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WHEN DO EXTRINSIC REWARDS UNDERMINE INTRINSIC MOTIVATION? A META-ANALYSIS

Aki Lehtivuori

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ABSTRACT

Intrinsic motivation—doing something because the activity is experienced as enjoyable, interesting, and fun—operates as an important energizer of human behaviors. Although researchers have studied intrinsic motivation and factors affecting it for decades, a debate persists on how extrinsic rewards affect intrinsic motivation. Originating from Deci's (1971) seminal study showing the undermining of intrinsic motivation by contingent extrinsic rewards, researchers in the field of psychology and more recently in the field of organizational behavior have examined and debated whether extrinsic rewards undermine existing intrinsic motivation and, if so, under what conditions.

Although the debate is old, researchers have failed to reach a consensus on this issue. In the field of psychology, the lack of consensus is partly driven by partially contradictory findings of past meta-analyses. While some previous meta-analytical studies have provided strong support for the undermining of intrinsic motivation by extrinsic rewards in experimental settings (e.g., Deci et al., 1999a), others have reached substantially different conclusions (e.g., Cameron et al., 2001). In contrast, in the field of organizational behavior, a lack of quantitative synthesis on extrinsic rewards–intrinsic work motivation literature has impaired the understanding of the undermining effect in organizational settings and led some scholars to dismiss possible drawbacks of using rewards to motivate employees.

Hence, the effect of rewards on intrinsic motivation remains highly debated. Drawing on cognitive evaluation theory (Deci & Ryan, 1985) and Deci, Koestner, and Ryan's (1999a) meta-analytical review, this doctoral thesis tries to bring some reconciliation to this debate. This goal will be achieved by meta-analytically synthesizing research evidence from two settings—experimental laboratory studies and organizational settings—on the effects of extrinsic rewards on intrinsic motivation. Specifically, the aim is to examine the suggested deleterious effects of contingently given rewards, which have been at the heart of the debate. This study focuses on answering the following questions:

1. *Under what reward contingencies and populations will extrinsic rewards have a negative effect, no effect, or positive effect on intrinsic motivation in controlled laboratory experiments? What is the magnitude of the effect?*
2. *What is the association between extrinsic rewards and intrinsic motivation in organizational settings? How strong is this association?*

A systematic search of published studies from seven electronic databases was carried out to answer these questions. Altogether, 158 peer-reviewed journal articles met the inclusion criteria. Three primary meta-analyses using a random-effects model and a hierarchical analysis framework were followed through. Following Deci et al.'s (1999a) steps, the analysis proceeded from a higher level of analysis examining the effect of all rewards on intrinsic motivation to more specified levels of analysis using reward type and reward contingency as moderators.

Two meta-analyses focused on examining the causal impact of extrinsic rewards on intrinsic motivation by synthesizing the evidence from 142 randomized controlled laboratory experiments (125 published articles). Separate meta-analyses were performed for the two measures of intrinsic motivation: free-choice intrinsic motivation (i.e., free-choice behavior) and self-reported interest/enjoyment. The third primary meta-analysis synthesized the evidence from observational studies conducted in work settings. The goal was to examine the relationship between extrinsic reward and self-reported intrinsic work motivation. Altogether, 42 independent samples from 35 published articles were used in the analyses.

For the meta-analysis of experimental studies using the free-choice behavioral measure of intrinsic motivation, the findings suggest that extrinsic rewards negatively affect intrinsic motivation after the rewards are no longer offered. The undermining of free-choice intrinsic motivation by extrinsic rewards was evident for all rewards (d = –0.28), tangible rewards (d = –0.39), and expected rewards (d = –0.41). More specifically, extrinsic rewards undermine free-choice intrinsic motivation when rewards are contingent on task engagement (d = –0.42), task completion (d = –0.48), or task performance (d = –0.24). Results show nonsignificant effects for free-choice intrinsic motivation when rewards are given unexpectedly (d = –0.04), not tied to doing a specific task (d = 0.10), or given as negative verbal feedback (d = –0.52). The only clear enhancement effect is evident for positive feedback (d = 0.33), albeit age moderates this effect.

For the meta-analysis on self-reported interest/enjoyment, the results generally do not provide compelling support for the enhancement effect or the undermining effect of extrinsic rewards on intrinsic motivation. Overall, the results show weaker mean effects, albeit the general pattern of effects is similar to the analysis of free-choice intrinsic motivation. The only statistically significant positive outcomes are evident for positive feedback (d = 0.26) and performance-contingent rewards (d = 0.11), while engagement-contingent rewards represent the only reward contingency to undermine self-reported interest and enjoyment (d = –0.16). Notably, age moderates this negative effect.

For the meta-analysis of observational studies, no significant overall level association was found for the relationship between extrinsic rewards and intrinsic work motivation. More specific analyses showed that self-reported positive feedback and base salary (i.e., task-noncontingent rewards) were positively associated with self-reported intrinsic work motivation (r = 0.19 and r = 0.19, respectively). The relationship between intrinsic work motivation and performance-based rewards (PBRs) was nonsignificant (r = 0.05) and extremely heterogeneous. A supplementary analysis revealed a weak negative mean correlation for the PBRs–intrinsic work motivation relationship when PBRs were perceived as more controlling than informational (r = –0.10).

Overall, this doctoral dissertation's findings support the conclusion that contingent extrinsic rewards can and do undermine intrinsic motivation. The negative effects are most readily observable when given rewards are contingent on doing something, and intrinsic motivation is assessed behaviorally after rewards are no longer offered. However, it is important to note that reward effects are partially dependent on how intrinsic motivation is measured (behavioral vs. self-report), the type of reward contingency and reward, and the context in which the extrinsic rewards–intrinsic motivation relationship is examined (laboratory vs. organizational). All three meta-analyses suggest that positive feedback can enhance intrinsic motivation and that task-noncontingent rewards are not harmful to intrinsic motivation. All in all, the results clearly support the postulates of cognitive evaluation theory.

As well as the meta-analytical contribution of this doctoral thesis, this thesis contributes to the research on intrinsic motivation by identifying significant future research avenues and potential methodological issues within both fields of research. Likewise, this study identified major theoretical differences between experimental and organizational studies that help explain why rewards' effects are stronger in experimental settings. These include the measurement of intrinsic motivation at different levels of generality (task-/situation specific vs. domain), the timing of intrinsic motivation assessment, the assessment of the effects of reward attainment versus reward expectancy, and the time lag between doing the task and receiving the promised reward. This thesis helps one understand and potentially explain why these two research fields may produce partially mixed findings by underscoring major theoretical differences between controlled laboratory experiments and studies conducted in organizational settings. Overall, this thesis contributes by helping one understand under what circumstances and populations extrinsic rewards will most likely yield negative or positive effects on intrinsic motivation. Moreover, this study highlights the inherent complexities associated with studying the effects of rewards on intrinsic motivation that should be taken into account.

