to-day type thing"; "The variable is great. A lot of excitement. The one dollar continuous is just the same old thing. You need excitement out here . . . It is fun, really fun" (Latham & Dossett, 1978, pp. 58-59). These preferences were confirmed in a follow-up study conducted four years later in the same organization (Saari & Latham, 1982). In that study, responses to a structured questionnaire were examined, and the mean rating for the VR4-$400 pay (567, SD = 175) was significantly higher than the mean rating for the CRF-$1.00 pay (475, SD = 198) ($p < .04$).

The satisfaction and preference data are ambiguous. Ratings appear to be affected by (a) whether or not workers are exposed to all of the pay systems and (b) the amount of pay earned. Participants can only make meaningful comparisons among different pay systems after exposure (Pritchard et al., 1976; Sundby, Dickinson, & Michael, 1996), yet such exposure often leads to differences in earnings. Thus, it is difficult to obtain valid comparisons of satisfaction and preference for different types of pay systems. Regardless, the ambiguity of worker satisfaction and preference data in the current studies corresponds to the ambiguity that has been historically reported in the literature. Dickinson and Gillette (1993) reviewed studies that examined employee satisfaction and preference for different types of pay systems and concluded that "although this research has spanned five decades, no general conclusions about employee preference have emerged" (p. 58). In an earlier review that examined satisfaction with fixed and variable pay, Thierry (1984) stated, "Turning our attention now to the issue of fixed or variable payment, we

must conclude yet again that little can be said with any certainty about the opinions and experience of employees on the grounds of the empirical research carried out to date. People often express a preference for a system they do not have . . . " (p. 1000). Readers interested in reviews of studies of worker satisfaction and preference for different types of pay systems are referred to Ayllon and Kolko (1982), Dickinson and Gillette (1993), Heneman and Schwab (1979), Latham and Huber (1992), Opsahl and Dunnette (1966), and Thierry (1984, 1987).

In work settings, satisfaction with different types of pay systems may be affected by so many organizational and task specific variables that general conclusions regarding employee preferences may be difficult, if not impossible, to obtain. However, this does not negate the importance of assessing employee satisfaction with particular pay systems within individual organizations (Dickinson & Gillette, 1993; Heneman & Schwab, 1979; Mawhinney, 1984, 1989), something behavioral psychologists have rarely done (Mawhinney, 1984, 1989). Within the laboratory, investigators should not abandon attempts to assess satisfaction with various types of pay systems, but such assessments should be conducted when (a) participants have been exposed to all pay systems and (b) have earned the same amount of money under the pay systems. As indicated earlier, however, this latter condition is indeed difficult to achieve in studies of monetary incentives. Moreover, because verbal reports are often controlled by variables that differ from those that control actual behavioral choice (Cole & Hopkins, 1995; Hickson, 1963; Lockhart, 1979), participants should be asked to choose the pay system they prefer with the knowledge that they will subsequently work under the selected pay system for a period of time. For a model of such a behavioral choice procedure in an actual work setting, readers are referred to Allison et al. (1992).

DISCUSSION AND CONCLUSIONS

Similar to the results of previous studies, in the studies reviewed in this paper, monetary incentives with feedback increased performance appreciably in comparison to hourly wages with feedback. Perhaps one of the most interesting findings to emerge is that performance improved appreciably when individuals earned only small percentages of their total or base pay in incentive pay; percentages as low as 3% of total pay affected performance. Moreover, in one field study, LaMere et al. (1996), high levels of performance were maintained over three years

when workers earned only 3%-9% of their total pay in incentive pay. While these findings may not be surprising if one considers the fact that small monetary and nonmonetary rewards have had an appreciable impact on employee performance in many applied behavior analytic studies (for reviews, see Frederiksen & Johnson, 1981; Hopkins & Sears, 1982; Komaki et al., 2000; O'Hara et al., 1985; Stajkovic & Luthans, 1997), they are noteworthy within the context of the literature on financial incentives and compensation.

In the studies reviewed, performance levels have not been a function of: (a) the percentage of total pay or base pay earned in incentive pay for percentages that have ranged from 3% to 100% of a person's total pay and, similarly, from 3% to 100% of a person's base pay; (b) the per piece incentive amount; (c) the amount earned in total pay or total incentive pay; (d) the ratio schedule of delivery for CRF, FR3, VR2, VR3, and VR4 schedules; or (e) linear, accelerating, and decelerating piece rate pay. Taken together, these data imply that, within the parameters investigated in these studies, the most critical determinant of performance is the ratio contingency between performance and pay; that is, a relationship in which individuals earn a specified amount of money for the number of work units they complete. Furthermore, variations in the performance-pay ratio contingency with respect to the percentage of total or base pay earned in incentive pay, the amount of the per work unit incentive pay or the ratio schedule may not greatly affect performance. It should certainly be noted, however, that relatively few studies have systematically examined variations in the ratio contingency between performance and pay, and that factors that have yet to be experimentally examined, such as the complexity of the performance measure (Abernathy, 2001), may well influence the effectiveness of variations in the performance-pay ratio relationship. Moreover, as discussed previously, there are limitations to the studies that have been reviewed in this paper. The main limitations are summarized below.

