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Extrinsic Rewards and Intrinsic Motivation in Education: Reconsidered Once Again

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The finding that extrinsic rewards can undermine intrinsic motivation has been highly controversial since it first appeared (Deci, 1971). A meta-analysis published in this journal (Cameron & Pierce, 1994) concluded that the undermining effect was minimal and largely inconsequential for educational policy. However, a more recent meta-analysis (Deci, Koestner, & Ryan, 1999) showed that the Cameron and Pierce meta-analysis was seriously flawed and that its conclusions were incorrect. This article briefly reviews the results of the more recent meta-analysis, which showed that tangible rewards do indeed have a substantial undermining effect. The meta-analysis provided strong support for cognitive evaluation theory (Deci & Ryan, 1980), which Cameron and Pierce had advocated abandoning. The results are briefly discussed in terms of their relevance for educational practice.

Gold stars, best-student awards, honor roles, pizzas for reading, and other reward-focused incentive systems have long been part of the currency of schools. Typically intended to motivate or reinforce student learning, such techniques have been widely advocated by some educators, although, in recent years, a few commentators have questioned their widespread use. The controversy has been prompted in part by psychological research that has demonstrated negative effects of extrinsic rewards on students' intrinsic motivation to learn. Some studies have suggested that, rather than always being positive motivators, rewards can at times undermine rather than enhance self-motivation, curiosity, interest, and persistence at learning tasks. Because of the widespread use of rewards in schools, a careful summary of reward effects on intrinsic motivation would seem to be of considerable importance for educators.

Accordingly, in the Fall 1994 issue of *Review of Educational Research*, Cameron and Pierce (1994) presented a meta-analysis of extrinsic reward effects on intrinsic motivation, concluding that, overall, rewards do not decrease intrinsic motivation. Implicitly acknowledging that intrinsic motivation is important for learning and adjustment in educational settings (see, e.g., Ryan & La Guardia, 1999), Cameron and Pierce nonetheless stated that "teachers have no reason to

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resist implementing incentive systems in the classroom" (p. 397). They also advocated abandoning Deci and Ryan's (1980) cognitive evaluation theory (CET), which had initially been formulated to explain both positive and negative reward effects on intrinsic motivation.

In the Spring 1996 issue of *RER*, three commentaries were published (Kohn, 1996; Lepper, Keavney, & Drake, 1996; Ryan & Deci, 1996) arguing that Cameron and Pierce's meta-analysis was flawed and that its conclusions were unwarranted. In that same issue, Cameron and Pierce (1996) responded to the commentaries by claiming that, rather than reanalyzing the data, the authors of the three commentaries had suggested "that the findings are invalid due to intentional bias, deliberate misrepresentation, and inept analysis" (p. 39). Subtitling their response "Protests and Accusations Do Not Alter the Results," Cameron and Pierce stated that any meaningful criticism of their article would have to include a reanalysis of the data. Subsequent to that interchange, Eisenberger and Cameron (1996) published an article in the *American Psychologist* summarizing the Cameron and Pierce (1994) meta-analysis and claiming that the so-called undermining of intrinsic motivation by extrinsic rewards, which they said had become accepted as reality, was in fact largely a myth.

We do not claim that there was "intentional bias" or "deliberate misrepresentation" in either the Cameron and Pierce (1994) meta-analysis or the Eisenberger and Cameron (1996) article, but we do believe, as Ryan and Deci argued in 1996, that Cameron and Pierce used some inappropriate procedures and made numerous errors in their meta-analysis. Therefore, because we believe the problems with their meta-analysis made their conclusions invalid, because we agree that a useful critique of their article must involve reanalysis of the data, and because the issue of reward effects on intrinsic motivation is extremely important for educators, we performed a new meta-analysis of reward effects on intrinsic motivation (Deci, Koestner, & Ryan, 1999). Our meta-analysis included 128 experiments, organized so as to provide a test of CET, much as Cameron and Pierce had done. The new meta-analysis, which we summarize in this article, showed that, in fact, tangible rewards do significantly and substantially undermine intrinsic motivation. The meta-analysis provided strong support for CET and made clear that there is indeed reason for teachers to exercise great care when using reward-based incentive systems.

The new meta-analysis was published in *Psychological Bulletin* (Deci et al., 1999). Included in that article was an appendix table (here reproduced with permission as Table 1a) listing every study in the meta-analysis and explaining exactly where errors were made by Cameron and Pierce, how our meta-analysis corrected their errors, and what studies were included in ours that had been overlooked or omitted by them. The table allows interested readers to see for themselves exactly how it is that Cameron and Pierce's meta-analysis and our meta-analysis arrived at such different conclusions.

In the seven years since the publication of Cameron and Pierce's (1994) article, academics, school administrators, and classroom teachers from many countries have spoken to us about the article, making it clear that the conclusions of the article had been widely disseminated and that the issue of reward effects is of considerable interest to educators around the world. Given the great importance of this issue for education, then, the current article is intended to set the record straight for the many readers of *RER*. In this article, we provide a brief description of CET,

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because it has guided much of the research in the field. This is followed by a summary of the methods and results of our meta-analysis and, finally, a discussion of the relevance of the results for education.

Cognitive Evaluation Theory

CET proposes that underlying intrinsic motivation are the innate psychological needs for competence and self-determination. According to the theory, the effects on intrinsic motivation of external events such as the offering of rewards, the delivery of evaluations, the setting of deadlines, and other motivational inputs are a function of how these events influence a person's perceptions of competence and self-determination. Events that decrease perceived self-determination (i.e., that lead to a more external perceived locus of causality) will undermine intrinsic motivation, whereas those that increase perceived self-determination (i.e., that lead to a more internal perceived locus of causality) will enhance intrinsic motivation. Furthermore, events that increase perceived competence will enhance intrinsic motivation so long as they are accompanied by perceived self-determination (e.g., Ryan, 1982), and those that decrease perceived competence will diminish intrinsic motivation. Finally, rewards (and other external events) have two aspects. The *informational* aspect conveys self-determined competence and thus enhances intrinsic motivation. In contrast, the *controlling* aspect prompts an external perceived locus of causality (i.e., low perceived self-determination) and thus undermines intrinsic motivation.

As noted, CET applies not only to reward effects but to the effects of various other external factors such as evaluations (Smith, 1975), deadlines (Amabile, DeJong, & Lepper, 1976), competition (Deci, Betley, Kahle, Abrams, & Porac, 1981), and externally imposed goals (Mossholder, 1980), as well as to the general climate of classrooms, schools, and other interpersonal settings (e.g., Deci, Connell, & Ryan, 1989; Deci, Schwartz, Sheinman, & Ryan, 1981). In this article, however, we focus only on CET as an explanation for reward effects.

In making predictions about reward effects on intrinsic motivation, CET analyzes the type of reward and the type of reward contingency to determine whether the reward is likely to be experienced as informational or controlling. The theory acknowledges that in some cases both the informational and controlling aspects will be somewhat salient, so, in those situations, additional factors are taken into account in making predictions. We begin our discussion of CET's reward-effect predictions by distinguishing between verbal rewards and tangible rewards, considering verbal rewards first and then moving on to tangible rewards.

Verbal Rewards

Although we do not usually use the term *verbal rewards*, preferring instead to speak of "positive feedback," we do use that term here in order to include the positive-feedback studies within the general category of reward effects. Verbal rewards typically contain explicit positive performance feedback, so CET predicts that they are likely to enhance perceived competence and thus enhance intrinsic motivation. In the meta-analysis, we tested the hypothesis that verbal rewards would enhance intrinsic motivation.

Nonetheless, verbal rewards can have a significant controlling aspect leading people to engage in behaviors specifically to gain praise, so verbal rewards have

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the potential to undermine intrinsic motivation. The theory therefore suggests that the interpersonal context within which positive feedback is administered can influence whether it will be interpreted as informational or controlling. As used here, the term *interpersonal context* refers to the social ambience of settings, such as classrooms, as they influence people's experience of self-determination (Deci & Ryan, 1991). When studied in laboratory experiments, the interpersonal climate is usually manipulated in terms of the interpersonal style used by the experimenter when providing the feedback (e.g., Ryan, 1982; Ryan, Mims, & Koestner, 1983). An interpersonal context is considered controlling to the extent that people feel pressured by it to think, feel, or behave in particular ways. Verbal rewards administered within such a context are thus more likely to be experienced as controlling rather than informational. For example, CET suggests that if a teacher uses an interpersonal style intended to make students do what he or she wants them to, verbal rewards administered by that teacher are likely to be experienced as controlling. In a supplemental meta-analysis involving five studies, we tested the prediction that controlling positive feedback would lead to less intrinsic motivation than informational positive feedback.

Tangible Rewards

Unlike verbal rewards, tangible rewards are frequently offered to people as an inducement to engage in a behavior in which they might not otherwise engage. Thus, according to CET, tangible rewards will tend to be experienced as controlling, and as a result they will tend to decrease intrinsic motivation. The meta-analysis tested the hypothesis that, overall, tangible rewards would decrease intrinsic motivation.

In order for tangible rewards to be experienced as controlling, however, people would need to be engaging in the behavior for the rewards; that is, they would need to expect that the behavior would lead to the rewards. If tangible rewards are given unexpectedly to people after they have finished a task, the rewards are less likely to be experienced as the reason for doing the task and are thus less likely to be detrimental to intrinsic motivation. The meta-analysis tested the hypothesis that unexpected tangible rewards would not undermine intrinsic motivation, whereas expected tangible rewards would.

Expected tangible rewards can be administered through various contingencies; that is, they can be made contingent upon different aspects of task-related behavior. In making more refined predictions about the effects of expected tangible rewards on intrinsic motivation, CET takes account of task contingency. Ryan et al. (1983) specified three types of reward contingencies: *task-noncontingent* rewards, which do not require engaging in the activity per se but are instead given for some other reason such as simply participating in the experiment; *task-contingent* rewards, which require doing or completing the target activity; and *performance-contingent* rewards, which require performing the activity well, matching a standard of excellence, or surpassing a specified criterion (e.g., doing better than half of the other participants).

A further distinction has been made between task-contingent rewards that specifically require completing the target task (herein referred to as *completion-contingent* rewards) and those that require engaging in the activity but do not require completing it (herein referred to as *engagement-contingent* rewards). We (e.g., Deci & Ryan, 1985) have considered the completion-contingent and engagement-contingent

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rewards to constitute the single category of task-contingent rewards because the effects of these two reward contingencies have seemed to be remarkably similar; however, we separated them for this meta-analysis in order to evaluate whether the effects of completion-contingent and engagement-contingent rewards are, in fact, the same.

Because task-noncontingent rewards do not require doing, completing, or doing well at the target task, there is no reason to expect these rewards to be experienced as either informational or controlling with respect to the task. Accordingly, the meta-analysis tested the hypothesis that intrinsic motivation would not be affected by these rewards.

Engagement-contingent rewards specifically require that people work on the task, so the rewards are likely to be experienced as controlling the task behavior. Because these rewards carry little or no competence affirmation, they are unlikely to increase perceived competence, and thus there will be nothing to counteract the negative effects of the control. Thus, the meta-analysis tested the hypothesis that engagement-contingent rewards would undermine intrinsic motivation.

Completion-contingent rewards require that people complete the task to obtain the rewards, so the rewards are likely to be experienced as even more controlling than engagement-contingent rewards. However, with completion-contingent rewards, receipt of the rewards conveys competence if the task required skill and the person had a normative sense of what constitutes good performance on the task. To the extent that the rewards do represent competence affirmation, this implicit positive feedback could offset some of the control. Still, averaged across different types of tasks, the competence-affirming aspect of completion-contingent rewards is not expected to be strong relative to the controlling aspect, so we tested the hypothesis that completion-contingent rewards would undermine intrinsic motivation at a level roughly comparable to that of engagement-contingent rewards. Parenthetically, because the category of task-contingent rewards is composed of engagement-contingent and completion-contingent rewards, we also expected this larger category to yield significant undermining of intrinsic motivation.

Finally, performance-contingent rewards are linked to people's performance, so there is even stronger control. People have to meet a standard to maximize rewards, and thus there is a strong tendency for these rewards to undermine intrinsic motivation. However, performance-contingent rewards can also convey substantial positive competence information when a person receives a level of reward that signifies excellent performance. In those cases, there would be a tendency for performance-contingent rewards to affirm competence and, thus, to offset some of the negative effects of control. In the meta-analysis, we tested the hypothesis that performance-contingent rewards would undermine intrinsic motivation, but we also expected that other factors would influence the effects of these rewards on intrinsic motivation. One such factor is whether or not the level of reward implies excellent performance. Thus, we examined the hypothesis that performance-contingent rewards would be more undermining of intrinsic motivation if the rewards did not convey high-quality performance.

Another factor that is expected to influence the effects of performance-contingent rewards is the interpersonal context (as was the case with verbal rewards). If the interpersonal climate within which these rewards are administered is demanding and controlling, the rewards are expected to be more undermining of intrinsic motivation.

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Although few studies have manipulated the interpersonal context of performance-contingent rewards, Ryan et al. (1983) compared a performance-contingent rewards group in which the rewards were administered in a relatively controlling manner and one in which they were administered in a relatively non-controlling manner. As predicted, the controlling administration of performance-contingent rewards led to undermining of intrinsic motivation relative to the noncontrolling administration. In terms of education, this is a particularly important finding because it suggests that when rewards are used in the classroom, it is important that the climate of the classroom be supportive rather than controlling so that the students will be less likely to experience the rewards as controlling.

Method

Our meta-analytic strategy (Deci et al., 1999) involved a hierarchical approach in which the results of 128 experiments were examined in two separate meta-analyses. The first involved 101 of the studies that had used a free-choice behavioral measure of intrinsic motivation, and the second involved 84 of the studies that had used self-reported interest as a dependent variable. In a hierarchical meta-analysis, one begins with the most general category and reports the composite effect size. If the set of effects is heterogeneous, then one proceeds to differentiate the overall category into meaningful subcategories in an attempt to achieve homogeneity of effects within the subcategories. Thus, in both meta-analyses (i.e., with the two dependent measures), we began by calculating the effects of all rewards on intrinsic motivation and then systematically differentiated the reward conditions. Only after we had exhausted all possible moderator variables did we discard outliers to create homogeneity within subcategories. Using this approach, we ended up discarding only about 4% of the effects as outliers, whereas Cameron and Pierce (1994) had discarded approximately 20% of the effects as outliers.