KEYWORDS: Intrinsic motivation, extrinsic rewards, undermining effect, meta-analysis, cognitive evaluation theory

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TIIVISTELMÄ

Sisäinen motivaatio – eli jonkin asian tekeminen, koska sen tekeminen itsessään on kiinnostavaa, nautinnollista ja hauskaa – toimii toimintamme tärkeänä energisoijana. Vaikka sisäistä motivaatiota ja siihen vaikuttavia tekijöitä on tutkittu jo useamman vuosikymmenen ajan, tutkimuskentällä vallitsee kiistaa siitä, miten ulkoiset palkkiot vaikuttavat yksilön sisäiseen motivaatioon. Alkujaan psykologian ja sittemmin myös organisaatiokäyttäytymisen tutkimuskentällä on käyty debattia siitä, heikentävätkö ulkoiset palkkiot yksilön sisäistä motivaatiota, ja jos heikentävät, niin missä tilanteissa. Tämä kiista juontaa juurensa Edward Decin (1971) tutkimukseen, joka osoitti ulkoisten palkkioiden voivan heikentää yksilön sisäistä motivaatiota.

Vaikka edellä mainittu kiista on jo vanha, jatkuu se edelleen, koska tutkijat eivät ole saavuttaneet konsensusta asiasta. Konsensuksen puutteen voi nähdä kumpuavan osittain aikaisemmin tehtyjen meta-analyysien paikoitellen ristiriitaisista tuloksista. Vaikka jotkin aikaisemmat kokeellisiin laboratoriotutkimuksiin pohjaavat meta-analyyttiset tutkimukset ovat antaneet vahvaa tukea ulkoisten palkkioiden sisäistä motivaatiota heikentävästä vaikutuksesta (esim. Deci ym., 1999a), toiset meta-analyyttiset tutkimukset ovat päätyneet hyvin erilaisiin lopputuloksiin (esim. Cameron ym., 2001). Sitä vastoin aihetta käsittelevän meta-analyyttisen tutkimuksen puute organisaatiokäyttäytymisen tutkimuskentällä on heikentänyt ymmärrystämme sisäisen motivaation mahdollisesta heikentymisestä työkontekstissa. Osittain tämän takia osa alan tutkijoista ei ole antanut painoarvoa mahdollisille haittapuolille, jotka aiheutuvat työntekijöiden motivoinnista ulkoisin palkkioin.

Edellä mainituitten tekijöjen takia selvyys siitä, miten ulkoiset palkkiot vaikuttavat yksilön sisäiseen motivaation on edelleen kiistelyn kohteena. Pohjautuen kognitiivisen arvioinnin teoriaan (Deci & Ryan, 1985) sekä Decin, Koestnerin ja Ryanin (1999a) meta-analyyttiseen tutkimukseen, tämän väitöskirjan tarkoituksena on tuoda selvyyttä tähän kiistaan. Tähän tavoitteeseen pyritään analysoimalla meta-analyyttisesti ulkoisten palkkioiden vaikutusta yksilön sisäiseen motivaation niin kokeellisten laboratoriotutkimusten kuin organisaatiokonteksteissa toteutettujen ei-kokeellisten tutkimusten konteksteissa. Tämän väitöskirjan tarkoituksena on tutkia erityisesti kiistan keskiössä olevaa ehdotusta siitä, että ehdollisesti annetut palkkiot heikentävät sisäistä motivaatiota. Tämä väitöskirjan keskeiset tutkimuskysymykset ovat seuraavat:

1. *Missä palkkio-olosuhteissa ja populaatioissa ulkoisilla palkkioilla on negatiivinen vaikutus, ei vaikutusta tai positiivinen vaikutus sisäiseen*

motivaatioon kontrolloiduissa laboratoriotutkimuksissa, ja mikä on tämän vaikutuksen voimakkuus?

2. *Mikä on ulkoisten palkkioiden ja sisäisen työmotivaation välinen yhteys työkontekstissa ja kuinka voimakas tämä yhteys on?*

Näihin kysymyksiin vastaamiseksi julkaistuja tutkimuksia etsittiin systemaattisella haulla seitsemästä eri tietokannasta. Yhteensä 158 vertaisarvioitua tieteellistä artikkelia täytti tutkimuksille asetetut sisällyttämiskriteerit. Tähän aineistoon pohjautuen toteutettiin kolme pääasiallista meta-analyysiä hyödyntäen satunnaisvaikutusten mallia. Analyysin toteutuksessa seurattiin Decin ym. (1999a) käyttämää hierarkkista analyysitapaa. Palkkioiden vaikutusten analysointi aloitettiin selvittämällä kaikkien palkkioiden kokonaisvaikutusta sisäiseen motivaatioon. Tämän jälkeen analyysissä siirryttiin analysoimaan spesifisempiä vaikutuksia. Palkkion tyyppiä sekä palkkio-olosuhdetta hyödynnettiin moderaattorimuuttujina.

Kaksi suoritettua meta-analyysiä tutki palkkioiden kausaalista vaikutusta yksilön sisäiseen motivaatioon. Aineistona näissä kahdessa analyysissä toimi 142 satunnaistettua kontrolloitua laboratoriotutkimusta, jotka oli poimittu 125:stä julkaistusta tieteellisestä artikkelista. Tutkimuksen selitettävinä muuttujina toimivat yksilön sisäisesti motivoitunut käyttäytyminen vapaan valinnan tilanteessa sekä itsearvioitu tehtävän kiinnostavuus. Kolmas meta-analyysi pohjasi puolestaan työkontekstissa tehtyihin havaintotutkimuksiin. Tavoitteena oli tutkia ulkoisten palkkioiden ja itsearvioidun sisäisen työmotivaation välistä yhteyttä. Analyysiin sisällytettiin yhteensä 42 riippumatonta otosta 35:stä julkaistusta tieteellisestä artikkelista.

Tutkimuksen tulokset indikoivat ulkoisilla palkkioilla olevan kokonaisvaltainen negatiivinen vaikutus yksilön sisäisesti motivoituneeseen käyttäytymiseen kokeellisissa tutkimuksissa, kun palkkioita ei ole enää tarjolla. Sisäisesti motivoituneen käyttäytymisen heikentyminen on nähtävillä kaikkien palkkioiden (d = –0.28), konkreettisten palkkioiden (d = –0.39) kuin odotettujen palkkioiden kohdalla (d = –0.41). Ulkoiset palkkiot heikentävät sisäisesti motivoitunutta käyttäytymistä erityisesti silloin, kun palkkioiden saaminen on riippuvaista tehtävän tekemisestä (d = –0.42), tehtävän valmistumisesta (d = –0.48) tai hyvästä suoriutumisesta tehtävässä (d = –0.24). Tulokset osoittivat puolestaan, että annetuilla palkkioilla ei ole tilastollisesti merkitsevää vaikutusta yksilön sisäisesti motivoituneeseen käyttäytymiseen, kun palkkio annetaan odottamattomasti (d = –0.04), palkkion saaminen ei ole riippuvaista tehtävän tekemisestä (d = 0.10) tai se annetaan negatiivisen verbaalisen palauteen muodossa (d = –0.52). Ainoastaan positiivisen palautteen tapauksessa ulkoinen palkkio vahvistaa sisäisesti motivoitunutta käyttäytymistä (d = 0.33), joskin vaikutuksen voimakkuus on riippuvaista iästä.