First, the amount of hourly pay earned by individuals may affect the extent to which the amount of the incentive pay and the percentage of total pay and base pay earned in incentive pay influence performance. Several studies in this review provided data relevant to these issues (Berger et al., 1975; Dickinson & Gillette, 1993; Frisch & Dickinson, 1990; LaMere et al., 1996; Latham & Dossett, 1978; Oah & Dickinson, 1992; Riedel et al., 1988; Saari & Latham, 1982; Yukl & Latham, 1975; Yukl et al., 1976; Yukl et al., 1972). Six of the eleven relevant studies were conducted in the laboratory where wages were low in comparison to actual work settings. In four of the five field studies (Latham &

Dossett, 1978; Saari & Latham, 1982; Yukl & Latham, 1975; Yukl et al., 1976), base wages were relatively low, $2.00, $5.00, or $7.00 per hour. In LaMere et al.'s (1996) study, truck drivers received $10.00 in base wages, however, only a small range of incentive percentages were examined (3%, 6%, and 9% of total wages earned in incentive pay). On the other hand, the relatively low base wages may not affect the generality of the results. For example, the difference between the wages offered in the laboratory studies and in work settings where base wages are considerably higher may not be a problem because (a) the tasks used in the laboratory studies were not as effortful as tasks performed by actual employees and (b) the work periods were not as lengthy. In 1986, Locke edited a text in which the authors empirically examined the extent to which results from the laboratory generalized to the work site. In a review of these articles, he stated:

> The evidence indicates that a detailed, point-by-point similarity with respect to subjects, tasks, settings, and so forth is not necessarily required in order to achieve generalizability. Both college students and employees appear to respond similarly to goals, feedback, incentives, participation, and so forth, perhaps because the similarities among these subjects (such as in values) are more crucial than their differences. Task differences do not seem overwhelmingly important. Perhaps all that is needed is that the participants in either setting become involved in what they are doing. The demand characteristics of laboratory settings may not bias the results because equivalent demand characteristics may be present on the job. Employees often try to do what the boss asks because he is the boss. Time span may only be crucial if the phenomenon in question is time dependent (for example, long term learning effects). (Locke, 1986, p. 6)

Hantula (2001) arrived at the same conclusion based on his review of studies of the effects of schedules of reinforcement on organizational performance: " . . . reinforcement schedule effects on work performance in the field are generally similar to those found in organizational laboratory simulation research" (p. 148). In their review of financial incentives, Jenkins et al. (1998) found that monetary incentives increased performance quantity in laboratory, simulation, and field studies. Similar to the data presented by Locke (1986) and Hantula (2001), their data suggest that the effects of financial incentives in laboratory and field settings are indeed similar. Thus, differences between the laboratory

simulations and the actual work place might not be as critical as some individuals may believe. In fact, based on the results of their review, Jenkins et al. argued in favor of laboratory simulations, stating that, "Experimental simulations combine the realism of field settings with the controls of laboratory settings, arguably offering the ideal arena to investigate financial incentives dynamics" (p. 783).

The data regarding the relative equivalence of the effects of various ratio schedules of monetary reinforcement appear to be definitive because of the mix of laboratory and field studies; that is, variations in the rate of reinforcement in ratio schedules does not appear to affect the level of performance. On the other hand, the satisfaction and preference data were inconclusive and confounded by the amount of money earned. Satisfaction and preference data also appear to be influenced by whether or not participants are exposed to the various pay systems being compared. Nonetheless, results of previous studies that have examined satisfaction and preference for different types of pay systems are as ambiguous as those in the studies reviewed in this manuscript.

Two key methodological issues emerged from this review: the absence of competing activities in laboratory studies and the presence of feedback as a component of the incentive system. Because the results of the field studies have, in general, been consistent with those from the laboratory, it is not clear whether potentially weak alternative sources of reinforcement (i.e., alternative tasks) have biased the results of the laboratory studies. Nonetheless, laboratory simulations should incorporate, to the extent possible, critical variables that are found in realistic settings. Strong sources of reinforcement are present in work settings and may well affect the way employees allocate their time and effort when offered incentives. Therefore, given the possible influence on performance, researchers should make every effort to model such attractive alternatives in the laboratory.

Feedback may well have sustained performance under the varying arrangements of pay in each of the three lines of research. Thus, any conclusions drawn from these studies should be restricted to situations in which monetary incentives are combined with frequent performance feedback. This fact does not, however, detract from the value of these studies. Performance feedback is often provided along with monetary incentives in actual work settings. Performance measures are readily available once an incentive program has been developed, and given the potentially enhancing effect of feedback, there seems little reason not to provide feedback. On the other hand, Buyinski (1995) maintained that performance feedback measures are the exception, rather than rule, for

incentive systems in most organizations. Thus, it is important to isolate the effects of monetary incentives from those of feedback. If feedback is found to be an important variable, then researchers should pursue the structural characteristics that are associated with its enhancing effects (e.g., frequency of delivery, source of feedback, content, mechanism of delivery–graphic, written, oral, etc.). Readers are referred to Balcazar, Hopkins and Suarez (1985/86) and Alvero et al. (2001) for detailed categorizations of feedback characteristics and analyses of how the various characteristics may influence feedback effectiveness.

In their statistical meta-analysis study of the effects of individual incentives, Jenkins et al. (1998) concluded:

> Overall, this study underscores the generalizable positive relationship between financial incentives and performance. It emphasizes the wisdom of designing incentive systems carefully; it also highlights the utility of including financial incentives as integral components in theoretical frameworks of organizational behavior and the management of human resources. (p. 784)

Financial incentives affect performance. Now, it is important to refine incentive technology by investigating specific parameters of incentive systems that may make them more or less effective and appealing. The studies reviewed here are an excellent beginning, but only a beginning.

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