In the differentiation, studies were first separated into those that examined verbal rewards versus those that examined tangible rewards. Then tangible rewards, which have been extensively studied, were analyzed as follows. The effects of rewards that were unexpected versus expected were examined separately. Studies of expected tangible rewards were then separated into four groups, depending on what the rewards were contingent upon. The groups were as follows: task noncontingent (rewards that did not explicitly require working on a task), engagement contingent (rewards that did require working on the task), completion contingent (rewards that required finishing a task), and performance contingent (rewards contingent upon a specified level of performance at a task). As described subsequently, because the performance-contingent reward effects on the free-choice measure were heterogeneous, that category was further differentiated. Finally, in categories in which the effect sizes were heterogeneous after all theoretically based differentiations had been completed, we compared the effects of the reward types on schoolchildren versus college students, an issue that had not been considered previously but emerged from an inspection of the data and seemed very important in terms of the educational relevance of the results.

Inclusion criteria for studies that spanned the period 1971 to 1996 were the following. First, because intrinsic motivation is pertinent to tasks that people experience as interesting and because the field of inquiry has always been defined in terms

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of reward effects on intrinsic motivation for interesting tasks, we included only studies or conditions within studies if the target task was at least moderately interesting (i.e., if it either was not defined a priori as a boring task by the experimenter or did not have a prereward interest rating below the midpoint of the scale). In contrast, Cameron and Pierce (1994) had aggregated across boring and interesting tasks without even addressing the issue in their article. Second, the analyses included only studies that assessed intrinsic motivation after the rewards had been clearly terminated, because while the reward is in effect participants' behavior reflects a mix of intrinsic and extrinsic motivation. Cameron and Pierce, however, included assessments which they called intrinsic motivation but which had been taken while the reward contingency was still in effect. Third, studies were included only if they had an appropriate no-reward control group. Cameron and Pierce had made numerous comparisons based on questionable selections of control groups, at times even using inappropriate control groups when appropriate ones were available.

In conducting the meta-analyses, we used Cohen's d as the measure of effect size. It reflects the difference between the means of two groups divided by the pooled within-group standard deviations, adjusted for sample size (Hedges & Olkin, 1985). The mean of the control group was subtracted from the mean of the rewards group, so a negative d reflects an "undermining effect," whereas a positive d reflects an "enhancement effect."

Means, standard deviations, t tests, F tests, and sample sizes were used to calculate d values. For any study in which insufficient data were provided to calculate an effect size, we assigned an effect of $d = 0.00$, and we included those imputed values in all analyses. All effect-size computations and summary analyses were done with DSTAT (Johnson, 1993), a meta-analytic software program. Each calculation of a composite effect size is accompanied by a 95% confidence interval (CI) (for additional methodological details, see Deci et al., 1999).

Results

Effects of All Rewards

Although the early discussions of extrinsic reward effects on intrinsic motivation (e.g., deCharms, 1968) tended to consider extrinsic rewards as a unitary concept, even the very first investigations of this issue differentiated the concept. Deci (1971, 1972b) distinguished between tangible rewards and verbal rewards (i.e., positive feedback), reporting that tangible rewards decreased intrinsic motivation, while verbal rewards increased it. Furthermore, Deci (1972a) differentiated task-contingent rewards from task-noncontingent rewards, finding that task-contingent rewards decreased intrinsic motivation but task-noncontingent rewards did not, and Lepper, Greene, and Nisbett (1973) distinguished between rewards that were expected and those that were unexpected, finding that expected rewards decreased intrinsic motivation but unexpected rewards did not.

Accordingly, given that different rewards and different reward contingencies seem to have different effects on intrinsic motivation, aggregating across all types of rewards meta-analytically is, in a sense, a meaningless endeavor, because the outcome will depend primarily on how many studies of each type of reward or reward contingency are included in the meta-analysis (Ryan & Deci, 1996). Nonetheless,

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because Cameron and Pierce (1994) calculated the effect of all rewards on intrinsic motivation in their meta-analysis, we also calculated it for comparative purposes. The effect of all types of rewards across all relevant studies revealed significant undermining for the free-choice behavioral measure of intrinsic motivation ($k = 101$; $d = -0.24$; CI = −0.29, −0.19),[1] although the overall effect for the self-report measure was not significant. These and other major results are summarized in Table 1.

As already mentioned, we expected that all rewards would not affect intrinsic motivation in a uniform way, and thus we both expected and found that the set of effects for the all-rewards category was heterogeneous. Consequently, we proceeded with more differentiated analyses of specific types of rewards, based on both theoretical and empirical considerations. We first separated studies of verbal rewards from those of tangible rewards.

TABLE 1
Major results of the meta-analysis of the effects of extrinsic rewards on free-choice intrinsic motivation and self-reported interest, shown as Cohen's composite d, *with* k *effects included*

	Free-choice behavior		Self-reported interest	
	d	*k*	*d*	*k*
All rewards	−0.24*	101	0.04	84
Verbal rewards	0.33*	21	0.31*	21[a]
College	0.43*	14[a]		
Children	0.11	7[a]		
Tangible rewards	−0.34*	92	−0.07*	70
Unexpected	0.01	9[a]	0.05	5[a]
Expected	−0.36*	92	−0.07*	69
Task noncontingent	−0.14	7[a]	0.21	5[a]
Engagement contingent	−0.40*	55	−0.15*	35[a]
College	−0.21*	12[a]		
Children	−0.43*	39[a]		
Completion contingent	−0.44*	19[a]	−0.17*	13[a]
Performance contingent	−0.28*	32	−0.01	29[a]
Maximal reward	−0.15*	18[a]		
Not maximum reward	−0.88*	6[a]		
Positive feedback control	−0.20*	10[a]		
Negative feedback control	−0.03	3[a]		

[a] These categories were not further differentiated and are homogeneous. Some of the studies used to determine the overall composite effect size (i.e., for all rewards) in each meta-analysis had multiple reward conditions, so the sums of the numbers of effect sizes in the most differentiated categories of each meta-analysis are greater than the numbers in the all-rewards category. There were 150 effect sizes in the most differentiated categories for the free-choice analyses, of which 6 were removed as outliers, and there were 114 effect sizes in the most differentiated categories of the self-report analyses, of which 6 were removed as outliers.

* Significant at $p < .05$ or greater.

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Verbal Rewards (Positive Feedback)

We first tested the CET prediction that, on average, verbal rewards would enhance intrinsic motivation. Twenty-one studies examined the effects of verbal rewards on free-choice intrinsic motivation, and 21 examined its effects on self-reports of interest. Results indicated that verbal rewards enhanced intrinsic motivation: for the behavioral measure, $d = 0.33$ (CI = 0.18, 0.43), and for self-reports, $d = 0.31$ (CI = 0.19, 0.44).

However, there are two important caveats to this general finding. First, because the set of effect sizes for verbal-reward effects on free-choice behavior was heterogeneous, we inspected the studies to determine whether there was any obvious pattern in the results. We noticed that the effects of verbal rewards on schoolchildren appeared to be different from the effects on college students, so we conducted separate analyses for schoolchildren and college students. It turned out that verbal rewards enhanced free-choice intrinsic motivation for college students ($k = 14$; $d = 0.43$; CI = 0.27, 0.58) but not for children ($k = 7$; $d = 0.11$; CI = −0.11, 0.34), a point that is very important when thinking about educational practices.

Second, CET has emphasized that although positive feedback can enhance intrinsic motivation, it can actually undermine intrinsic motivation if it is administered with a controlling interpersonal style. Five studies examined the administration of verbal rewards with an informational versus controlling interpersonal style, so we did a supplemental analysis of these studies. The results indicated, as hypothesized, that although informationally administered verbal rewards enhanced intrinsic motivation ($d = 0.66$; CI = 0.28, 1.03), controllingly administered verbal rewards undermined intrinsic motivation ($d = -0.44$; CI = −0.82, −0.07).

To summarize, research indicates that verbal rewards (i.e., positive feedback) tend to have an enhancing effect on intrinsic motivation; however, verbal rewards are less likely to have a positive effect for children than for older individuals. Furthermore, verbal rewards can even have a negative effect on intrinsic motivation if the interpersonal context within which they are administered is controlling rather than informational.

Tangible Rewards

Next, we tested the CET prediction that, overall, tangible rewards (including material rewards, such as money and prizes, and symbolic rewards, such as trophies and good player awards) would decrease intrinsic motivation, because tangible rewards are frequently used to persuade people to do things they would not otherwise do, that is, to control their behavior. The meta-analysis included 92 tangible reward studies with a free-choice measure and 70 with a self-report measure. As predicted by CET, results indicated that, on average, tangible rewards significantly undermined both free-choice intrinsic motivation ($d = -.34$; CI = −0.39, −0.28) and self-reported interest ($d = -0.07$; CI = −0.13, −0.01). Of course, we have regularly argued that a full understanding of the effects of tangible rewards requires a consideration of additional factors such as reward contingency and interpersonal context, but these results do highlight the general risks associated with the use of tangible rewards as a motivator.

Because age effects had emerged for verbal rewards, we also compared the effects of tangible rewards in studies of children versus college students. This revealed that

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even though tangible rewards significantly undermined intrinsic motivation for both groups, the undermining effect was significantly greater for children than for college students on both behavioral and self-report measures of intrinsic motivation. The real-world implications of this pattern of results are extremely important. There is great concern about children's motivation for schoolwork, as well as for other behaviors such as sports, art, and prosocial activities, and a study conducted by Boggiano, Barrett, Weiher, McClelland, and Lusk (1987) indicated that adults tend to view salient extrinsic rewards as an effective motivational strategy for promoting these behaviors in children. However, the age-effect analyses indicate that, although tangible rewards may control immediate behaviors, they have negative consequences for subsequent interest, persistence, and preference for challenge, especially for children. In summary, the age effects that emerged from our meta-analysis indicate that tangible rewards have a more negative effect on children than on college students and that verbal rewards have a less positive effect on children than on college students.

Unexpected Rewards and Task-Noncontingent Rewards

We next tested the CET prediction that unexpected rewards would not be detrimental to intrinsic motivation, whereas expected rewards would. The reasoning was that if people are not doing a task in order to get a reward, they are not likely to experience their task behavior as being controlled by the reward. The meta-analysis supported the hypothesis. Nine studies of free-choice behavior revealed no undermining ($d = 0.01$; CI = –0.20, 0.22), and five studies of self-reported interest revealed similar results ($d = 0.05$; CI = –0.19, 0.29).

In contrast, analyses of expected rewards did yield undermining for both free-choice behavior ($k = 92$; $d = -0.36$; CI = –0.42, –0.30) and self-reported interest ($k = 69$; $d = -0.07$; CI = –0.13, –0.01). It is interesting in this regard to note that verbal rewards are generally unexpected, and that may be one of the reasons they do not typically have a negative effect on intrinsic motivation.

According to CET, rewards not requiring task engagement should be unlikely to affect intrinsic motivation for the task because the rewards are not given for doing the task. Although relatively few studies of task-noncontingent rewards have been done, the meta-analysis revealed no evidence that these rewards significantly affected either measure of intrinsic motivation ($k = 7$; $d = -0.14$; CI = –0.39, 0.11, for free-choice behavior and $k = 5$; $d = 0.21$; CI = –0.08, 0.50, for self-reported interest).

Engagement-Contingent Rewards

Engagement-contingent rewards are offered explicitly for engaging in an activity. When children were told they would get a good player award for working on an art activity (Lepper et al., 1973), the reward was engagement contingent. Similarly, when college students were told they would receive a reward if they performed a hidden-figures activity, the reward was engagement contingent (Ryan et al., 1983). In neither case was there a performance requirement: Participants did not have to finish the task or do well on it; they simply had to work on it. More studies have used engagement-contingent rewards than any other reward contingency, and that is particularly true for studies of children. Results of the meta-analyses confirmed that engagement-contingent rewards significantly diminished intrinsic motivation

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measured in both ways ($k = 55$; $d = -0.40$; CI = −0.48, −0.32, for free-choice and $k = 35$; $d = -0.15$; CI = −0.25, −0.06, for self-reports). Furthermore, the undermining on the free-choice measure, while significant for both children and college students, was significantly stronger for children than for college students. The strength of the undermining on self-reports did not differ for the two groups.

Completion-Contingent Rewards

The first study of reward effects on intrinsic motivation in humans (Deci, 1971) employed completion-contingent rewards. In it, participants were offered $1 for each of four puzzles they completed within a specified amount of time. As already mentioned, the pressure associated with the completion-contingent rewards was greater than that associated with engagement-contingent rewards, but we expected this to be offset somewhat by the implicit competence affirmation provided by the reward. Overall, we predicted an undermining effect for this category of rewards comparable to that for engagement-contingent rewards (Ryan et al., 1983).

Twenty studies examined completion-contingent reward effects on free-choice behavior, and 15 examined effects on self-reports. Analyses revealed that completion-contingent rewards significantly undermined intrinsic motivation for both dependent measures. Because the effects for these rewards on free-choice behavior were heterogeneous and there were no age effects, we had to remove one outlier to achieve homogeneity. With the outlier removed, the results were as follows: $k = 19$; $d = -0.44$; CI = −0.59, −0.30. For self-reports, the effects were also heterogeneous, and again there were no age effects; thus, we had to remove two outliers. With these outliers removed, we also found significant undermining by the completion-contingent rewards ($k = 13$; $d = -0.17$; CI = −0.33, −0.00, for self-reports).[2] As expected, the effects of engagement-contingent and completion-contingent rewards were virtually identical.

Task-Contingent Rewards

In the first taxonomy of reward contingencies, Ryan et al. (1983) included task-contingent rewards, and Cameron and Pierce included the category in their meta-analysis. Because the task-contingent reward category is simply the aggregate of engagement-contingent rewards and completion-contingent rewards, this category is redundant. However, for comparative purposes, we mention it here. Task-contingent rewards undermined intrinsic motivation assessed with both measures ($k = 74$; $d = -0.39$; CI = −0.46, −0.32, for free choice and $k = 48$; $d = -0.12$; CI = −0.20, −0.04, for self-reports). Again, the undermining tended to be worse for children.

Performance-Contingent Rewards

From the standpoint of CET, performance-contingent rewards are the most interesting type of tangible rewards. Performance-contingent rewards were defined by Ryan et al. (1983) as rewards given explicitly for doing well at a task or for performing up to a specified standard. Examples of performance-contingency studies include the Ryan et al. study, in which all participants in the performance-contingent-rewards condition received $3 for "having done well at the activity," and the Harackiewicz, Manderlink, and Sansone (1984) study, in which participants received a reward because they were said to have performed better than 80% of other participants.