Itsearvioidun tehtävän kiinnostavuuden osalta meta-analyyttiset tulokset eivät anna tukea palkkioiden sisäistä motivaatiota vahvistavalle tai heikentävälle vaikutukselle. Kokonaisuudessaan ulkoisten palkkioiden vaikutukset itsearvioituun kiinnostukseen ovat vähäisempiä kuin sisäisesti motivoituneen käyttäytymisen kohdalla, joskin vaikutusten yleinen kaava on samansuuntainen. Ainoat tilastollisesti merkitsevät positiiviset vaikutukset ovat nähtävillä positiiviselle palautteelle (d = 0.26) sekä suoriutumisesta riippuville palkkioille (d = 0.11). Tehtävän tekemisestä riippuvat palkkiot muodostavat puolestaan ainoan palkkiotyypin, jolla on itsearvioitua sisäistä motivaatiota heikentävä vaikutus (d = –0.16). On kuitenkin huomioitava, että vaikutus on riippuvaista iästä.

Havaintotutkimuksiin pohjautuva meta-analyysi indikoi, ettei ulkoisten palkkioiden ja sisäisen työmotivaation välillä ole yleistason yhteyttä. Tarkemmat analyysit osoittavat kuitenkin sen, että itsearvioidun positiivisen palautteen ja sisäisen työmotivaation ($r = 0.19$) sekä pohjapalkan määrän ja sisäisen työmotivaation ($r = 0.19$) välillä on tilastollisesti merkitsevät positiiviset yhteydet. Sen sijaan meta-analyysin tulokset indikoivat, ettei suoriutumiseen sidottujen palkkioiden ja sisäisen työmotivaation välillä ole tilastollisesti merkitsevää yhteyttä ($r = 0.05$). Lisäksi tulokset indikoivat, että näiden kahden muuttujan välinen yhteys on erittäin heterogeeninen. Suoritettu lisäanalyysi osoittaa, että suoriutumiseen sidottujen palkkioiden ja sisäisen työmotivaation välillä on tilastollisesti merkitsevä negatiivinen yhteys ($r = –0.10$), kun edellä mainituilla palkkioilla koetaan olevan voimakkaampi toimintaa kontrolloiva kuin informatiivinen (palautetta viestivä) psykologinen merkitys.

Kokonaisuudessaan tämän väitöskirjan tulokset antavat tukea johtopäätökselle, että ehdollisesti annetut palkkiot voivat heikentää yksilön sisäistä motivaatiota. Tämä negatiivinen vaikutus on nähtävillä selkeimmin palkkioiden ollessa tavalla tai toisella riippuvaisia tehtävän tekemisestä, ja kun sisäisen motivaation arviointi pohjautuu käyttäytymisen havainnointiin tilanteessa, jolloin palkkioita ei ole enää saatavilla. On kuitenkin tarpeellista huomioida, että palkkioiden vaikutukset ovat osittain riippuvaisia siitä, miten sisäinen motivaation on operationalisoitu (käyttäytyminen vs. itsearvio), annettavan palkkion tyypistä ja sen saamisen ehdollisuudesta sekä kontekstista, jossa ulkoisten palkkioiden ja sisäisen motivaation välistä vuorovaikutusta tutkitaan (laboratorio vs. organisatorinen). Mielenkiintoisesti kaikki kolme suoritettua meta-analyysiä indikoivat positiivisen palautteen vahvistavan sisäistä motivaatiota, ja että tehtävästä riippumattomat palkkiot eivät heikennä sisäistä motivaatiota. Kokonaisuudessaan tulosten voidaan nähdä antavan tukea kognitiivisen arvioinnin teorialle.

Näiden lisäksi tämä väitöskirja kontribuoi motivaation tutkimuskenttään tunnistamalla metodologisia heikkouksia ja jatkotutkimusmahdollisuuksia niin kokeellisen psykologian kuin organisaatiokäyttäytymisen tutkimuskentillä. Lisäksi tässä väitöskirjassa tunnistettiin merkittäviä teoreettisia eroja kontrolloitujen laboratoriotutkimusten ja organisaatiokontekstissa suoritettavien havaintotutkimusten välillä, jotka auttavat ymmärtämään sitä, miksi palkkioiden vaikutukset sisäiseen motivaatioon ovat voimakkaampia tutkittaessa ilmiötä kontrolloidulla koeasetelmalla. Tunnistetut erot liittyvät sisäisen motivaation mittaamiseen toiminnan yleisyyden eri tasoilla (tehtävä/tilannekohtainen motivaatio vs. kontekstisidonnainen motivaatio), sisäisen motivaation arvioinnin ajankohtaan, palkkioon todelliseen saamiseen sekä aikaviiveeseen tehtävän tekemisen ja siitä saatavan palkkion välillä. Erojen huomioiminen ja ymmärtäminen näiden kahden tutkimuskentän välillä auttaa ymmärtämään, miksi nämä kaksi tutkimustapaa saattavat tuottaa osittain erilaisia tuloksia. Kokoisuudessaan tämän väitöskirjan kontribuutio liittyy ymmärryksen luomiseen siitä, missä olosuhteissa sekä ryhmissä ulkoisilla palkkioilla on todennäköisesti negatiivisia tai positiivisia seurauksia yksilön sisäiseen motivaatioon. Lisäksi tämä tutkimus ilmentää ulkoisten palkkioiden ja sisäisen motivaation keskinäisen vaikutussuhteen tutkimiseen liittyvää monimutkaisuutta, joka tulisi ottaa huomioon tulevissa tutkimuksissa.

ASIASANAT: Sisäinen motivaatio, ulkoiset palkkiot, sisäisen motivaation heikentyminen, meta-analyysi, kognitiivisen arvioinnin teoria

Acknowledgements

I took the first steps of my PhD journey many years ago while I was pondering a suitable topic for my bachelor's thesis. For some unknown reason, I found the topic of motivation especially intriguing and fascinating. This fascination with understanding human motivation or "what makes us tick" has continued to fuel my curiosity, eventually leading me to embark on my quest for a PhD. This journey has been interesting, suspenseful, challenging, and occasionally quite frustrating. However, my ultimate feeling is that the journey has been extremely intrinsically rewarding. I have been fortunate to have the opportunity to do a job I genuinely enjoy doing. As in many cases, this journey and its outcome—this doctoral thesis—would not have been possible without the support and encouragement of many.

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Helsinki, 14.12.2022
Aki Lehtivuori

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1 Introduction

For 50 years, scholars have investigated and debated the effects of extrinsic rewards on intrinsic motivation. Since the early 1970s, an ongoing debate concerning the possibility that extrinsic rewards might damage intrinsic motivation has raged. Many scholars have participated in this debate either empirically or theoretically (e.g., Bruno, 2013; Calder & Staw, 1975b; Cameron et al., 2001; Cameron & Pierce, 1994; Deci, 1971, 1976; Deci et al., 1999a; Deci & Ryan, 1985; Dickinson, 1989; Eisenberger & Cameron, 1996; Gerhart & Fang, 2014; Goswami & Urminsky, 2017; Guzzo, 1979; Hendijani et al., 2016; Lepper et al., 1973; Parker et al., 2017; Reiss, 2013; Reiss & Sushinsky, 1975; W. E. Scott, 1976). This controversial suggestion was first empirically explored by Deci (1971, 1972a, 1972b), Kruglanski, Friedman, and Zeevi (1971), and Lepper, Greene, and Nisbett (1973), who showed that extrinsic rewards given for doing an inherently interesting activity could undermine a person's interest in the task. The negative effect of extrinsic rewards on intrinsic motivation is commonly known as the *undermining effect* (Deci, 1975), the *overjustification effect* (Lepper et al., 1973), or the *crowding-out effect* (Frey & Jegen, 2001), depending on the theoretical framework used.