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According to CET, performance-contingent rewards have the potential to affect intrinsic motivation in two ways, one quite positive and one quite negative. Performance-contingent rewards can maintain or enhance intrinsic motivation if the receiver of the reward interprets it informationally, as an affirmation of competence. Yet, because performance-contingent rewards are often used as a vehicle to control not only what the person does but how well he or she does it, such rewards can easily be experienced as very controlling, thus undermining intrinsic motivation. According to CET, it is the relative salience of the informational versus controlling aspects of performance-contingent rewards which determines their ultimate effect on intrinsic motivation.

In most experiments examining performance-contingent rewards, all participants receive rewards as if they had done very well (which, of course, does not happen in the real world). Therefore, these studies do not address the effects of receiving only partial rewards or no rewards under performance contingencies, a circumstance that is more common in the real world and would undoubtedly diminish both perceived competence and perceived self-determination and accordingly have a very negative effect on intrinsic motivation. There can thus be little doubt that research on the effects of performance-contingent rewards markedly underestimates the negative effects of this type of reward, since it has focused largely on people who succeed at the contingency. In contrast, a real-world contingency in which only those achieving above the 80th percentile receive a reward, if veridically applied, would mean that 80% of participants would end up getting no reward and, implicitly, receiving negative competence feedback.

The meta-analyses for the overall effects of performance-contingent rewards included 32 studies with a free-choice measure and 30 with a self-report measure. Performance-contingent rewards significantly undermined free-choice behavior ($d = -0.28$, CI $= -0.38, -0.18$), whereas results for the self-report studies were not significant. We did not do further analyses of studies with the self-report measure because the set of effects was homogeneous with only one outlier removed. However, the effects for the free-choice measure were quite heterogeneous. Consequently, we separated the effects into four categories based on the following two considerations.

First, different studies of performance-contingent rewards have used different control groups; specifically, some have used control groups in which participants received neither rewards nor feedback, whereas others have used control groups in which participants received no rewards but did receive the same feedback conveyed by the rewards to the participants who received rewards. In this latter instance, for example, if the rewards were given for doing better than 80% of the participants, participants in a no-reward control group that received feedback would have been told that they did better than 80% of the participants.

To examine the *combined* effects of performance-contingent rewards and the feedback inherent within them, one would compare the rewards condition with a no-rewards, no-feedback condition. On the other hand, to examine the effects of the rewards per se, independent of the feedback conveyed by them, one would compare the rewards group with a no-rewards group that received comparable feedback.

Second, although the definition of performance-contingent rewards used in the majority of studies involves giving rewards to all participants as if they had performed well, some studies gave rewards in a way that conveyed to some or all of

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the participants that they had not performed well. These participants got less than the maximum available rewards, thus indicating that their competence was not optimal. For example, in a study conducted by Rosenfield, Folger, and Adelman (1980) that involved a feedback control group, rewarded participants got a small reward for performing in the bottom 15% of all participants, and the corresponding control group received the comparable "negative" feedback without the reward. Clearly, this and other such studies are quite different from the more typical studies of performance-contingent rewards in which all participants receive the same maximum reward for having done well.

Studies involving different types of control groups and different levels of performance were aggregated without comment by Cameron and Pierce (1994). In our meta-analysis, however, because performance-contingent reward effects were not homogeneous, we examined four categories of performance-contingent rewards rather than simply discarding outliers as Cameron and Pierce had done. The four categories were as follows: effects involving no-feedback control groups in which everyone received the maximum possible rewards, effects involving no-feedback control groups in which all participants did not receive the maximum possible rewards, effects involving comparable-feedback control groups in which all participants received positive feedback, and effects involving comparable-feedback control groups in which all participants received negative feedback.

With the free-choice measure, for studies that compared no-feedback control groups and participants who received the maximum possible rewards, there was significant undermining ($k = 18$; $d = -0.15$; CI = −0.31, −0.00).[2] For studies with no-feedback control groups in which all participants did not receive the maximum possible rewards, there was also significant undermining ($k = 6$; $d = -0.88$; CI = −1.12, −0.65). The same was true for studies with comparable-feedback control groups in which everyone received positive feedback ($k = 10$; $d = -0.20$; CI = −0.37, −0.03). However, for the three studies with comparable-feedback control groups in which participants received negative feedback, there was not a significant effect for reward versus no reward.

The group in which at least some participants got less than the maximum possible rewards and the control group received no feedback stands out and deserves special mention. This represents the type of performance-contingent rewards that one would typically find in the real world, in that here rewards are a direct function of performance. Those who perform best get the largest rewards, and those who perform less well get smaller rewards or no rewards. The analysis showed that this type of reward had the largest undermining effect of any category used in the entire meta-analysis ($d = -0.88$), indicating clearly that rewarding people as a direct function of performance runs a very serious risk of negatively affecting their intrinsic motivation.

Summary of the Primary Analyses

To summarize the primary findings from the meta-analyses, when free-choice behavior was used as the dependent measure, all rewards, all tangible rewards, all expected rewards, engagement-contingent rewards, completion-contingent rewards, task-contingent rewards, and performance-contingent rewards significantly undermined intrinsic motivation. Only verbal rewards enhanced intrinsic motivation in general, but verbal rewards did undermine intrinsic motivation if they were given

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with a controlling interpersonal style. The undermining of intrinsic motivation by tangible rewards was worse for children than for college students, and the enhancement by verbal rewards was weaker for children than for college students. The most damaging reward contingency was the commonly used one of performance-contingent rewards in which not all participants receive maximum rewards.

When self-reported interest served as the dependent measure, all tangible rewards, all expected rewards, engagement-contingent rewards, completion-contingent rewards, and task-contingent rewards significantly undermined intrinsic motivation. Verbal rewards enhanced self-reported interest.

Supplemental Analyses

To further clarify the limiting conditions and moderator effects of rewards, we performed two supplemental analyses. First, to determine whether the undermining of intrinsic motivation is simply a transitory phenomenon, we examined the effects of tangible rewards on the free-choice behavior of children, dividing the studies into three groups: those for which intrinsic motivation was assessed immediately after the reward was terminated, those for which it was assessed a few days later, and those for which it was assessed at least a week later. Analyses indicated that timing of the dependent measure did not affect the results. For all three groups, the composite effect sizes were between –0.40 and –0.53, all statistically significant. If anything, the undermining was strongest in the studies in which the measure was taken at least a week after the rewards were given.

Second, although our primary meta-analyses included only studies for which the target activity was initially interesting, whereas Cameron and Pierce collapsed across interesting and dull tasks without analyzing task effects, we conducted a set of analyses to consider this issue empirically. In our first analysis, we included data from the dull-task conditions and repeated the overall meta-analysis. For the free-choice analyses, every undermining effect that had appeared when only initially interesting tasks were included also appeared after the dull-task conditions were added in; for the self-report analyses, all except one of the effects that had indicated significant undermining when only interesting tasks were used were again significant when the dull-task conditions were included. The one exception for self-report studies was that the inclusion of the dull-task data led the undermining of self-reported interest in the completion-contingent condition to drop to nonsignificance.

In our second analysis, we examined the 13 studies that had included both interesting and dull tasks, assessing the effects of tangible rewards separately for interesting and dull tasks. For the 11 studies with a free-choice measure, results indicated a large undermining by rewards in the interesting-task conditions ($d = -0.68$; CI = –0.89, –0.47) but not in the dull-task conditions ($d = 0.18$; CI = –0.03, 0.39). For 5 studies with self-reports, there was also significant undermining with the interesting task ($d = -0.37$; CI = –0.67, –0.07) but not the dull task ($d = 0.10$; CI = –0.09, 0.40).

In summary, it is clear that rewards do not undermine people's intrinsic motivation for dull tasks because there is little or no intrinsic motivation to be undermined. But neither do rewards enhance intrinsic motivation for such tasks. From our perspective (see, e.g., Ryan & Deci, 2000; Ryan & Stiller, 1991), the issue of promoting self-regulation of uninteresting activities is addressed with the concept of internalization rather than reward effects on intrinsic motivation. In other words,

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if a task is dull and boring, the issue is not whether the rewards will lead people to find the task intrinsically interesting because rewards do not add interest value to the task itself. Rather, the issue is how to facilitate people's understanding the importance of the activity to themselves and thus internalizing its regulation so they will be self-motivated to perform it.

Summary and Conclusions

To summarize, results of the meta-analysis make clear that the undermining of intrinsic motivation by tangible rewards is indeed a significant issue. Whereas verbal rewards tended to enhance intrinsic motivation (although not for children and not when the rewards were given controllingly) and neither unexpected tangible rewards nor task-noncontingent tangible rewards affected intrinsic motivation, expected tangible rewards did significantly and substantially undermine intrinsic motivation, and this effect was quite robust. Furthermore, the undermining was especially strong for children. Tangible rewards—both material rewards, such as pizza parties for reading books, and symbolic rewards, such as good student awards—are widely advocated by many educators and are used in many classrooms, yet the evidence suggests that these rewards tend to undermine intrinsic motivation for the rewarded activity. Because the undermining of intrinsic motivation by tangible rewards was especially strong for school-aged children, and because studies have linked intrinsic motivation to high-quality learning and adjustment (e.g., Benware & Deci, 1984; Ryan & Grolnick, 1986), the findings from this meta-analysis are of particular import for primary and secondary school educators.

Specifically, the results indicate that, rather than focusing on rewards for motivating students' learning, it is important to focus more on how to facilitate intrinsic motivation, for example, by beginning from the students' perspective to develop more interesting learning activities, to provide more choice, and to ensure that tasks are optimally challenging (e.g., Cordova & Lepper, 1996; Deci, Schwartz, et al., 1981; Harter, 1974; Reeve, Bolt, & Cai, 1999; Ryan & Grolnick, 1986; Zuckerman, Porac, Lathin, Smith, & Deci, 1978). In these ways, we will be more able to facilitate the type of motivation that has been found to promote creative task engagement (Amabile, 1982), cognitive flexibility (McGraw & McCullers, 1979), and conceptual understanding of learning activities (Benware & Deci, 1984; Grolnick & Ryan, 1987).

The results of the meta-analysis also provided strong support for CET. Specifically, the predictions made by CET, based on an analysis of whether reward types and reward contingencies are likely to be experienced as informational or controlling, were uniformly supported and were particularly strong for the behavioral measure. Thus, although Cameron and Pierce argued that CET should be abandoned and stated that there is no reason for teachers to resist using rewards in the classroom, it is clear that CET provides an excellent account of reward effects and that there is, in fact, good reason for teachers to think carefully about when and how to use rewards in the classroom.

Appendix

A list of each study used in our meta-analyses. A (D) indicates an unpublished dissertation. The second column indicates types of rewards and/or reward contingencies, followed by whether participants were children or undergraduates, followed

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by whether the dependent measure was free-choice behavior or self reported interest. (Codes appear in Notes to the Appendix.) Finally, we explain whether our treatment of the study and results differed from Cameron and Pierce's. If a study was coded the same, the same control groups were used in the comparisons, and the effect sizes we reported did not differ from the effect sizes Cameron and Pierce reported by more than 0.10 in either direction, we noted that the study was the same in the two meta-analyses. If there was a difference, we explained what it was.

Table 1a
Studies used in our meta-analyses compared with Cameron and Pierce (1994)

Study	Variables	Comparison with Cameron & Pierce's (1994) analysis
Amabile et al., 1986, Exp. 1	*E*, 1, *F*, *S*	Same.[1]
Amabile et al., 1986, Exp. 3	*E*, 2, *S*	Same.
Anderson et al., 1976	*V*, *E*, 1, *F*	This had multiple no-reward control groups. We selected the one recommended as appropriate by the study's authors and comparable to ones used for other studies in this meta-analysis. C. & P.[2] used a control group that the authors said was inappropriate, in which the experimenter avoided eye contact with the young children and ignored their attempts to interact, even though there were just the two people in the room. The study's authors said that this condition was uncomfortable, even painful, for both the children and experimenter. Not surprisingly, that group showed free-choice intrinsic motivation that was considerably lower than any other group.
Anderson & Rodin, 1989	*V*, 2, *S*	Nearly the same.[3] Both meta-analyses treated the composite dependent variable as self-report.
Arkes, 1979	*C*, 2, *F*, *S*	Same.
Arnold, 1976	*E*, 2, *S*	Same.
Arnold, 1985	*E*, *C*, 2, *S*	Same.
Bartelme, 1983 (D)	*P*, 2, *S*	Excluded, type I.[4]
Blanck et al., 1984, Exp. 1	*V*, 2, *F*, *S*	Same for free-choice; nearly the same for self-report.
Blanck et al., 1984, Exp. 2	*V*, 2, *F*, *S*	Excluded, type II.[5]
Boggiano & Ruble, 1979	*E*, *P*, 1, *F*	Excluded, type II.
Boggiano et al., 1982	*E*, 1, *F*	Same.
Boggiano et al., 1985	*E*, *C*, *P*, 1, *F*	The study's authors crossed reward contingency with salience of reward. They referred to the two reward contingencies as task contingent and performance contingent, and C. & P. coded them that way, treating the task-contingent conditions as engagement contingent.[6] However, the salience manip-

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Table 1a. *(continued)*

Study	Variables	Comparison with Cameron & Pierce's (1994) analysis
		ulation in the task-contingent condition changed the contingency. In the low-salience group, rewards were given for simply working on the puzzles, which makes them engagement contingent, but in the high salience group, rewards were given for each puzzle "completed," which makes them completion contingent.
Brennan & Glover, 1980	*E*, 2, *F*	This was engagement contingent because participants got rewards if they "work with the Soma puzzle for at least 8 minutes," but C. & P. coded it task noncontingent. Further, C. & P. combine two control groups, including one that had not worked on the task for the same amount of time as the rewards group during the experimental period, but we used only the control group that had worked on the task for the same amount of time.
Brewer, 1980 (D)	*E*, *P*, 1, *F*, *S*	Excluded, type I.
Brockner & Vasta, 1981	*C*, 2, *F*, *S*	Same.
Butler, 1987	*V*, 1, *S*	Nearly the same.
Calder & Staw, 1975	*C*, *D*, 2, *S*	This study provided monetary rewards for completing a set of puzzles, thus making it completion contingent, but C. & P. coded it engagement contingent. Also, C. & P. collapsed across interesting and dull tasks.[7]
Chung, 1995	*E*, *P*, *D*, 1, *F*	Excluded, type III.[8]
Cohen, 1974 (D)	*V*, *P*, 2, *F*, *S*	Excluded, type I.
Crino & White, 1982	*V*, 2, *F*, *S*	Same.
Dafoe, 1985 (D)	*N*, *P*, 1, *F*, *S*	Excluded, type I.
Daniel & Esser, 1980	*P*, *D*, 2, *F*, *S*	In this study, participants were told "they could win up to $2 depending on how quickly they correctly assembled the puzzles." This conveyed that the rewards depended on doing well relative to a standard and not just on finishing the puzzles. Thus, we coded it performance contingent, but C. & P. coded it completion contingent. Also, C. & P. collapsed across interesting and dull tasks.
Danner & Lonky, 1981, Exp. 2	*V*, *E*, 1, *F*, *S*	Nearly the same.
Deci, 1971, Exp. 1	*C*, 2, *F*, *S*	Same.
Deci, 1971, Exp. 3	*V*, 2, *F*, *S*	Same.
Deci, 1972a	*N*, 2, *F*	Same.

continued

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Table 1a (*continued*)

Study	Variables	Comparison with Cameron & Pierce's (1994) analysis
Deci, 1972b	*V*, *C*, 2, *F*	Same.
Deci et al., 1975	*V*, 2, *F*	Excluded, type II.
DeLoach et al., 1983	*E*, 1, *F*	Same.
Dimitroff, 1984 (D)	*E*, 1, *F*, *S*	Excluded, type I.
Dollinger & Thelen, 1978	*V*, *P*, 1, *F*, *S*	This had three tangible rewards groups, a verbal rewards group, and a control group. C. & P. inappropriately collapsed across verbal and tangible rewards, and they did not use the free-choice data.
Earn, 1982	*N*, 2, *F*, *S*	Rewards were given "simply for participating in the study" which makes it task noncontingent, but C. & P. coded it engagement contingent.
Efron, 1976 (D)	*V*, *E*, *P*, 2, *S*	Excluded, type I.
Eisenstein, 1985	*U*, *C*, *D*, 1, *F*	Excluded, type II.
Enzle et al., 1991	*P*, 2, *F*	Excluded, type II.
Fabes, 1987, Exp. 1	*C*, *P*, 1, *F*	Same for the performance-contingent condition. For the other condition, participants were given rewards "when they finished" a block construction, making it completion contingent, but C. & P. coded it engagement contingent.
Fabes, 1987, Exp. 2	*C*, 1, *F*	This study used the same procedure as the completion-contingent condition in Fabes (1987, Exp. 1), making it completion contingent, but C. & P. coded it engagement completion.
Fabes et al., 1986	*E*, 1, *F*, *S*	Excluded, type II.
Fabes et al., 1988	*E*, 1, *F*, *S*	Same for free-choice, but C. & P. did not include the self-report. In this study, children selected a face ranging from frown to smile to reflect how much they enjoyed the task, a procedure that is common for obtaining self-report data from young children.
Fabes et al., 1989	*E*, 1 *F*	Excluded, type II.
Feehan & Enzle, 1991, Exp. 2	*C*, 2, *F*	Excluded, type II.
Goldstein, 1977 (D)	*V*, *C*, *P*, 1, *F*, *S*	Excluded, type I.
Goldstein, 1980 (D)	*C*, 2, *F*	Excluded, type I. This included competition conditions but we did not use those because competition has a complex effect on intrinsic motivation (Reeve & Deci, 1996).
Greene & Lepper, 1974	*U*, *E*, *P*, 1, *F*	Same for the two unexpected groups and the engagement-contingent group, but C. & P. exclude the performance-contingent group.
Griffith, 1984 (D)	*E*, *D*, 1, *F*	Excluded, type I. To be comparable to most other studies in this meta-analysis, we included only partici-

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Table 1a (*continued*)

Study	Variables	Comparison with Cameron & Pierce's (1994) analysis
		pants who worked in the individual context.
Griffith et al., 1984	*C*, 1, *F*	Children were rewarded for finishing reading a passage up to the bookmark, which makes it completion contingent, but C. & P. coded it engagement contingent. (The McLoyd, 1979 study used the same instructions and C. & P. did code it completion contingent.)
Hamner & Foster, 1975	*E*, *C*, *D*, 2, *S*	Same coding for completion contingent. In engagement contingent, participants were paid "75 cents for the 20 minute task," but C. & P. coded it as task noncontingent. Also, C. & P. collapsed across interesting and dull tasks.
Harackiewicz, 1979	*V*, *E*, *P*, 1, *S*	Same for verbal rewards. Nearly the same for engagement contingent. C. & P. excluded the two performance-contingent rewards groups.
Harackiewicz & Manderlink, 1984	*P*, 1, *S*	Same.
Harackiewicz et al., 1984, Exp. 1	*P*, 2, *F*, *S*	Same.
Harackiewicz et al., 1984, Exp. 2	*U*, *P*, 2, *F*, *S*	Same coding, but C. & P. made an error in the self report effect size for performance contingent, showing it as enhancement when in fact it was undermining with a $d = -0.16$.
Harackiewicz et al., 1984, Exp. 3	*P*, 2, *F*, *S*	Same.
Harackiewicz et al., 1987	*P*, 1, *S*	Same.
Hitt et al., 1992	*E*, *D*, 2, *F*, *S*	Excluded, type III.
Hyman, 1985 (D)	*E*, *P*, 1, *F*	Excluded, type I.
Karniol & Ross, 1977	*E*, *P*, 1, *F*	Same except we coded the performance-contingent conditions for whether participants got the maximum rewards with implicit positive feedback or less than maximum rewards with implicit negative feedback.
Kast & Connor, 1988	*V*, *IC*, 1, *S*	Excluded, type II.
Koestner et al., 1987	*V*, 2, *F*, *S*	Same.
Kruglanski et al., 1971	*N*, 1, *S*	Rewards were given "because you have volunteered for this study . . ." so they were task noncontingent, but C. & P. coded them engagement contingent.
Kruglanski et al., 1972	*U*, 1, *S*	Same.
Kruglanski et al., 1975, Exp. 1	*C*, 1, *S*	Participants were rewarded either for the number of coin flips they guessed correctly or for the number of block constructions they completed correctly, making it completion contingent, but C. & P. coded it

continued

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Table 1a (*continued*)

Study	Variables	Comparison with Cameron & Pierce's (1994) analysis
		performance contingent. It explored moderation by endogenous versus exogenous rewards.
Kruglanski et al., 1975, Exp. 2	*P*, 1, *S*	There were two reward groups and two control groups. In one pair, people worked on a stock market game and earned cash after each trial for good investments. The control group was the same as the experimental group except they were told they had to give back their earnings, so it was not a reasonable no-reward control group. In the other pair of conditions, money was not mentioned to the no-reward control group. We excluded the pair of conditions without a proper control group, but C. & P. collapsed across the two pairs of conditions.
Lee, 1982 (D)	*P*, 2, *F*, *S*	Excluded, type I.
Lepper et al., 1973	*U*, *E*, 1, *F*	Same coding. Same effect sizes for engagement contingent. C. & P. made an error in calculating the effect size for unexpected rewards.
Lepper et al., 1982, Exp. 3	*E*, 1, *F*	Excluded, type II.
Liberty, 1986, Exp. 1 (D)	*C*, 2, *F*, *S*	Excluded, type I.
Liberty, 1986, Exp. 2 (D)	*C*, 2, *F*, *S*	Excluded, type I.
Loveland & Olley, 1979	*E*, *D*, 1, *F*	Same coding, but C. & P. collapsed across interesting and dull tasks.
Luyten & Lens, 1981	*C*, *P*, 2, *F*, *S*	Same for performance contingent. In the other rewards condition participants were paid after each of three puzzles they solved, so it was completion contingent, but C. & P. coded it as engagement contingent.
McGraw & McCullers, 1979	*C*, 2, *S*	Same.
McLoyd, 1979	*C*, *D*, 1, *F*	Coded the same, but C. & P. collapsed across interesting and dull tasks.
Morgan, 1981, Exp. 1	*E*, 1, *F*, *S*	Same on free-choice; nearly the same on self-report.
Morgan, 1981, Exp. 2	*E*, 1, *F*, *S*	Same.
Morgan, 1983, Exp. 1	*E*, 1, *F*, *S*	Same on free-choice; nearly the same on self-report.
Morgan, 1983, Exp. 2	*E*, 1, *F*, *S*	Same.
Mynatt et al., 1978	*E*, *D*, 1, *F*	Coded the same, but C. & P. collapsed across interesting and dull tasks.
Newman & Layton, 1984	*E*, *D*, 1, *F*	Excluded, type II.
Ogilvie & Prior, 1982	*E*, 1, *F*	Same.
Okano, 1981, Exp. 1	*E*, 1, *F*, *S*	Excluded, type II.
Okano, 1981, Exp. 2	*N*, *E*, 1, *F*, *S*	Excluded, type II.
Orlick & Mosher, 1978	*V*, *U*, *P*, 1, *F*	Same coding for verbal and unexpected. In performance contingent, children got rewards "if you do a good job today and tomorrow on the balance

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Table 1a (*continued*)

Study	Variables	Comparison with Cameron & Pierce's (1994) analysis
		board," but C. & P. coded it as completion contingent. There were discrepancies in the effect sizes.
Pallak et al., 1982	*V*, *U*, *P*, 1, *F*	Same for verbal and unexpected. C. & P. did not report how they coded the tangible expected rewards condition, which was performance contingent.
Patrick, 1985 (D)	*E*, *P*, 1, *F*, *S*	Excluded, type I.
Perry, et al., 1977	*E*, 1, *F*, *S*	Excluded, type II.
Picek, 1976 (D)	*E*, *P*, 2, *F*, *S*	Excluded, type I.
Pittman et al., 1977	*P*, 2, *F*, *S*	Same coding, but C. & P. used only self-report. We also used free-choice persistence, calculated as the number of trials.
Pittman et al., 1980	*V*, *IC*, 2, *F*	Same except that C. & P. did not do an analysis of informational versus controlling positive feedback.
Pittman et al., 1982, Exp. 1	*N*, *E*, 1, *F*	Same codings and nearly the same free-choice effects. C. & P. imputed a self-report value of 0.00, but participants were not asked how interesting or enjoyable they found the activity.
Pittman et al., 1982, Exp. 2	*E*, 1, *F*	Nearly the same.
Porac & Meindl, 1982	*C*, 2, *F*	C. & P. coded this engagement contingent, but participants received $1.50 for each puzzle solved. C. & P. reported a comparison for 40 experimental and 20 control participants, but there were only 50 participants in the study. We calculated the reward effect size based on a comparison of the rewarded groups with neutral and extrinsic mind sets versus the non-rewarded groups with neutral and extrinsic mind sets, because that comparison provided corresponding reward versus no-reward conditions.
Pretty & Seligman, 1984, Exp. 1	*V*, *U*, *E*, 2, *F*, *S*	Same for unexpected and engagement contingent. Nearly the same for verbal on free-choice.
Pretty & Seligman, 1984, Exp. 2	*U*, *E*, 2, *F*, *S*	Same.
Reiss & Sushinsky, 1975, Exp. 1	*E*, 1, *F*	Same.
Rosenfield et al., 1980	*P*, 2, *F*, *S*	This study had performance-contingent, completion-contingent, and task-noncontingent groups, and a control group with feedback comparable to that in performance contingent. There was no appropriate control group for completion contingent or task noncontingent. It also crossed tangible rewards with positive versus

continued

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Table 1a (*continued*)

Study	Variables	Comparison with Cameron & Pierce's (1994) analysis
		negative feedback. C. & P. reported a verbal effect for positive versus negative feedback, and then they collapsed across feedback to examine tangible-reward effects. We did a moderator analysis of rewards signifying positive versus negative feedback. C. & P. listed a performance-contingent self report $d = 2.80$, but the correct d was 0.22. For free-choice, there was a modest discrepancy.
Ross, 1975, Exp. 1	*E*, 1, *F*, *S*	Same for free-choice; they did not include self-report.
Ross, 1975, Exp. 2	*E*, 1, *F*, *S*	Nearly the same for free-choice; they did not include self-report.
Ross et al., 1976	*N*, *E*, 1, *F*	Same for engagement contingent. In the other group, children were rewarded "for waiting," which is task noncontingent, but C. & P. coded it engagement contingent.
Ryan, 1982	*IC*, 2, *F*	We included this study only in the supplemental meta-analysis of Informational versus Controlling verbal rewards. C. & P. excluded it.
Ryan et al., 1983	*V*, *E*, *P*, *IC*, 2, *F*, *S*	Same on verbal and engagement contingent. There were two performance-contingent groups, one informational and one controlling. There were three no-reward control groups, one with informational positive feedback, one with controlling positive feedback, and one with no-feedback. We compared performance-contingent both to comparable-feedback controls and no-feedback controls in the moderator analyses. C. & P. did only the comparable-feedback comparisons. Also, C. & P. did not do an informational-controlling comparison.
Salancik, 1975	*P*, 2, *F*, *S*	Same coding. C. & P. collapsed across positive and negative feedback conditions, but we did a moderator analysis for positive versus negative.
Sansone, 1986	*V*, 2, *S*	Same.
Sansone, 1989	*V*, 2, *S*	Same.
Sansone et al., 1989	*V*, 2, *S*	Same.
Sarafino, 1984	*E*, 1, *F*, *S*	Same.
Shanab, 1981	*V*, 2, *F*, *S*	Same.
Shiffman-Kaufman, 1990 (D)	*E*, *P*, 1, *F*, *S*	Excluded, type I. For comparability with other studies, we used only data from the 10-day assessments.