Due to the controversial nature of the claim that extrinsic rewards might be motivationally unbeneficial, this suggestion led to many subsequent studies that either replicated the initial findings (e.g., R. Anderson et al., 1976; Daniel & Esser, 1980; Greene & Lepper, 1974) or failed to replicate them (e.g., Arnold, 1976, 1985; Brennan & Glover, 1980; Feingold & Mahoney, 1975; Hamner & Foster, 1975). Moreover, these early studies started a heated debate in the field of psychology between the "intrinsic motivation theorists" (Deci, 1975; Deci et al., 1999a, 1999b; Deci & Ryan, 1985; Lepper et al., 1973; Lepper & Greene, 1975; Lepper & Henderlong, 2000) and those advocating behaviorism (Blocker & Edwards, 1982; Cameron et al., 2001; Dickinson, 1989; Eisenberger & Cameron, 1996; Flora, 1990; Flora & Flora, 1999; Reiss, 2013; Reiss & Sushinsky, 1975), which continues even today (see Akin-Little & Little, 2009; Festré & Garrouste, 2015; Gerhart, 2017; Goswami & Urminsky, 2017; Peters & Vollmer, 2014).

Despite being on "hiatus" for some time, the debate (and the field of research) has become livelier in recent years. Among others, recent experimental research has

addressed issues such as reward timing (Woolley & Fishbach, 2018), reward salience (Hendijani & Steel, 2020), the longevity of effects of repeatedly given rewards (Goswami & Urminsky, 2017), the role of causality orientations (Hagger et al., 2015; Hagger & Chatzisarantis, 2011), and the effect of task-congruent rewards (Marinak & Gambrell, 2008; Steiner, 2011). It is also notable that scholars outside the realm of experimental psychology have become interested in studying the extrinsic rewards–intrinsic motivation relationship. Research stemming from the fields of economics, industrial and organizational psychology, and organizational behavior have begun to emerge in recent years at a quickening pace (see, e.g., Bruno, 2013; Fang & Gerhart, 2012; Frey & Jegen, 2001; Hewett & Leroy, 2019; Kuvaas et al., 2020; Thibault Landry et al., 2019).

Although well over 150 studies have investigated this issue, including several direct meta-analyses (Cameron et al., 2001; Cameron & Pierce, 1994; Deci et al., 1999a; Eisenberger, Pierce, et al., 1999; Eisenberger & Cameron, 1996; Rummel & Feinberg, 1988; S. Tang & Hall, 1995) and indirect ones (Cerasoli et al., 2014, 2016; Kim et al., 2022; Weibel et al., 2010), the debate remains somewhat unresolved. Both empirical studies and meta-analyses have produced somewhat unequivocal and partially contradictory results. For example, the results of a widely cited meta-analysis by Deci et al. (1999a) showed that extrinsic rewards tend to undermine intrinsic motivation when they are expected and contingent on doing or completing a task or performing well at a task while having no effect when the rewards are given unexpectedly or unlinked to doing any specific activity. Similarly, earlier meta-analytical studies by Tang and Hall (1995) and Rummel and Feinberg (1988) reported the undermining of intrinsic motivation by contingent rewards.

In contrast, several meta-analyses by Cameron and her colleagues (Cameron et al., 2001; Cameron & Pierce, 1994; Eisenberger, Pierce, et al., 1999; Eisenberger & Cameron, 1996) have reached somewhat different conclusions. For example, Eisenberger and Cameron (1996) argued that the undermining of intrinsic motivation by extrinsic rewards is largely a myth, concluding that the detrimental effects can be easily avoided. In Cameron et al.'s (2001) most recent meta-analytical study, they failed to find many of the negative effects that Deci et al. (1999a) reported, leading Cameron et al. (2001, p. 1) to conclude that "*the pattern of results indicates that reward contingencies do not have pervasive effects on intrinsic motivation.*"[1] Hence, ambiguity and disagreement remain under what circumstances extrinsic rewards will have detrimental or positive effects on intrinsic motivation.

[1] Meta-analyses by Cameron and colleagues have spurred a great deal of criticism due to methodological problems (see Ryan & Deci, 1996; Lepper, 1995; Lepper et al., 1996; Deci et al., 1999b; Hennessey & Amabile, 1998; Lepper et al., 1999).

Moreover, considerable disagreement exists about methodological, experimental, theoretical, and philosophical issues. For example, many behaviorists remain skeptical, claiming this so-called detrimental effect of extrinsic rewards is largely a myth and argue that studies demonstrating decreased intrinsic motivation by administering extrinsic rewards contain many methodological flaws (Carton, 1996; Carton & Nowicki, 1998; Flora, 1990; Guzzo, 1979; Mawhinney, 1979, 1990; Reiss, 2005, 2013).

Besides, some doubts exist about the ecological validity and practical relevance of these findings, as well as disagreement about the generalizability of the detrimental effects of extrinsic rewards to real-world settings among the debate's different factions. While behavioral-oriented scholars (e.g., Bates, 1979; Eisenberger, Pierce, et al., 1999; Eisenberger & Cameron, 1996; Jovanovic & Matejevic, 2014) generally dispute or downplay the practical relevancy of the undermining effect in applied settings, intrinsic motivation scholars view that the experimental results have significant practical relevancy (Deci et al., 1999a; Deci, Ryan, et al., 2001; Morgan, 1984).

While the debate on the existence and generalizability of the undermining effect has mostly been limited to experimental psychology, during the past two decades, several compensation scholars (e.g., Bartol & Locke, 2000; Gerhart, 2017; Gerhart & Fang, 2014, 2015; Gupta & Shaw, 1998; Shaw & Gupta, 2015) have become increasingly critical towards the undermining effect and especially questioned whether experimental findings have any relevance regarding everyday work-life. The presented critique is commonly aimed at the nature of experimental tasks (e.g., solving puzzles), which do not represent typical work activities either concerning task duration or task content (Gerhart & Fang, 2014; Gerhart & Rynes, 2003).

Furthermore, some scholars argue that the phenomenon of undermining effect carries scant relevance to the actual work context because jobs are often boring, meaning not intrinsically motivating (Donovan, 2001, p. 61; A. H. Kunz & Pfaff, 2002). In turn, Latham (2012, p. 107) has argued that the concept of intrinsic motivation and the predominant way of measuring it in experimental settings using a measure of free-choice persistence when rewards have been removed are rather irrelevant to organizational settings because workplaces contain many extrinsic constraints and motivators (e.g., deadlines, imposed standards and incentives). Moreover, Donovan (2001, p. 61) argues that the possible decrease in intrinsic motivation due to reward administration is irrelevant in the work context because providing extrinsic rewards would increase extrinsic motivation, thus nullifying this adverse effect (see also Gerhart & Fang, 2014).

As the preceding discussion implies, the debate on the interaction between extrinsic rewards and intrinsic motivation seems all but settled, partly because the field of inquiry has failed to provide a clear viewpoint and conditions concerning the

possible negative or positive impact of extrinsic rewards on intrinsic motivation. As such, the impact of extrinsic rewards on intrinsic motivation remains, at least partially, unresolved.