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Table 1a (*continued*)

Study	Variables	Comparison with Cameron & Pierce's (1994) analysis
Smith, 1975 (D)	*V*, *U*, *P*, 2, *F*, *S*	Excluded, type I.
Smith, 1980 (D)	*E*, *D*, 1, *F*	Excluded, type I. In this study, there was also a condition called positive feedback, but the statements were not competence feedback.
Smith & Pittman, 1978	*P*, 2, *F*, *S*	Same for self-report. C. & P. imputed a score of 0.00 for free-choice performance, even though means and significance tests were reported.
Sorensen & Maehr, 1976	*C*, 1, *F*	Excluded, type II.
Staw et al., 1980	*C*, 2, *S*	Participants got a $1 reward for completing 15 puzzles, making it completion contingent, but C. & P. coded it engagement contingent.
Swann & Pittman, 1977, Exp. 1	*N*, *E*, 1, *F*	Same.
Swann & Pittman, 1977, Exp. 2	*E*, 1, *F*	There were two engagement-contingent groups, an engagement-contingent plus verbal-rewards group, and two no-reward control groups. There was not a control group for the engagement plus verbal group. We compared the two engagement to the two control groups, but C. & P. used all three reward groups.
Taub & Dollinger, 1975	*P*, 2, *S*	Same.
Thompson et al., 1993	*E*, 2, *F*	Excluded, type III.
Tripathi & Agarwal, 1985	*V*, *E*, 2, *F*, *S*	Nearly the same.
Tripathi & Agarwal, 1988	*E*, *P*, 2, *F*, *S*	Same for engagement contingent on free-choice. For performance contingent, there were two tasks, with free-choice data reported for only one. Both we and C. & P. used the data for the one task and assigned $d = 0.00$ for the other, but C. & P. averaged the effects whereas we combined them meta-analytically. In the self-report data, C. & P. combined the engagement and performance conditions, so it is unclear which analysis they were used in.
Vallerand, 1983	*V*, 1, *S*	Same.
Vallerand & Reid, 1984	*V*, 2, *S*	Same.
Vasta & Stirpe, 1979	*C*, 1, *F*	This study had pre-post data for a rewards group and a control group. C. & P. did pre-post analyses for the rewards group and ignored the control group. We compared the rewards group to the control group with pre-post analyses. We coded it completion contingent, but C. & P. did not code it.
Weinberg & Jackson, 1979	*P*, 2, *S*	Same.

continued

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Table 1a (*continued*)

Study	Variables	Comparison with Cameron & Pierce's (1994) analysis
Weiner, 1980	*C*, 2, *F*, *S*	Participants received $.25 for each anagram completed, which makes it completion contingent, but C. & P. coded it performance contingent.
Weiner & Mander, 1978	*E*, *P*, 2, *F*, *S*	Same.
Williams, 1980	*E*, 1, *F*, *S*	Same.
Wilson, 1978 (D)	*E*, *D*, 2, *F*, *S*	Excluded, type I.
Wimperis & Farr, 1979	*N*, *C*, 2, *S*	In one group, participants received $1.75 for being in the study, making it task noncontingent, but C. & P. coded it engagement contingent. In the other, participants "were paid for each model or subunit completed," making it completion contingent, but C. & P. coded it performance contingent.
Yuen, 1984 (D)	E, 2, *F*, *S*	Excluded, type I.
Zinser, 1982	*V*, 1, F	Same.

Note. (D) = Unpublished Dissertation; V = Verbal Rewards; U = Unexpected Tangible Rewards; N = Task-Noncontingent Rewards; E = Engagement-Contingent Rewards; C = Completion-Contingent Rewards; P = Performance-Contingent Rewards; D = Dull-Task condition included in study and used in supplemental meta-analysis; IC = Informational versus Controlling comparison was made in supplemental meta-analysis. The code of 1 means the participants were children and the code of 2 means they were undergraduates. Finally, F means that the free-choice dependent measure was used and S means that the self-report measure was used.

[1] Same means that Cameron and Pierce and we coded the study the same, used the same control groups, and found effects sizes that did not differ from each other by more that 0.10 in either direction.

[2] C. & P. refers to Cameron and Pierce.

[3] Nearly the same means the studies were coded the same and the same control groups were used, but that the effect sizes were different by more than 0.10, probably due to differences in estimation of standard deviations. If the discrepancy is large, we make note of that.

[4] "Excluded, type I" refers to dissertations, and Cameron and Pierce excluded all dissertations.

[5] "Excluded, type II" refers to studies that Cameron and Pierce excluded for no apparent reason.

[6] Cameron and Pierce (1994) did not use the term "engagement-contingent." When we say they coded a reward engagement-contingent, it means that they coded it as both "task-contingent" and what they referred to as "not contingent using a behavioral definition." Because the intersection of those two codes is equivalent to our engagement-contingent code, we say that they coded it as engagement-contingent to minimize confusion for the reader. Similarly, they did not use the term completion-contingent, but what they coded as both "task-contingent" and "contingent using a behavioral definition" is equivalent to what we call completion-contingent.

[7] These studies used both interesting and uninteresting tasks. We excluded the uninteresting tasks from the primary meta-analyses and included them in the supplemental meta-analysis concerned with initial task interest. Cameron and Pierce collapsed across the interesting and dull tasks even though it has been firmly established in the literature that initial task interest interacts with reward effects.

[8] "Excluded, type III" refers to studies that Cameron and Pierce excluded because they were published after Cameron and Pierce's cut-off date.

Notes

[1]The value *k* represents the number of effects considered in calculating a composite effect size. Because, for any given calculation, the data were aggregated across all relevant conditions within a study in order to ensure independence of effect sizes, *k* also represents

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the number of studies that were included in the calculation of a composite effect size. The value *d* represents the composite effect size corrected for reliability (Hedges & Olkin, 1985). In regard to CIs, if both endpoints are on the same side of 0.00, it indicates that the mean for the reward groups is significantly different from the mean for the no-reward groups.

[2]Although one end of the CI appears to be 0.00, it was actually slightly negative and was rounded to 0.00. A significance test indicated that the composite effect size was significant.

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Negative Effects of Reward on Intrinsic Motivation—A Limited Phenomenon: Comment on Deci, Koestner, and Ryan (2001)

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A major concern in educational settings is that the use of rewards and incentives may destroy students' intrinsic motivation to perform activities. In collaboration with other researchers, the author conducted a meta-analysis of the literature that showed that negative effects of reward were limited and easily avoidable (Cameron & Pierce, 1994; Eisenberger & Cameron, 1996). Deci, Koestner, and Ryan (2001) suggest that our work was seriously flawed; they present a summary of their meta-analysis on the topic (Deci, Koestner, & Ryan, 1999a) and claim that rewards do substantially undermine intrinsic interest. In this comment, it is argued that there is no inherent negative property of reward. By organizing studies according to cognitive evaluation theory, Deci et al. (1999a) collapsed across distinct reward procedures and were able to obtain pervasive negative effects. When studies are organized according to the actual procedures used, however, negative effects are limited to a specific set of circumstances.

Many teachers use gold stars, recognition, bonuses, access to preferred activities, or other types of rewards to encourage high levels of performance by their students. Over the past 30 years, a number of psychologists have questioned the wisdom of this practice. The concern is that rewards undermine students' intrinsic motivation and performance. If students are rewarded for doing an interesting task, the claim is that they will come to like the task less and engage in it less once the rewards are no longer forthcoming. The contention that rewards undermine intrinsic motivation rests on a body of experimental research from social psychology. A few years ago, our research team conducted a meta-analysis of this literature to determine when and under what conditions rewards produce increases or decreases in measures of intrinsic motivation (Cameron & Pierce, 1994; Eisenberger & Cameron, 1996). We concluded that negative effects of reward occur under a circumscribed set of conditions and that, when appropriately arranged, rewards can be used to enhance motivation and performance.

Our findings and recommendations were highly contentious to those who argue that rewards are inherently harmful. Spurred by our research, Deci, Koestner, and Ryan (1999a) conducted a reanalysis of the literature; a summary of their results is presented in this issue (Deci, Koestner, & Ryan, 2001). Deci et al. (2001) suggest that our previous meta-analysis was seriously flawed and that rewards do, in

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fact, have a substantial undermining effect. In this comment, I show that there is no inherent negative property of rewards. On the basis of an updated meta-analysis on this topic (Cameron, Banko, & Pierce, in press), a careful examination of Deci et al.'s (1999a) work, and our previous reviews of this literature (Cameron & Pierce, 1994; Eisenberger & Cameron, 1996), I contend that there is no reason to accept Deci et al.'s (1999a, 2001) claim that rewards have pervasive negative effects on people's intrinsic motivation. Before I elaborate on any of these points, I begin with a brief history of how I became involved in this research area and the controversy that has ensued.

My own interest in the topic of rewards and intrinsic motivation began in the early 1990s. Prior to that time, I had been a teacher and director of an educational program for refugees and immigrants to Canada. My colleagues and I taught courses in English as a second language, life skills, and citizenship education. The overall goal of our programs was to provide an environment where students could acquire the language as well as the knowledge, skills, and attitudes that would enable them to fully participate in society. One way we attempted to achieve this goal was to design materials and tasks that actively involved students and that were challenging and relevant to their lives (e.g., see Cameron & Derwing, 1996). We set up our programs to provide regular feedback and to recognize and reward students' efforts and accomplishments.

When I returned to the university as a graduate student in the 1990s, I encountered the literature on rewards and intrinsic motivation. Throughout my readings were numerous statements denouncing the use of extrinsic rewards in educational settings. I became concerned. The message was that rewards and reinforcement destroy students' intrinsic motivation. I was concerned because such statements suggested that my past efforts as an educator were not only ineffective but detrimental. The implication was that the program we had designed to motivate our students was actually more harmful than beneficial.

I was curious to learn more. What I discovered was a large body of research on the topic. Since Deci's (1971) initial study, dozens of experiments had been conducted to investigate negative effects of reward on people's intrinsic motivation. I expected to find a robust set of research findings that showed strong negative effects of reward. Instead, as I delved into the topic, I discovered that the literature was a hotbed for debate. Several competing theories and hypotheses had been formulated to account for reward effects, procedures and conclusions reached in the early studies were questioned (e.g., see Scott, 1975), the generality of negative effects was contested (e.g., see Feingold & Mahoney, 1975), and the reality of the concept "intrinsic motivation" was disputed (see Bandura, 1986; Dickinson, 1989; Flora, 1990).

Further reading indicated that the results from experiments on the topic were not at all clear cut. A cursory examination of the findings revealed negative, positive, or no effects of reward. Even Deci, who reported detrimental effects of tangible reward in his original study (Deci, 1971), found positive effects of the same type of reward, under similar conditions, in a subsequent study (Deci, 1972). A number of reviewers had noted the contradictory nature of the findings and attempted to delineate the conditions under which extrinsic rewards produce decrements on measures of intrinsic motivation (Bates, 1979; Bernstein, 1990; Dickinson, 1989; Flora, 1990; Morgan, 1984). Although the general conclusion from these reviews

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has been that negative effects of reward occur under a specific set of circumstances, many writers continue to condemn the use of all rewards in applied settings (e.g., Kohn, 1993).

What was clear to me, at the time, was that another study was not needed. What was needed was a way to organize and make sense of the literature. In collaboration with other researchers, I used the technique of meta-analysis as a way to integrate the findings. This work culminated in a meta-analysis of 96 studies on rewards and intrinsic motivation; our research was published in this journal in 1994 (Cameron & Pierce, 1994), with additional analyses published in *American Psychologist* (Eisenberger & Cameron, 1996). On the basis of our results, and in accord with narrative reviews on the topic, we argued that negative effects of reward were minimal and could easily be prevented in applied settings.

Reactions to Our Meta-Analytic Findings

Our findings and recommendations created furor and debate (Kohn, 1996; Lepper, Keavney, & Drake, 1996; Ryan & Deci, 1996). Those who had argued that rewards are generally harmful could not accept our results. Lepper et al. (1996) stated that the procedures we used were akin to turning silk purses into sows' ears. They suggested that our analysis was comparable to putting a beautiful dessert (peaches and ice cream drizzled with raspberry sauce and a dollop of whipped cream) into an industrial blender and liquefying the entire concoction. Popular trade-book writer Alfie Kohn (1996) commented that "a closer look at their [Cameron and Pierce's] review—and at the empirical literature as a whole—reveals that there is more than adequate justification for avoiding the use of incentives . . ., particularly in a school setting" (p. 3).

Our research was clearly contentious and appears to have served as the impetus for the meta-analysis conducted by Deci et al. (1999a) that is summarized and reported in this issue (Deci et al., 2001). Deci et al. (2001) suggest that our conclusions are incorrect and that our failure to detect more pervasive negative effects in our prior meta-analysis was due to a number of errors and methodological inadequacies. Specifically, Deci et al. (1999a) criticized us for the following: (a) collapsing across tasks with high and low initial interest in our overall analysis, (b) including studies that used inappropriate control groups, (c) omitting studies/data as outliers rather than attempting to isolate moderators, (d) omitting studies that were published during the period covered by our meta-analysis, (e) omitting unpublished doctoral dissertations, and (f) misclassifying studies into reward contingencies as defined by cognitive evaluation theory. The meta-analysis conducted by Deci et al. (1999a) was designed to address these concerns, to test cognitive evaluation theory, and to provide a more comprehensive review of the literature. The researchers claim that their findings support cognitive evaluation theory and that, generally, tangible rewards significantly undermine people's intrinsic motivation (Deci et al., 2001).

An Evaluation of Deci, Koestner, and Ryan's (1999a) Meta-Analysis

To rectify issues they had with our previous work, Deci et al. (1999a) focused their meta-analysis on the effects of rewards on tasks of high initial interest only. In Deci et al.'s (1999a) primary analysis, studies or conditions within studies were included only if the tasks used were measured or defined to be interesting. In addi-

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tion, Deci et al. (1999a) excluded studies if they were deemed to have inappropriate control groups, and they included new experiments and studies missed in our previous research as well as a number of unpublished doctoral dissertations.

Deci et al. (1999a) identified 128 experiments on rewards and intrinsic motivation, including 20 unpublished studies from doctoral dissertations. In accord with our previous meta-analysis (Cameron & Pierce, 1994), each study in Deci et al.'s (1999a) meta-analysis included a comparison of a rewarded group and a non-rewarded control group. The effects of reward were assessed on two measures of intrinsic motivation: free-choice behavior (time spent on the experimental task after rewards were removed or performance during the free-choice period) and self-reported task interest. Deci et al. (1999a) conducted a hierarchical analysis that began at the level of assessing the effects of all rewards on high-interest tasks. When a set of effect sizes was not considered homogeneous, Deci et al. (1999a) searched for moderators and broke the studies into subcategories. As was done in our meta-analysis (Cameron & Pierce, 1994), Deci et al. (1999a) subdivided studies by reward type (verbal, tangible), reward expectancy (unexpected, expected), and reward contingency. Deci et al. (2001) present a summary of their findings for the effects of rewards on high-interest tasks in their Table 1. On the basis of their results, the authors claim that their findings support the predictions made by cognitive evaluation theory and "that there is indeed reason for teachers to exercise great care when using reward-based incentive systems" (Deci et al., 2001, p. 2).

One important difference between Deci et al.'s (1999a) and Cameron and Pierce's (1994) meta-analyses occurs at the level of all rewards. Cameron and Pierce (1994) began their review with an assessment of the overall effects of reward across all types of tasks. In contrast, Deci et al. (1999a) argued that this was inappropriate and that the more theoretically relevant question concerns the effects of rewards on high-interest tasks. According to cognitive evaluation theory, negative effects of reward are predicted solely for situations in which students are rewarded on tasks that they already enjoy doing. Thus, Deci et al.'s (1999a) primary analysis began at the level of the effects of reward on high-interest tasks only.

From the perspective of an educator, it is my contention that a more complete hierarchical analysis should begin at the level of all rewards over all types of tasks. Practically speaking, the concern of teachers, administrators, and parents is that rewards and incentive systems generally disrupt students' intrinsic motivation across all types of activities (e.g., reading, math, science, computer games); no distinction is made between low and high initial levels of task interest. In fact, few teachers set up incentive systems for tasks in which students already have a high level of interest; most programs of reward are designed to instill interest in tasks that hold little initial appeal. In addition, policy makers, who adopt the view that rewards are harmful, rarely distinguish between the effects of rewards on high- versus low-interest activities. Because of this, an analysis of the overall effects of reward is warranted. Following that analysis, we break down reward effects on high- and low-interest tasks.

A close inspection of the procedures used and the sample of studies selected for Deci et al.'s (1999a) primary meta-analysis on the effects of rewards on high-interest tasks reveals several shortcomings. One issue is that Deci et al. (1999a) omitted conditions from several studies that were relevant to their analyses. In addition, as did Cameron and Pierce (1994), Deci et al. (1999a) missed some experiments that

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met their inclusion criteria and that were published during the period covered by their meta-analysis. As well, several studies using high-interest tasks that revealed positive effects of reward on self-reported task interest measures were either excluded or inadvertently omitted from Deci et al.'s (1999a) analyses. Each of these issues is thoroughly documented in a set of appendices in our updated review of this literature (Cameron et al., in press).

The major area of disagreement between Deci et al. (1999a) and our previous analysis concerns the effects of expected tangible rewards. Deci et al. (2001) report general negative effects of expected tangible rewards that are engagement contingent, completion contingent, and performance contingent. In contrast, in our previous meta-analysis, no negative effects were found when tangible rewards were offered contingent on completing a task or meeting a performance standard. In terms of reward contingencies, we classified studies according to a behavioral definition; in addition, we used the framework suggested by cognitive evaluation theory, as outlined by Deci and Ryan (1985). In their recent review, however, Deci et al. (1999a) suggested that many studies in our analysis (Cameron & Pierce, 1994) were miscategorized. Deci et al. (1999a) provided a new statement of cognitive evaluation theory and established the categories of task-noncontingent, engagement-contingent, completion-contingent, and performance-contingent reward.

Although this categorization system may be useful for cognitive evaluation theory, there are problems. One issue is that the categories used by Deci et al. (1999a) are too broad. Studies that used different procedures were pooled into overall categories of engagement-contingent, completion-contingent, and performance-contingent reward. Eisenberger, Pierce, and Cameron (1999) examined some of these diverse reward procedures and found very different effects on measures of intrinsic motivation. The point is that studies using different procedures that produce different results need to be analyzed separately and not combined into overall categories. Rather than quibbling about which studies best fit into the cognitive evaluation framework, a way to resolve this issue is to go back to the original studies, write down the precise statement of the reward contingency used, and code the studies according to the procedures actually employed in the experiment. If studies are categorized in terms of the actual contingencies used, educators can determine whether the reward procedures used in laboratory experiments are comparable to those used in applied settings. Furthermore, a procedural categorization allows for a test of cognitive evaluation theory, along with providing a test of alternative accounts of the effects of rewards on intrinsic motivation.

Resolving Differences: New Findings

In order to resolve differences between previous meta-analyses of rewards and intrinsic motivation, our research team (Cameron et al., in press) conducted a new analysis designed to build on the strengths of previous work while correcting flaws. Our sample incorporated the databases of Cameron and Pierce (1994), Deci et al. (1999a), new studies, and studies missed in previous analyses. The resulting sample consisted of 145 studies (21 of the experiments were from unpublished doctoral dissertations). For each study, a rewarded group was compared with a nonrewarded group on the main measures of intrinsic motivation (free-choice behavior and self-reported task interest). We conducted a hierarchical analysis that began at the level of all rewards across all types of tasks. We then examined the effects of different

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moderator variables. Our first breakdown was in terms of high and low initial task interest. On tasks of high initial interest, studies were then subdivided by reward type (verbal, tangible), tangible rewards were further broken down by reward expectancy (expected, unexpected), and the effects of expected tangible rewards were assessed by the reward contingency.

Through the use of a procedural classification of reward contingencies, studies were organized into seven main categories: rewards delivered regardless of task involvement (task noncontingent); rewards given for doing a task; rewards for doing well; rewards for finishing or completing a task; rewards given for each problem, puzzle, or unit solved; rewards for achieving or surpassing a specific score; and rewards for meeting or exceeding others. The procedures used and definitions of each reward contingency are presented in Cameron et al. (in press). As a supplementary analysis, studies were labeled "maximum" reward if participants in the reward condition met the performance requirements and received the full reward; "less than maximum" reward occurred when there was a time limit such that some participants did not meet all of the requirements and were given less than the full reward.

A summary of our findings is presented in Table 1. In terms of the overall effects of reward, in accord with our earlier reviews, our meta-analysis indicates no evidence for detrimental effects of reward on measures of intrinsic motivation. This analysis was not presented as part of Deci et al.'s (1999a) primary analysis, and thus the findings cannot be compared. This finding is important because many researchers and writers espouse the view that rewards, in general, reduce motivation and performance. In addition, many students of psychology and education are taught that, overall, rewards are harmful and should be avoided in applied settings. Our finding of no overall effect of reward, however, must be treated with caution. In our meta-analysis, the overall reward category lacked homogeneity, indicating the appropriateness of a moderator analysis. In other words, the overall reward category is too inclusive; rewards have different effects under different moderating conditions.

In Table 1, the effects of all rewards are first broken into high- and low-interest tasks. The results show that when the tasks used in the studies are of low initial interest, rewards increase free choice but do not affect self-reported task interest.[1] This finding indicates that rewards can be used to enhance time and performance on tasks that initially hold little enjoyment. In education, a major goal is to instill motivation and enjoyment of academic activities. Many academic activities are not of high initial interest to students. An implication of our finding is that rewards can be used to increase motivation and performance on low-interest academic activities.

On high-interest tasks (comparable to "all rewards" in Table 1 of Deci et al.'s [2001] article), the effects of reward depend on reward type, reward expectancy, and reward contingency. Table 1 shows that verbal rewards significantly enhance both free-choice intrinsic motivation and self-reported task interest. These results were also obtained by Deci et al. (1999a), who reported similar small to moderate positive effects of verbal rewards. When the effects of verbal reward were examined with children versus adults (mainly college students), children showed a smaller positive effect than adults, but both effect sizes were statistically significant.[2] These findings suggest that when praise and other forms of positive feedback are given and later removed, people continue to engage in the activity and express high levels of task interest.

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TABLE 1
Hierarchical analysis of the effects of rewards on measures of intrinsic motivation, based on Cameron, Banko, and Pierce (in press)

	Free-choice behavior		Self-reported interest	
Reward condition	*d+*	*k*	*d+*	*k*
All reward	−0.08	115	0.12*	100
Low initial task interest	0.28*	12[a]	0.12	11[a]
High initial task interest	−0.09*	114	0.12*	98
Verbal reward	0.31*	25[a]	0.32*	21[a]
College students	0.36*	15[a]		
Children	0.22*	10[a]		
Tangible reward	−0.17*	102	0.08*	83
Unexpected reward	0.02	9[a]	0.03	5[a]
Expected reward (offered)	−0.18*	101	0.08*	81
Task noncontingent	−0.10	7[a]	0.17	6[a]
Reward offered for doing task	−0.35*	57	−0.13*	38[a]
College students	−0.24*	13[a]		
Children	−0.29*	39[a]		
Reward offered for doing well	−0.31*	11[a]	0.04	6[a]
Reward offered for finishing task	−0.24	6[a]	0.32*	6[a]
Reward offered for each unit solved	−0.16*	20[a]	0.15*	20[a]
Maximum reward	−0.03	6[a]		
Less than maximum reward	−0.22*	14[a]		
Reward offered for surpassing a score	0.02	11[a]	0.24*	11[a]
Reward offered for exceeding others	0.18*	11[a]	0.14*	14[a]

Note: d+ = mean weighted effect size; *k* = number of studies.
[a] Categories considered to be homogeneous based on a chi-square test. The analysis in this table begins at the level of all reward across all types of tasks. Deci et al.'s (2001) analysis of "all rewards" begins at the level of "high initial task interest."
*$p < .05$.

In accord with Deci et al.'s (1999a) findings, the effects of tangible rewards differ by reward expectancy. When rewards are delivered unexpectedly (without a description of the reward contingency), there is no evidence of significant effects (Deci et al. also report nonsignificant effects for unexpected tangible rewards). This finding suggests that it is not tangible rewards, per se, that undermine motivation; instead, undermining of motivation depends on instructions and the statement of contingency.

At the next level of analysis, in Table 1, expected tangible rewards are categorized according to the description of the reward contingency. When the offer of reward was unrelated to task behavior (task noncontingent), we found no evidence for an effect of reward on either the free-choice or the self-report measure (as did Deci et al., 1999a). On the other hand, when people were offered a tangible reward for doing a task or for doing well at a task, they chose to do the activity less in a free-choice period. On self-reported task interest, a negative effect occurred for expected tangible rewards given simply for doing an activity.

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No negative effect was detected on the self-report measure when the rewards were offered for doing well. It is possible that the true effect on task interest of rewards offered for doing well may also be negative, but, at present, there are too few studies in this category to yield a reliable estimate. Generally, when the description of the reward contingency implies that rewards are loosely tied to performance, the evidence suggests that people show a small reduction in performance and interest.

Table 1 shows that rewards offered for finishing or completing a task have a nonsignificant effect on free choice and a positive effect on task interest. Because there were few studies in this category, a firm conclusion about these effects is premature. A stronger conclusion can be drawn for the analysis of rewards offered for each unit solved. When participants are offered a reward for each problem/puzzle/unit solved, the findings indicate a negative effect on free choice.

A supplementary analysis involving less than maximum reward and maximum reward shows that the negative effect on free choice occurs when participants are offered a reward for each unit solved but obtain less than the full reward. In studies of less than maximum reward, participants are given a time limit to solve problems. Thus, the negative effect may be a result of time pressure rather than reward. Another interpretation is that if people are told they can obtain a certain level of reward but are given less than that level, they have received feedback information that indicates failure. In other words, this type of situation may represent failure feedback, not reward. When participants are not under time pressure and are able to obtain the maximal reward, there is no reliable effect on the free-choice measure. No other analyses were conducted on maximum versus less than maximum reward; in most categories, participants received the maximum reward.

Finally, the results in Table 1 show that when rewards are offered for meeting or surpassing a score, there is no significant effect on free choice but a significant positive effect on task interest. When rewards are given for exceeding the performance level of others, the results show a significant increase in both free-choice intrinsic motivation and self-reported task interest.

Overall, in accord with our previous reviews (Cameron & Pierce, 1994; Eisenberger & Cameron, 1996), our updated meta-analysis (Cameron et al., in press) shows that rewards can be used to produce both negative and positive effects on measures of intrinsic motivation. Rewards can be used to increase motivation and performance on tasks that are of low initial interest. On high-interest tasks, positive effects are obtained when participants are verbally praised for their work and when tangible rewards are offered and explicitly tied to performance standards and to success. Negative effects are produced when tangible rewards signify failure or are loosely tied to behavior.

A Comparison of Meta-Analytic Findings

It is important to point out that there are several areas of agreement among our current analysis (Cameron et al., in press), Deci et al.'s (1999a) meta-analysis, and our previous reviews (Cameron & Pierce, 1994; Eisenberger & Cameron, 1996). In each of these meta-analyses, verbal rewards are shown to increase measures of intrinsic motivation. The findings also show that unexpected tangible rewards do not affect measures of intrinsic motivation. As well, when rewards are tangible, offered beforehand (expected), and not related to the task at hand (task noncontin-

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gent), intrinsic motivation is unaffected. Clearly, not all rewards inevitably result in a loss of intrinsic motivation.

Deci et al.'s (2001) claim that tangible rewards are generally harmful is based on their analysis of expected tangible reward contingencies. In Figure 1, we compare our analysis of expected tangible reward contingencies (Cameron et al., in press) with Deci et al.'s (1999a). Figure 1 shows the effects of rewards on free-choice behavior and self-reported task interest when studies are classified according to cognitive evaluation theory versus a procedural classification of the contingencies.

An examination of Figure 1 indicates pervasive negative effects when reward contingencies are organized by cognitive evaluation theory. In contrast, a procedural classification shows circumscribed negative effects. For example, on free-choice intrinsic motivation, Deci et al. (1999a) showed a negative effect for performance-contingent rewards. The "performance-contingent" category included some studies of rewards offered for each unit solved, rewards offered for doing well, rewards offered for surpassing a score, and rewards offered for exceeding others. By combining these distinct reward procedures, Deci et al. (1999a) obtained an overall negative effect for performance-contingent reward. In contrast, when contingencies are defined by the procedures used in the studies, Figure 1 shows that different procedures produce different effects on free choice. Deci et al. (1999a) collapsed over reward categories for the task interest measure, and similar problems arose. In addition, Deci et al. (1999a) omitted several positive effects that, when included, resulted in positive findings for task interest.

In summary, the major difference between Deci et al.'s (1999a) meta-analysis and our research concerns the effects of expected tangible rewards. Deci et al. (1999a) used reward contingencies that were theoretically relevant but that collapsed over distinct reward procedures. This strategy resulted in pervasive negative effects of expected tangible reward contingencies. When Deci et al.'s (1999a) categories are organized according to the actual procedures used in the studies, negative effects are limited to a specific set of circumstances.

Theoretical Implications

Deci et al. (2001) assert that their meta-analytic results provide strong support for cognitive evaluation theory. According to cognitive evaluation theory, when individuals like what they are doing, they experience feelings of competence and self-determination. On high-interest tasks, when tangible rewards are offered to people for doing the task, for completing the task, or for meeting a performance standard, the claim is that the rewards will be experienced as controlling, and hence an individual's sense of self-determination will be undermined. Although in some instances contingent rewards may convey competence, the prediction is that the loss of self-determination will override feelings of competence, and the net result will be a decrease in intrinsic motivation for engagement-contingent, completion-contingent, and performance-contingent rewards.