The importance of studying this phenomenon is emphasized because intrinsic motivation operates as a natural and innate energizer of many human behaviors (Ryan & Deci, 2017). As well as being associated with many positive outcomes that are typically valued by current societies, such as better academic achievement (Howard et al., 2021) and performance across various domains of life (e.g., work) (Cerasoli et al., 2014; Van den Broeck et al., 2021; Weibel et al., 2010), the importance of intrinsic motivation is also underlined by the fact that being intrinsically motivated is an enjoyable state in and of itself (Ryan & Deci, 2017, p. 173). By trying to motivate employees and students to work hard via extrinsic incentives, we may end up in a situation in which we have unintentionally damaged our innate and volitional tendency and desire that drives us to seek and conquer challenges, to improve and exercise our skills, learn, and explore new things (Ryan & Deci, 2000a, p. 70).

Due to the conflicting views and mixed results, there is an evident need for a new meta-analysis that synthesizes current knowledge and clarifies those conditions in which reward typically enhances or undermines intrinsic motivation. Moreover, as previous meta-analyses have concentrated exclusively on experimental laboratory studies, there is a need for a new meta-analysis that examines and synthesizes (nonexperimental) evidence from organizational settings. By quantitatively synthesizing the evidence stemming from controlled experimental studies and organizational settings, this doctoral thesis aims to create a more extensive review of the literature, thus advancing our understanding of how extrinsic incentives affect intrinsic motivation in different settings. This thesis draws especially on cognitive evaluation theory (Deci & Ryan, 1985) to understand the effects of extrinsic rewards on intrinsic motivation and the psychological processes underlying the extrinsic rewards–intrinsic motivation relationship.

The main purpose of this thesis is to identify under what reward contingencies and populations extrinsic rewards will have a negative, neutral, or positive effect on intrinsic motivation and assess the magnitude of these effects. This goal will be achieved by means of a meta-analysis. Meta-analysis is a statistical method through which the results of many empirical quantitative studies can be statistically synthesized (Lipsey & Wilson, 2001). Three meta-analyses will be performed to examine the relationship between extrinsic rewards and intrinsic motivation. Two meta-analyses will be based on controlled experimental laboratory studies. Following an analysis framework set by Deci, Koestner, and Ryan (1999a), behavioral (i.e., free-choice behavior) and self-report (i.e., self-reported interest and enjoyment) measures of intrinsic motivation will be analyzed separately. The third

meta-analysis will be performed on the observational data originating solely from work settings to examine the relationship between extrinsic incentives and self-reported intrinsic work motivation.

The following chapters are structured as follows: Chapter 2 describes the concept of intrinsic motivation and presents a review of different theoretical approaches to understand rewards' effects on intrinsic motivation. Chapters 3 and 4 present research questions and methodological choices. Chapter 4 also describes the literature search, coding of studies, and utilized meta-analytical practices. Chapter 5 presents the results of meta-analyses. Finally, Chapter 6 presents a summary and discussion of the results. Future research agendas that emerged from the literature review, as well as the limitations of the conducted meta-analyses, will be discussed.

2 Theoretical frameworks

The aim of this chapter is to discuss the concept of intrinsic motivation and compile an overview of various theoretical frameworks that try to explain via what mechanisms extrinsic rewards affect intrinsic motivation. This chapter will begin by introducing the construct of intrinsic motivation. Then, a general review of the literature will be presented, and several theoretical frameworks explaining the undermining effect will be reviewed. Although the most focus will be given to the psychological explanations of the undermining effect, other theoretical explanations will also be presented. Further, the main critiques on intrinsic motivation and the undermining of intrinsic motivation by extrinsic rewards will be reviewed because understanding the critique is a prerequisite for understanding the debate. Throughout this thesis, cognitive evaluation theory (Deci & Ryan, 1985) will be used as the underlying theoretical framework for understanding the construct of intrinsic motivation and the undermining effect.

2.1 The concept of intrinsic motivation

Intrinsic motivation refers to doing activities "for their own sake" (Ryan & Deci, 2020, p. 2) because they are fun, enjoyable, and interesting (Csikszentmihalyi & Figurski, 1982, p. 27; Gagné & Deci, 2005, p. 336). In essence, intrinsic motivation means doing an activity because of the inherent satisfaction that stems from doing it. This means that intrinsic motivation is noninstrumental by nature (Ryan & Deci, 2000a, 2000b): It is energized by the satisfaction of intrinsic psychological processes or needs (DeCharms, 1983; Deci, 1975b, 1992; Deci & Ryan, 1985, 2000; White, 1959; see also Hidi & Renninger, 2006). In the literature, intrinsic motivation is typically contrasted and defined in relation to extrinsic motivation, which is instrumental by nature: The motivation to act derives from a desire to attain some extrinsic motivator (e.g., a reward) (Ryan & Deci, 2000b). For example, Deci (1971, 1976, p. 131) used this juxtaposition when he coined an initial and now widely applied operational definition of intrinsic motivation: intrinsically motivated behavior refers to a situation in which an activity is performed out of enjoyment in the absence of any apparent external rewards.

As noted above, the conceptualization of intrinsic motivation emphasizes the inherent rewarding nature of intrinsically motivated behaviors (see, e.g., White, 1959). In his seminal paper, White (1959) argued that many human behaviors are motivated by innate "energy"—competence motivation or effectance motivation—that manifests itself through explorative and playful behaviors (i.e., intrinsically motivated behaviors) (see also Deci & Ryan, 1985, p. 19). Such behaviors are rewarding in themselves and thus capable of initiating and maintaining task engagement and performance (Cerasoli et al., 2014; Deci et al., 1999a). According to White (1959, p. 297), competence refers to one's effective interaction with their environment. People have an inherent tendency to be curious, explore their environment, and experience feelings of efficacy. This is seen, for example, in children when they play and explore their environment (White, 1959). Later, Deci and colleagues (Deci, 1975; Deci & Ryan, 1980, 1985) developed White's (1959) notion of effectance motivation, conceptualizing it as a psychological need for competence. The psychological need for competence means that an individual experiences feelings of mastery regarding their interaction with the social environment (Ryan & Deci, 2017, p. 86). Seeking out and conquering optimally challenging tasks or situations satisfies the need for competence, which in turn energizes intrinsic motivation (Deci & Ryan, 1985; Ryan & Deci, 2017).

Another important and perhaps the most central psychological antecedent of intrinsic motivation is the psychological need for autonomy/self-determination or the internal perceived locus of causality (i.e., being the origin of one's behavior) (deCharms, 1983; Deci & Ryan, 1985). According to deCharms (1983, pp. 269–274), when someone experiences an internal locus of causality regarding their actions or behaviors, they feel being the origin of their behavior. In this case, intrinsic motivation is said to energize behavior (deCharms, 1983, p. 328). The concept of internal perceived locus of causality or perceived autonomy/self-determination is at the core of intrinsic motivation (deCharms, 1983; Deci et al., 1999a, 1999b; Reeve et al., 2003). One's behavior is then self-determined as the motivation for engaging in an activity is based on interest, volition, and choice (i.e., intrinsic motivation) (Deci & Ryan, 2000, pp. 233–234; Gagné & Deci, 2005, p. 333). Ryan and Deci (2000a, p. 70) elaborate that self-determination is vital for intrinsic motivation as people must feel self-determined to be intrinsically motivated.