There are two problems with this prediction. First, as we have seen, when expected tangible rewards are classified according to the procedures used, no negative effects are detected when the rewards are linked to success, to surpassing a score, or to exceeding others. A second difficulty is that Deci et al. (2001) have not provided a test of the mediators (perceptions of competence and self-determination) that are

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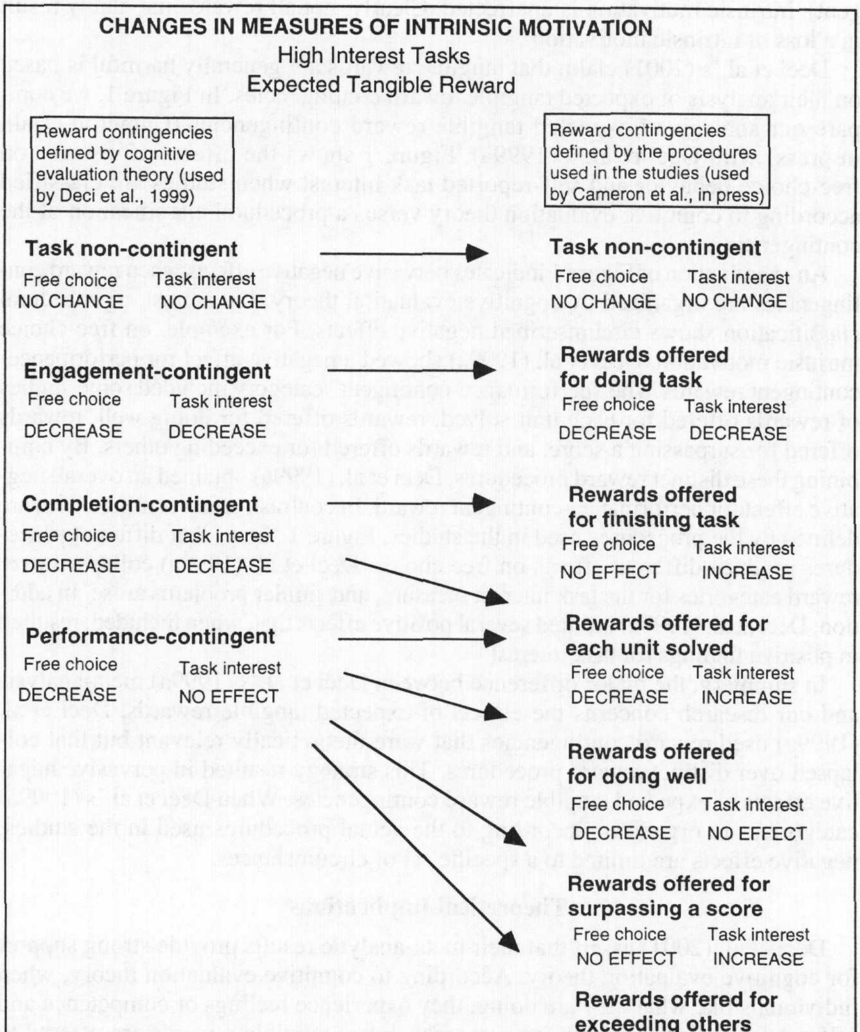

FIGURE 1. *A comparison of Deci et al.'s (1999) findings with a procedural analysis of the effects of expected tangible reward contingencies on free-choice intrinsic motivation and self-reported task interest for tasks of high initial interest. Deci et al.'s (1999) categories of completion-contingent and performance-contingent reward contained studies that involved "reward offered for each unit solved."*

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said to be critical in producing changes in people's intrinsic motivation. Instead, Deci et al. (1999a) used evidence of decreases in measures of intrinsic motivation to infer the controlling nature of rewards. In a response to Deci et al.'s (1999a) work, Eisenberger et al. (1999) evaluated studies with measures of self-determination and showed that rewards offered for doing, completing, or meeting a performance criterion often increased people's perceived freedom and autonomy. Although Deci, Koestner, and Ryan (1999b) have suggested that these studies did not use pure measures of perceived self-determination, at present the best evidence is that rewards are not viewed by people as controlling or as restrictive to their sense of freedom. The point is that cognitive evaluation theorists have not provided any evidence to indicate why people show a loss of intrinsic motivation for expected tangible reward contingencies.

Based on a procedural classification of reward contingencies, the findings are more in accord with a social learning (social cognitive) perspective (Bandura, 1986). The emphasis in social learning is on how reward contingencies relate to perceived competence or self-efficacy. Reward contingencies that enhance perceived competence or self-efficacy are expected to increase interest in and performance of an activity. Social cognitive theory predicts that rewards tied to level of performance enhance self-efficacy to the extent that a person is able to attain the performance standard (i.e., succeed). Greater self-efficacy leads to higher interest in a task and to more time spent on the activity.

Social learning theory distinguishes between non-competency-contingent rewards and competency-contingent rewards. Non-competency-contingent rewards include rewards given without regard to mastery of performance (e.g., rewards offered for doing, for doing well, for completing, or for repeating an activity). This type of reward contingency includes many of the studies that Deci et al. (1999a) classified as involving task-, completion-, and performance-contingent rewards. From a social cognitive perspective, the bulk of experiments on rewards and intrinsic motivation have involved rewards offered for engaging in an activity without regard to a standard or criterion of performance. According to Bandura (1986), non-competency-contingent rewards provide little indication of competency in that the rewards are loosely tied to behavior. Rewards given for mastery (i.e., achieving relatively challenging behavioral standards) are termed competency-contingent rewards, and it is this type of reward contingency that is said to develop perceptions of self-efficacy and task interest. In our analyses, rewards given for surpassing a score or for exceeding others could be considered a subset of competency-contingent rewards, and positive effects may be a result of increased feelings of competence and self-efficacy.

Applied Implications

A close examination of Deci et al.'s (1999a) meta-analysis and a reanalysis using procedural definitions of reward contingencies indicate that extrinsic rewards do not have pervasive negative effects on people's intrinsic motivation. On tasks of low initial interest, extrinsic rewards can be used to increase motivation and performance. On high-interest tasks, verbal praise and tangible rewards linked to success or to obtaining or exceeding a specific performance standard can enhance people's interest without disrupting performance of the activity in a free-choice setting. These reward contingencies can be viewed as a subset of the many possible

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arrangements of the use of reward in everyday life. Rewards can be arranged to progressively shape performance (Schunk, 1983, 1984), to cultivate initial interest in an activity and build skills (Bandura, 1986), and to maintain or enhance effort and persistence at a task (Eisenberger, 1992).

A negative effect occurs when a task is of high initial interest, when the rewards are tangible and offered beforehand, and when the rewards are delivered without regard to success on the task or to any specified level of performance. Under this combination of conditions, experimental findings indicate that some rewarded participants spend less time on the task (in a free-choice period without reward) and report less task enjoyment than nonrewarded participants. Although small, this effect has been statistically significant in all of the meta-analyses to date on this topic. In educational settings, such a use of incentives is not common. As Bandura (1986) noted, the effects of this type of reward contingency are

> of no great social import because rewards are rarely showered on people regardless of how they behave. Nor is there much call for incentive systems for activities people find highly interesting and thus readily pursue on their own without extrinsic motivators. (p. 246)

In my own experience as a teacher and from numerous observations of classroom settings, educators most often provide rewards to shape successful performance and to recognize student accomplishment. In addition, in educational environments, the rewards are usually presented over a period of time, and, as proficiency in a task increases, the rewards are gradually faded out. In contrast, in the typical reward and intrinsic motivation experiment, the procedure involves a single reward delivery followed by a single assessment of intrinsic motivation without reward.[3] The point is that the procedures used in the experimental studies to obtain negative effects of reward on intrinsic motivation are not characteristic of the use of rewards in the classroom. Thus, it is difficult to extrapolate the findings to applied settings.

Finally, it is important to consider how the meta-analytic findings on rewards and intrinsic motivation can inform policy makers. As shown in this comment, when studies are categorized according to the actual contingency used, negative, neutral, and positive effects are obtained. However, using cognitive evaluation theory to guide the classification of studies, Deci et al. (1999a) obtained pervasive negative effects of tangible reward contingencies. That the results of a meta-analysis can be altered by adding one or two experiments and by assigning studies to categories based on a particular theoretical orientation suggests that, overall, the literature on rewards and intrinsic motivation is one of meager effects. The implication, at this point in time, is that it would be unwise to make applied policy decisions based on this body of research.

Conclusion

In the target article, Deci et al. (2001) present a summary of their meta-analysis on rewards and intrinsic motivation; they claim that the use of rewards and incentives in educational settings is of particular concern because rewards produce significant and substantial decreases in students' intrinsic motivation. For some, this claim may provide solace. Setting up effective incentive programs in an educational environment is not easy. The claim that rewards and incentives are harmful

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relieves us of this difficult and demanding task. In this comment, however, an examination of Deci et al.'s (1999a) meta-analysis, findings from an updated review on the topic (Cameron et al., in press), and previous reviews of this literature indicates that there is no inherent negative property of reward. Rewards can be used to produce positive, negative, or no effects on measures of intrinsic motivation. Importantly, for educators, obtaining a negative effect of reward requires an unusual combination of conditions bearing little resemblance to the actual use of incentives in classroom settings.

Notes

[1]Deci et al. (1999a) provided a supplementary analysis of the effects of reward on low-interest tasks. Their findings showed no significant effects on either free-choice intrinsic motivation or self-reported task interest. This analysis included a small subset of studies from their primary analysis; the problem is that several studies that used low-interest tasks were excluded (e.g., Freedman & Phillips, 1985; Overskeid & Svartdal, 1996).

[2]For the effects of verbal reward, Deci et al. (1999a) reported a significant positive effect on free-choice behavior for adults but a nonsignificant positive effect for children. In Cameron et al. (in press), the effect size for children was statistically significant because more studies were included in the analysis.

[3]A few researchers have used a single-subject design (e.g., Feingold & Mahoney, 1975) and have found that when rewards are delivered repeatedly and repeated assessments of performance on the task are taken without reward, detrimental effects are not evident. Five studies have been conducted using this type of design, and negative effects of reward have not been obtained. Meta-analysis is typically conducted with between-group design studies wherein an experimental group is compared with a control group; hence, the single-subject design studies have not been included in meta-analyses of this literature.

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The Pervasive Negative Effects of Rewards on Intrinsic Motivation: Response to Cameron (2001)

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Our meta-analysis (this issue) clarified when rewards undermine, leave unchanged, and enhance intrinsic motivation and pointed out flaws in Cameron and Pierce's (1994) meta-analysis. Cameron's (2001) commentary did not reveal any problems with our meta-analysis, nor did it defend the validity of Cameron and Pierce's. Instead, Cameron referred to a fourth meta-analysis by her group; little detail was presented about the new meta-analysis, but it appears to have the same types of errors as the first three. Cameron also presented a new theoretical account of reward effects—the fourth by her group, which sequentially abandoned the previous ones as they were found wanting. Cameron concluded again that there is no reason to avoid using performance-contingent rewards in educational settings, yet her application of the research results to education lacks ecological validity.

There are four primary points in Cameron's (2001) commentary on our article (Deci, Koestner, & Ryan, 2001). First, she reported that she and her colleagues have conducted a new meta-analysis of reward effects, and she stated that "extrinsic rewards do not have pervasive negative effects on people's intrinsic motivation" (p. 39). Second, Cameron claimed that studies of reward effects on intrinsic motivation for dull, boring activities should be included in the meta-analysis even though the research field that is being evaluated has always been defined in terms of reward effects on intrinsic motivation for interesting activities. Third, she argued that cognitive evaluation theory (CET) does not explain the findings from the various meta-analyses, and instead she endorsed social learning theory as an explanation of reward effects on intrinsic motivation. Fourth, she concluded once again that there is little reason for teachers to be concerned about the use of rewards in classrooms. We consider each point in turn.

The New Meta-Analysis

Cameron stated that she and her colleagues have done a new meta-analysis of reward effects on intrinsic motivation—their fourth in the last 7 years—although virtually nothing was said about the methods used, the studies included, or the classification of studies, and no data were presented. Thus, the material in her com-

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mentary provides no definitive basis for evaluating any aspect of her claims, so we have no choice but to extrapolate from the meager information presented in her commentary and from the first three meta-analyses her group published. We therefore consider her current claims accordingly.

Cameron (2001) stated that the new meta-analysis includes 145 studies, whereas ours had included 128. Cameron made clear that the meta-analysis included studies that used dull, boring tasks, and her Table 1 suggests that there were approximately 12 such boring-task studies included in her meta-analysis. Furthermore, because Eisenberger, Pierce, and Cameron (1999) were able to identify only one published study that we (Deci, Koestner, & Ryan, 1999a) had not included in our meta-analysis, it appears that most of the 17 studies her group included that we had not were boring-task studies (along with perhaps a few that have been published since our meta-analysis). As such, it appears that the set of interesting-task studies the Cameron group included in its new meta-analysis was nearly identical to ours. Yet, in spite of using nearly the same interesting-activity studies, their results yielded far less negative reward effects than did ours, and Cameron reported a few positive effects that had not emerged in our results.

How is one to account for this strikingly different set of composite effect sizes? The best we can do is point out how the Cameron group obtained such results in their first three meta-analyses and assume that the current results were most likely obtained in a similar manner.

The first meta-analysis done by the Cameron groups appeared in *RER* (Cameron & Pierce, 1994), and it is that meta-analysis to which the appendix table of our article in this issue refers. One can see in that table the various errors made and the improper procedures they used. If it really is true that, unlike the 1994 meta-analysis, their new one did not include any of the boring-task conditions in the analysis of interesting tasks and they did not discard a large percentage of studies as outliers, then one must assume that the Cameron group's results were a function of (a) using inappropriate control groups, (b) misclassifying studies, (c) using improper measures of intrinsic motivation, such as behavior assessed while reward contingencies were still operative, (d) including irrelevant experimental conditions and excluding relevant ones, and (e) collapsing across experimental conditions without doing moderator analyses. By examining the appendix table in our article, one can see how such inappropriate procedures led to erroneous results in the Cameron and Pierce meta-analysis, and we now point out a few examples of how such procedures distorted the results of their group's second and third meta-analyses.

In the second of the previous meta-analyses, Eisenberger and Cameron (1998) compared performance-contingent reward groups that had specific performance standards (e.g., rewards for surpassing the 80th percentile) with comparable-positive-feedback control groups, and they stated, in a published piece that also failed to include methods and effect sizes of individual studies, that rewards enhanced intrinsic motivation with both the behavioral and self-report measures. To evaluate their assertion, we conducted precisely that meta-analysis using the appropriate studies from the set of 128 used in our (Deci et al., 1999a) meta-analysis, and we found that they were simply wrong in their assertion, that there was not enhancement with either measure but, if anything, there was a tendency toward undermining with both. These analyses can be found in Deci et al. (1999a, p. 655). Because Eisenberger and Cameron had not described their methods, we could not determine

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what they had done to get their results, but it is clear that their conclusions were invalid.