Building on the concepts of the perceived locus of causality and effectance motivation, Deci and Ryan (1985, p. 32) provided the following definition of intrinsic motivation: "*Intrinsic motivation is based in the innate, organismic needs for competence and self-determination. It energizes a wide variety of behaviors and*

psychological processes for which the primary rewards are the experiences of effectance and autonomy."[2]

In their later work, Deci and Ryan (2000, p. 233) clarified the relationship between intrinsic motivation and basic psychological needs by pointing out that although basic psychological needs must be satisfied to maintain intrinsic motivation, the goal of intrinsically motivated behavior is not necessarily the satisfaction of needs for autonomy and competence *per se*. As Deci and Ryan (2000, p. 233) elaborate, when a person is intrinsically motivated, they freely and volitionally engage in a particular activity *out of interest.*

Focusing on psychological processes (e.g., curiosity, the satisfaction of basic psychological needs) as the energizers of volitional behavior is one aspect that differentiates intrinsic motivation, for example, from traditional drive theories; drive theories assume motivation to be initiated by different physiological drives (e.g., hunger, thirst) (Beswick, 2017, p. 28; Ryan & Deci, 2017, pp. 111–112; Seward, 1956; for a review, see Beckmann & Heckhausen, 2018, pp. 113–129). Unlike physiological drives, which are cyclical by nature as they stop motivating behavior when satisfied, intrinsic motivation is postulated as ongoing and continuous psychological process (Deci & Ryan, 1985, pp. 12, 32, 232–236; White, 1959, p. 321). The emphasis on psychological processes also differentiates intrinsic motivation from a behavioristic viewpoint that stresses that motivation results from past or present reinforcing contingencies in one's environment (Guzzo, 1979; W. E. Scott, 1976; White, 1959). Moreover, the intrinsic motivation paradigm provides quite a different perspective on human motivation than many management, compensation, and economic theories of human behavior do. These theories (e.g., expectancy theory, agency theory) hold a view that extrinsic incentives are the primary motivators of human behavior (Fall & Roussel, 2014, pp. 199–208)[3].

Somewhat similar to Deci's (1971, 1976) initial operationalization of intrinsic motivation, early research by Lepper and colleagues (Lepper et al., 1973, pp. 129–130; Lepper & Greene, 1975, pp. 479–480) emphasized the role of internal motivational processes that motivate behavior in the absence of extrinsic contingencies. Lepper and his colleagues' (1973) definition emphasizes the importance of an attribution process. A person infers their reason for doing an activity by examining the social environment for possible external contingencies that

[2] More recent theoretical and empirical research on intrinsic motivation has acknowledged the psychological need for relatedness as an antecedent of intrinsic motivation (Deci & Ryan, 2000; Van den Broeck et al., 2016).

[3] This can be seen, for example, in Vroom, Porter, and Lawler's (2005) review of expectancy theories: although recognizing that intrinsic rewards (i.e., intrinsic motivation) can motivate behaviors, the discussion revolves almost entirely around extrinsic incentives.

could explain their behavior. In the absence of salient extrinsic contingencies, the behavior will be attributed to internal causes (i.e., interest). In contrast, the behavior will be attributed to extrinsic causes when a strong extrinsic reason can explain engagement in the task.

A more recent theoretical account of intrinsic motivation comes from Kruglanski et al. (2018) and Shah and Kruglanski (2000), who proposed a means-ends fusion theory of intrinsic motivation[4]. In essence, the theory postulates that intrinsically motivated behaviors are those in which the activity and its goal (attainment) are fused: engagement in the activity is argued to represent goal attainment; therefore, the activity and goal are inseparable (Kruglanski et al., 2018, p. 167; Shah & Kruglanski, 2000, pp. 107, 117). The activity and its goal are thus "inextricably interwoven" (Kruglanski et al., 2018, p. 171). Kruglanski et al. (2018) also hypothesize that when another goal (e.g., extrinsic reward) is brought into a realm of already intrinsically motivated activity, this new goal will affect intrinsic motivation via two mechanisms: First, a new and separate goal, such as a reward, can dilute the association (i.e., the perceived fusion between an activity and its goal) between the original goal and the activity, thus decreasing intrinsic motivation; second, Kurglanski et al. (2018) suggest that this new goal can enhance the total value a person attaches to the activity. This attachment happens via a mechanism called the transfer effect. According to Kruglanski et al. (2018), the net motivational effect of adding a new goal and then withdrawing it depends on the relative dominance of the dilution effect and transfer effect.

Overall, different definitions of intrinsic motivation seem to share some common characteristics. Kunz and Pfaff (2002, p. 280) elaborate that most definitions of intrinsic motivation seem to emphasize at least one of the following aspects:

1. Intrinsic motivation is an internal psychological energizer of behavior.
2. Intrinsic motivation is noninstrumental by nature.
3. Intrinsic motivation is associated with positive affective experiences.

First, intrinsic motivation is typically considered a psychological energizer of volitional behavior originating within an individual (Deci & Ryan, 1985; A. H. Kunz & Pfaff, 2002). Factors such as curiosity (Beswick, 2017, p. 64; Silvia, 2019, p. 159) and novelty (Reeve, 1989; White, 1959) are often portrayed as central components of intrinsically motivated activities. Second, intrinsically motivated behavior does not aim at getting some separable outcome (e.g., reward), as doing or engaging in the activity is intrinsically rewarding (Beswick, 2017, p. 64; Deci & Ryan, 2000; A.

[4] See also Fishbach and Woolley (2022) for a discussion on the means-end fusion model of intrinsic motivation.

H. Kunz & Pfaff, 2002, p. 281; White, 1959; cf. Kruglanski et al., 2018). Thus, this type of behavior lacks extrinsic instrumentality (Ryan & Deci, 2000b). Finally, positive affective experiences or emotions such as interest, satisfaction, and enjoyment are integral parts of intrinsic motivation, and these feelings are experienced during intrinsically motivated activities (Deci & Ryan, 1985; Isen & Reeve, 2005; Reeve, 1989; Silvia, 2006; Thoman et al., 2017). This is exemplified, for example, by Sansone and Smith's (2000, pp. 343, 345) view of intrinsic motivation that emphasizes the affective component of intrinsically motivated behaviors. As Sansome and Smith (2000, p. 345) point out, when engaged in an intrinsically motivated activity, "…*the general affective tone is positive*." However, Deci (1987) remarks that differentiating the psychological mechanism energizing intrinsic motivation (i.e., need for autonomy and competence) from positive emotional consequences (e.g., feeling of excitement) that derive from or are accompanied by intrinsically motivated behaviors is important.

Despite being a focal theoretical construct, surprisingly few authors have tried to explore or advance theoretical understanding of intrinsic motivation *per se* in the field of inquiry (i.e., the research field studying the effects of extrinsic rewards on intrinsic motivation). However, some authors have tried (see, e.g., Arkes, 1978, 1979; Boggiano et al., 1982; Deci, 1975, 1976; Deci & Ryan, 1980; Harackiewicz & Manderlink, 1984; Houlfort et al., 2002; Sansone et al., 1989; Vallerand & Reid, 1984). While Arkes (1978, 1979) and Boggiano et al. (1982) emphasize feelings of competence or mastery as the central psychological component of intrinsic motivation, Harackiewicz and Manderlink (1984) suggested that competence valuation (i.e., the subjective importance of doing well at a task) is a determinant of intrinsic motivation. Houlfort et al.'s (2002) more recent work investigated the role of affective experience of autonomy, while Eisenberger and Aselage (2009) concentrated their efforts on examining the performance pressure–intrinsic motivation relationship. However, most studies in the field of inquiry have not explicitly been interested in broadening the theoretical base of intrinsic motivation. The field of study has mainly adopted the operational definitions of cognitive evaluation theory (Deci & Ryan, 1985) and overjustification hypothesis (Greene et al., 1976; Lepper et al., 1973; Lepper & Greene, 1975) regarding intrinsic motivation while concentrating on examining the interaction between intrinsic motivation and extrinsic rewards.

However, other scholars outside the direct realm of the undermining effect research have provided some additional insights into the psychological and neural processes underlying intrinsic motivation (see, e.g., Abuhamdeh et al., 2015; Abuhamdeh & Csikszentmihalyi, 2012a, 2012b; Chen et al., 2001; Elliot & Harackiewicz, 1994; Hidi, 2016; Hidi & Renninger, 2006; Isen & Reeve, 2005; Kruglanski et al., 2018; Lee & Reeve, 2017; Reeve, 1989; Reeve et al., 2003;

Renninger & Stephanie Su, 2012; Thomas & Velthouse, 1990). For example, via three experiments, Reeve et al. (2003) showed that the internal perceived locus of causality and volition are the most focal and valid indicators of self-determination, while perceived choice is not. Furthermore, Reeve et al. (2003) found that a latent factor of self-determination constituting these two indicators explained a significant proportion of the variance in intrinsic motivation while the explanatory power of perceived choice was much weaker. Reeve et al.'s (2003) finding is important because some studies (e.g., Eisenberger, Rhoades, et al., 1999) have operationalized self-determination as a perceived choice when examining the effects of rewards on intrinsic motivation.

Other more recently explored psychological processes in the field of intrinsic motivation research include outcome uncertainty and suspense (Abuhamdeh et al., 2015), the type of intrinsically motivating activity (goal-directed vs. non-goal directed), immersion in the activity (Abuhamdeh & Csikszentmihalyi, 2012a, 2012b), positive affect (Isen & Reeve, 2005), and dimensions of situational interest (Chen et al., 2001), to name but a few. For example, Abuhamdeh et al. (2015) explored the role of outcome uncertainty (i.e., winning a game by a small vs. a large margin) and feelings of suspense as possible psychological processes underlying intrinsic motivation. Abuhamdeh et al.'s (2015) findings suggest that an evenly matched game (i.e., a relatively high outcome uncertainty) led to higher experienced suspense and eventually stronger intrinsic motivation than winning a game by a large margin. Abuhamdeh et al.'s (2015) findings echo a long-ago established proposition that optimally challenging tasks are most conducive to intrinsic motivation (Deci, 1976, 1992, p. 50; Deci & Ryan, 1980, p. 42).

In turn, Chen et al. (2001) examined the dimensional sources of situational interest (i.e., intrinsic motivation)[5]. By drawing partly on Deci's (1992) theoretical

[5] In recent years, a discussion has emerged in the field of motivation research that has questioned whether intrinsic motivation and interest should be treated as an integrated psychological construct or as distinct yet interrelated constructs (Hidi & Harackiewicz, 2000; O'Keefe & Harackiewicz, 2017). For instance, Hidi and Renninger (Hidi, 2000; Hidi & Renninger, 2006; Renninger, 2000) have distinguished interest from intrinsic motivation, for example, by emphasizing the dispositional and developmental aspects of interest. Hidi and Renninger (2006) have conceptualized interest as a construct having not only affective and cognitive dimensions but dimensions of knowledge and stored value. Although perceiving (and studying) intrinsic motivation and interest as separate psychological constructs have their merits, the present doctoral thesis adopts a view espoused, for example, by Deci (1992, p. 49) and Harackiewicz and Knolger (2017, p. 335), where interest is viewed to represent one aspect of intrinsic motivation or, as Harackiewicz and Knolger remark (2017, p. 335), interest is seen as a prototypical construct of intrinsic motivation. Thus, the adopted view aligns with that of Thoman, Sansone, and Geerling (2017, p. 28), who have inextricably linked the experience of interest and intrinsic motivation.

work, Chen et al. (2001) postulated a five-factor model of situational interest that included instant enjoyment, attention demand, exploration intention, challenge, and novelty as sources of situational interest. Using two samples of middle school students and a physical education context, Chen et al. (2001) tested their theoretical model, discovering that all five dimensions significantly correlated with the overall level of situational interest in physical activities[6]. Additionally, Chen et al. (2001) found that instant enjoyment of the activity was the most focal predictor of situational interest. Their results suggest that instant enjoyment operates as a mediator between the overall level of situational interest and the other postulated dimensions of situational interest. Interestingly, Chen et al. (2001) found that challenge was a substantially less important dimension than the other dimensions for experiencing situational interest and enjoyment of the activity. However, Chen et al. (2001) hypothesized that this finding might simply result from the chosen domain (viz., physical activity) because perceived challenge has been linked to the experience of interest in tasks requiring cognitive effort (see, e.g., Abuhamdeh & Csikszentmihalyi, 2012a).

2.2 Why does intrinsic motivation matter?

What makes intrinsic motivation such an important phenomenon? First of all, Ryan and Deci (2000a, p. 70) have quite eloquently described the essence of intrinsic motivation with the following phrase, highlighting the importance of this psychological phenomenon: "*Perhaps no single phenomenon reflects the positive potential of human nature as much as intrinsic motivation, the inherent tendency to seek out novelty and challenges, to extend and exercise one's capabilities, to explore, and to learn*." Another illustrative, although an anecdotal piece of evidence comes from Arthur Schawlow, who won the Nobel Prize in Physics in 1982. When asked what the difference between moderately and highly creative scientists is, he stated, "*The labor of love aspect is important. The most successful scientists often are not the most talented. But they are the ones who are impelled by curiosity*". (as cited in Amabile, 1997, p. 39.) In a way, intrinsic motivation can be seen as representing the embodiment of the human spirit (cf. Maslow, 1943): it encourages us to pursue self-realization values and develop our potential to the fullest (Waterman et al., 2008).

Because being intrinsically motivated is a rewarding experience in and of itself, it operates as an innate energizer of exploration, growth, and learning (Deci & Ryan, 2000; Silvia, 2019). Research has associated intrinsic motivation and its

[6] The proposed five-dimensional model of situational interest by Chen et al. (2001) was later replicated by Sun al. (2008), who used confirmatory factor analysis to examine the hypothesized dimensionality.

antecedents—basic psychological needs—with many positive outcomes such as high-quality performance (Cerasoli et al., 2014, 2016; Weibel et al., 2010), creativity (Amabile, 1983; de Jesus et al., 2013), selection of more challenging tasks (Shapira, 1976), high academic outcomes (Froiland & Worrell, 2016; Howard et al., 2021), general well-being, positive work behavior and work engagement (Slemp et al., 2018; Van den Broeck et al., 2016; see also Martela et al., 2022), problem-solving acumen (McGraw & McCullers, 1979), and conceptual learning (Grolnick & Ryan, 1987; Vansteenkiste et al., 2008). Howard et al.'s (2021) recent meta-analysis examined the relationship between different motivation types and student outcomes in the educational context. Regarding intrinsic motivation, Howard et al. (2021) found it to be positively associated, for example, with effort, positive affect, general satisfaction vitality, and mastery approach goals, while being negatively associated with outcomes such as anxiety, depression, and an intention to quit studies. Howard et al. (2021) also showed that intrinsic motivation was not only the strongest predictor of self-reported academic performance but the strongest positive energizer of objective academic performance.