The third of the group's previous meta-analyses (Eisenberger et al., 1999) included only performance-contingent reward studies. The group argued that this reward contingency was less detrimental than our results (Deci et al., 1999a) had indicated. When we examined their methods, we found that Eisenberger et al. had arrived at their conclusion by excluding from their analyses 11 of the 40 performance-contingent reward studies we had used in ours, by using the wrong control groups in several comparisons, and by collapsing across conditions that were intended by the experimenters to have different psychological meanings (see Deci, Koestner, & Ryan, 1999b, for more detail).

One of the main points in the Eisenberger et al. (1999) meta-analysis was that performance-contingent rewards given for exceeding an explicit performance standard would enhance intrinsic motivation, whereas those given with a vague performance standard would not. It turned out that only one experiment on intrinsic motivation had directly tested that hypothesis. Specifically, Enzle, Roggeveen, and Look (1991) included both a vague-standards condition and an explicit-standards condition in a study with a crossword game as the target activity. Participants in both the vague and explicit conditions were told that they could earn $3 by constructing "complex patterns of words" (p. 473). In the "explicit-standards" condition, participants were shown three specific examples of what constituted complex word patterns, but in the "vague-standards" condition, nothing was said about what would be considered a complex pattern. Thus, in the explicit-standards condition participants had a basis for guiding their behavior toward the goal, while in the vague-standards condition they did not.

The results of the Enzle et al. study were exactly counter to the Eisenberger et al. hypothesis; participants who were rewarded for meeting explicit standards showed very strong undermining for free-choice behavior, $d = -1.32$ (confidence interval [CI] = −2.29, −0.36), whereas those who were rewarded for meeting vague standards showed a nonsignificant effect, $d = -0.13$ (CI = −1.01, 0.74). Remarkably, Eisenberger et al. collapsed across the two conditions, classifying them both as vague standards, and did not report the results that directly contradicted their hypothesis.

To summarize, in the new meta-analysis by the Cameron group referred to in the Cameron (2001) commentary, we have no way of knowing what was actually done that resulted in their finding less negative reward effects than we did. However, on the basis of their past three meta-analyses and the precision of our 1999 meta-analysis as summarized in our article, it is a virtual certainty that Cameron's conclusion that "extrinsic rewards do not have pervasive negative effects on people's intrinsic motivation" (p. 39) is not an accurate reflection of what the data show.

Boring Tasks

In her commentary, Cameron emphasized once again that studies of reward effects on dull, boring tasks should be included in meta-analyses of reward effects on intrinsic motivation. We address this issue first with regard to scientific considerations and then with regard to practical ones. The field of research that Cameron's group has purported to evaluate in their various meta-analyses has, for

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30 years, been defined by researchers in the field as "reward effects on intrinsic motivation for interesting activities." To do an evaluation after redefining the field as "reward effects on intrinsic motivation for interesting *and boring* activities" and then use the results of that evaluation to discredit the field as it had originally been defined is scientifically inappropriate. Thus, although Cameron began her commentary by posing the question of whether rewards can destroy students' intrinsic motivation, her group attempted to answer the question, in part, by examining reward effects on boring tasks for which there was no intrinsic motivation to be destroyed.

Thirteen studies discussed in our meta-analysis (Deci et al., 1999a) had included both interesting and boring tasks in order to clarify limiting conditions to the undermining effect of rewards. As expected, our meta-analysis confirmed that expected, tangible rewards decreased intrinsic motivation for interesting tasks and did not have a significant effect on intrinsic motivation for uninteresting tasks. Rewards did not undermine intrinsic motivation for boring tasks because there was little intrinsic motivation to undermine, but neither did they enhance intrinsic motivation for those tasks.

In her commentary, Cameron justified the practice of combining interesting and dull tasks on practical terms. She argued that, in schools, students have to deal with both interesting and dull tasks, and because it is not clear what tasks will be interesting for what students, it is best to simply average reward effects across all tasks. That, however, misses the point. If tangible rewards typically undermine intrinsic motivation for interesting tasks but do not affect intrinsic motivation for boring tasks, averaging across the tasks and claiming that the negative effects of rewards are small and inconsequential not only obfuscates important scientific evidence concerning the moderator effect of tasks but also justifies a practice that can destroy intrinsic motivation for interesting tasks without enhancing intrinsic motivation for boring tasks. To us, that is peculiar logic.

Cognitive Evaluation Theory and the Alternatives

Throughout each of their relevant papers, the Cameron group has argued that CET does not provide an account of the findings and should be abandoned. In fact, Cameron and Pierce (1994) organized their analyses explicitly to test CET, claiming to have found no support for the theory. Now that our meta-analysis has shown definitively that the data do in fact support CET, Cameron has argued that the reason we found pervasive undermining as predicted by CET is that we organized the studies in accord with CET concepts. She then went on to say that CET is inadequate for explaining the data, apparently not recognizing that these two statements are contradictory. Having backed herself into a corner by the way she criticized our meta-analytic support for CET, she apparently had no choice but to be self-contradicting.

In contrast to our use of CET, which has remained the same (with minor refinements) for 25 years and has been supported by narrative reviews (e.g., Deci & Ryan, 1980, 1985) and by three previous meta-analyses (Rummel & Feinberg, 1988; Tang & Hall, 1995; Wiersma, 1992) as well as our own meta-analysis (Deci et al., 1999a), the Cameron group has had a continually changing set of theoretical accounts and organizations of the data. First, consider theory. Initially, Cameron and Pierce (1994) used a general behaviorist approach, arguing "that constructs such as self-determination, goal definition, and intrinsic motivation are scientifi-

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cally unclear and that it would be more appropriate to deal with the effects of reward and reinforcement on behavior" (p. 396). Then Eisenberger and Cameron (1996) abandoned that approach and proposed helplessness theory as an account of the reward-effect results. Their explanation (viz., that receiving task-noncontingent rewards makes one feel helpless relative to, say, completion-contingent rewards) was not only implausible but was directly contradicted by their own analyses, as pointed out by Deci et al. (1999a). Accordingly, Eisenberger et al. (1999) abandoned helplessness theory (without mentioning having done so) and proposed a general interest theory. It too had problems, as we subsequently pointed out (Deci et al., 1999b), and now Cameron has abandoned it (again without mentioning having done so) and has proposed social learning theory as an account of when rewards will undermine intrinsic motivation.

Now consider how the group has organized the studies in the different meta-analyses. There were four reward contingencies considered in the original Cameron and Pierce (1994) article: performance-contingent rewards, task-contingent rewards that are contingent according to a behavioral definition, task-contingent rewards that are noncontingent according to a behavioral definition, and task-noncontingent rewards. Eisenberger and Cameron (1996) changed the categories to include only three: quality dependent, completion dependent, and performance independent. Eisenberger and Cameron (1998) again changed the focus to a comparison of quality-dependent rewards that involved an explicit performance standard and success feedback relative to those that involved only success feedback. In doing so, they were implicitly granting that rewards that are engagement contingent, completion contingent, and quality dependent without explicit standards and success feedback are undermining of intrinsic motivation.

Subsequently, Eisenberger et al. (1999) changed the focus again to consider performance-contingent rewards with a vague standard versus those with an explicit standard. As the results of the analyses for each of their previous distinctions were shown to be problematic, the focus changed, as it has again in the meta-analysis that is discussed in Cameron's (2001) commentary. One gets the sense that the group is trying to find any way to cut the data that will allow them to justify their championing the use of rewards instead of grappling meaningfully with what the data make clear, namely, that the use of tangible rewards to motivate students' learning tends, on average, to have significantly negative effects on students' self-regulation.

The bottom line, then, is that CET has consistently been found to be the most useful of the theories that have thus far been brought to bear on this research field, and the series of theoretical accounts proposed by the Cameron group has had little enduring value.

Issues of Ecological Validity: The Practical Implications

In their early articles, the Cameron group made sweeping conclusions such as "teachers have no reason to resist implementing incentive systems in the classroom" (Cameron & Pierce, 1994, p. 397). However, beginning with the Eisenberger et al. (1999) article, they have attenuated their claims and restricted their focus to performance-contingent rewards, implicitly acknowledging that they were wrong in their earlier, more global claims. In the Cameron commentary, what we find is an argument that although rewards made contingent upon working at a task,

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completing some or all of a task, or doing well at a task all tend to undermine intrinsic motivation, these results need not be of concern to classroom teachers. Specifically, the argument has two parts: First, that teachers do not give rewards for tasks that students find interesting, so all of these results are of little consequence anyway; and, second, that teachers do not give rewards for doing a task, completing some or all of a task, or doing a task well, so this provides further reason not to be concerned about the research results. In other words, although even Cameron's analysis indicates that there are reasons for teachers to resist offering incentive systems for doing an interesting task, for completing some or all of it, or for doing it well, Cameron assumes that classroom teachers would not use rewards in these ways, so she sees no reason to caution them.

What, then, does Cameron suggest that teachers should do? On the basis of the most recent meta-analysis, the Cameron group argued that rewards given for surpassing a performance standard (for example, obtaining an examination score of 90 or above) or for exceeding the performance of others (for example, beating out 80% of the other students) would not have a negative effect on students' intrinsic motivation and thus are effective motivational strategies for the classroom.

Let us, for the sake of argument, assume that the findings are correct, even though our meta-analysis suggests that they are not, and let us imagine what it would be like to use these reward strategies in the classroom. First, consider the case of meeting a performance standard (i.e., surpassing a score), for example, obtaining an exam score of at least 90. Unless the exam is so easy that everyone gets a 90 or above, some students will receive a reward and some will not.

The experiments on which Cameron built her argument are ones in which relatively stringent performance standards were set and every participant was rewarded, indicating that every participant had met the standards. No one failed to get the reward. In the classroom, if a reward structure based on meeting a performance standard were implemented, many students would fail to get a reward. Unfortunately, there has been no research in which the intrinsic motivation of all participants—those who surpass a performance standard and receive a reward and those who fail to surpass it and thus receive no reward—has been assessed, so it is not possible to say definitively what the overall effect would be; however, it is certainly worth sounding a note of caution. When students work hard within a stringent reward contingency and then do not get a reward, the experience is likely to be highly detrimental both because the contingency tends to be controlling and because not getting the reward will probably be experienced as failing. Thus, even if the intrinsic motivation of the few who receive a reward is not diminished, it seems quite likely that the intrinsic motivation of those who do not receive a reward will be destroyed. In short, Cameron's application of these research results to the classroom lacks ecological relevance because giving everyone a reward for meeting a performance standard is unworkable.

A closely related approach that would be ecologically workable involves giving rewards in such a way that the amount of the reward varies as a function of how well each student does on the target task, with those doing very well getting the largest rewards and those doing less well getting smaller rewards. In our meta-analysis, we examined this approach. Specifically, we calculated the composite effect size for performance-contingent rewards that were given so everyone got a reward but not everyone got the maximum reward. The results showed that this

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approach, which is perhaps the most commonly used reward contingency in classrooms, led to the largest undermining of any reward contingency in our entire meta-analysis (as shown in Table 1 of our article, the large and statistically significant *d* value for the behavioral measure was −0.88 [CI = −1.12, −0.65]). In short, use of the performance-standard approach Cameron advocated in a way that is ecologically meaningful in the classroom appears to be the most detrimental of all approaches.

The other contingency that Cameron explicitly advocated was one in which students are rewarded for exceeding others, that is, for beating their classmates. Importantly, the studies that used this contingency were ones in which all participants received rewards indicating that they had all beaten the others, a strategy that would be pretty difficult to implement in a classroom. In actuality, what would happen is that winners would get a reward and losers would not. It turns out that there is one published study that examined this approach. Specifically, Pritchard, Campbell, and Campbell (1977) offered rewards for beating others in a group, and then the intrinsic motivation of both the winners and losers was assessed. Neither we, nor the Cameron group, included this study in the meta-analyses because not all experimental participants got rewards; however, the study did show statistically significant undermining, with large effect sizes of $d = -0.95$ on the free-choice measure and $d = -0.76$ on self-reported interest.

It appears then, that even if the Cameron group's meta-analysis was correct concerning the effects of performance-contingent rewards given for surpassing either a performance standard or others' performance—that is, even if these contingencies do not undermine the intrinsic motivation of people who get the rewards—there is every indication that implementing such strategies in the classroom would be perhaps the most disastrous of all strategies for the classroom as a whole. It is also worth noting that, when these kinds of reward contingencies are implemented in applied settings, they are typically accompanied by an emphasis on evaluation, surveillance, and competition, all of which have been shown to undermine intrinsic motivation, independent of the effects of extrinsic rewards (e.g., Deci, Betley, Kahle, Abrams, & Porac, 1981; Plant & Ryan, 1985; Smith, 1975). This, of course, further questions the strong advocacy of such reward structures (see also Ryan & Deci, 2000).

Conclusions

Thirty years ago, the first studies appeared showing that tangible rewards given for doing an interesting activity undermined intrinsic motivation for the activity (Deci, 1971), and for 25 years we have used CET to interpret the results of studies that followed from this initial finding. The theory has usefully explained when rewards undermine, leave unchanged, and enhance intrinsic motivation, and narrative reviews of the literature, as well as meta-analyses conducted by Rummel and Feinberg (1988), Wiersma (1992), Tang and Hall (1995), and Deci et al. (1999a), have consistently supported the theory. During the past 7 years, beginning with the Cameron and Pierce (1994) article in *RER*, the Cameron group has attempted to sweep the matter under the rug, presenting flawed meta-analyses that minimize the undermining effect of rewards on intrinsic motivation. Interestingly, even they have found substantial evidence for undermining in their meta-analyses, yet at the same time they have argued that these results need be of no concern to classroom

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teachers, in that the authors apparently believe that supporting and nurturing intrinsic motivation is of little social import. Indeed, as already mentioned, Cameron and Pierce stated that it is more appropriate to focus on behavior than on intrinsic motivation.

As we have argued in our article and in this response to Cameron's (2001) commentary on our article, there is indeed reason to be concerned about how rewards are used. As our research and theory have always suggested, there are ways of using even tangible rewards that are less likely to have a negative effect and may, under limited circumstances, have a positive effect on intrinsic motivation. However, the use of rewards as a motivational strategy is clearly a risky proposition, so we continue to argue for thinking about educational practices that will engage students' interest and support the development of their self-regulation. We believe that it is an injustice to the integrity of our teachers and students to simply advocate that educators focus on the use of rewards to control behavior rather than grapple with the deeper issues of (a) why many students are not interested in learning within our educational system and (b) how intrinsic motivation and self-regulation can be promoted among these students. Until these issues are given greater attention by educational researchers, it is unlikely that meaningful progress will be made in dealing with the problems facing our educational system today.

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