Likewise, recent studies conducted in work settings by Kuvaas et al. (2016, 2017) showed that while intrinsic work motivation was positively associated with work performance/effort, the relationship between extrinsic motivation and work performance/effort was less positive or sometimes even negative. Similarly, Becker et al. (2018) showed in the context of scientific research that intrinsic work motivation was not only a positive predictor of the self-set difficulty level of research goals and commitment to them, it was also indirectly related to objective research productivity (see also Stupnisky et al., 2019). Finally, meta-analytical research by Van den Broeck et al. (2016) showed that the psychological antecedents of intrinsic motivation (i.e., basic psychological needs) were related to a host of positive work outcomes such as work engagement, job satisfaction, task performance, and creative performance. Also, via another meta-analysis, Van den Broeck et al. (2021) showed that intrinsic work motivation was significantly correlated with work engagement ($r = 0.61$) and performance ($r = 0.30$). Interestingly, the correlation between extrinsic work motivation (external regulation) and these two variables was much weaker ($r = 0.03$ and $r = 0.01$, respectively) and statistically significant only for the relationship between intrinsic work motivation and performance.

2.3 Criticism of the intrinsic motivation concept

As the previous section discussed, intrinsic motivation relates to many positive outcomes, especially at the individual level. However, from early on, the concept of intrinsic motivation and its various definitions have evoked criticism and even resistance, especially from the school of behaviorism but also from cognitive

motivation theorists, and organization behavior researchers (e.g., Fay & Frese, 2000; Feingold & Mahoney, 1975; Flora, 1990, 2004; Reiss, 2005; Reiss & Sushinsky, 1975; W. E. Scott, 1976). This critique continues even today (see Locke & Schattke, 2019). Because critiquing intrinsic motivation is inextricably intertwined with investigating how extrinsic rewards affect intrinsic motivation, reviewing the critique's main points is necessary. These include the vagueness of the construct, difficulty distinguishing intrinsic motives from extrinsic, the lack of a robust theoretical foundation, and the existence of intrinsic motivation as a psychological phenomenon.

Reiss (2005, 2012, 2013; Reiss & Sushinsky, 1975) has profiled himself as one of the most prominent critics of intrinsic motivation. He has criticized the common definitions of intrinsic motivation for faulty logic, not being based on robust scientific evidence, and incapable of adequately explaining why some extrinsic factors can initiate behaviors (e.g., exploration) that can be considered intrinsically motivating. In more recent work, Reiss (2012) argues that the psychological construct of intrinsic motivation lacks construct validity and has questioned the validity and reliability of behavioral measures of intrinsic motivation.

In turn, Guzzo (1979, p. 76) aimed his critique toward the commonly used definition of intrinsic motivation that Deci (1976, p. 131) coined: "*behavior is intrinsically motivated when there are no apparent external rewards.*" According to Guzzo (1979, p. 76), defining intrinsic motivation based on the absence or presence of rewards is problematic because an activity classified as intrinsically motivating can occur due to "sporadically" received rewards. Guzzo (1979) argues that verifying that intrinsic motivation has motivated a certain behavior is difficult due to the possibility that extrinsic factors might account for this behavior. Pittenger (1996) furthers this argument by stating that the environment may include reinforcing factors that have gone unnoticed, and the behavior caused by these hidden reinforcers is mistakenly interpreted as intrinsically motivated. Furthermore, Pittenger (1996) criticizes Deci's (1976) definition of intrinsic motivation because it is impossible to define in advance which behaviors will be intrinsically motivated. A diverse range of factors such as the novelty of stimuli, cognitive contingencies, self-reinforcement (Feingold & Mahoney, 1975, p. 376) or the expected benefits that will realize in the future (Cameron & Pierce, 2002, p. 40), may also cause behavior that is seemingly motivated by intrinsic interest

Unlike intrinsic motivation researchers, behaviorists view intrinsic motivation simply as an unprogrammed and unidentified external reinforcement that has not yet been identified (Horcones 1987, as cited in Skaggs et al., 1992, pp. 48–49). This view echoes a more general behavioristic view that all behaviors are based on some type of environmental stimuli produced by the external environment (Skaggs et al., 1992, p. 48; see also Flora, 1990, 2004). The most prominent advocates of

behaviorism have even gone so far as to question the scientific usefulness of the construct of intrinsic motivation. For example, Flora (1990, p. 324) has taken an extreme view. He has strongly criticized the concept of intrinsic motivation by arguing that "*intrinsic interest and its supposed undermining are hypothetical inventions that forestall scientific progress*." Flora (1990) argues that the social-cognitive version of intrinsic motivation is an irrelevant and hypothetical concept that cannot or does not explain behavior (see also Flora, 2004).

Flora (1990) suggests that a behaviorist approach, called the *matching law theory,* can better explain behavior initiated by "intrinsic motivation." In essence, the matching law suggests that each behavior has a certain probability of occurring when a suitable environmental stimulus (reinforcing event) is present. The rate of behavior will match the relative rate of this reinforcement. The probability that a certain behavior occurs depends on the relative rate of the appropriate reinforcing stimulus that maintains the desired behavior and the relative rates of other competing reinforcers in the environment. Introducing a reward acts as a competing stimulus that reduces the original stimulus' relative reinforcing properties, leading to decreased persistence in the original behavior (see also Mawhinney, 1979, 1990).

Some authors have further criticized the concept of intrinsic motivation for being vague, having ambiguous terminology, and having no clear and consistent theoretical foundation (A. H. Kunz & Pfaff, 2002, pp. 282–283; Reiss & Sushinsky, 1975). One criticism relates to the intrinsic–extrinsic motivation dichotomy. For example, Kunz and Pfaff (2002, pp. 282–283) point out that the existing theories of intrinsic motivation have failed to illustrate when a certain factor or task is either intrinsic or extrinsic, under what conditions intrinsic motivation is in danger, and what the interaction mechanisms behind extrinsic and intrinsic motivation are.

Other scholars have also criticized the intrinsic–extrinsic dichotomy. Based on Kruglanski's (1975) work, Wimperis and Farr (1979, p. 233) point out that this classification system's weakness is the apparent difficulty of distinguishing extrinsic and intrinsic motives from each other. Depending on the situation, a particular task can be classified as intrinsic or extrinsic. Another critique of the intrinsic–extrinsic motivation dichotomy relates to the circularity of argumentation and subjective nature of behavior motives (A. H. Kunz & Pfaff, 2002). Bandura (1986, as cited in A. H. Kunz & Pfaff, 2002, p. 283) has pointed out that perceiving a certain factor or activity as intrinsic or extrinsic depends on one's subjective interpretation. Thus, it is difficult to say whether a specific activity is performed for intrinsic or extrinsic

reasons[7]. Kunz and Pfaff (2002, p. 283) further point out that another prevailing theoretical framework—the overjustification hypothesis—has received somewhat similar critique from the research community. The main critique is that even if a reward is absent, such does not guarantee or mean that an individual's behavior will be intrinsically motivated because the motivation for doing something might be caused by organizational goals or social interaction.

Finally, recent work by Locke and Schattke (2019) criticizes especially self-determination theory's / cognitive evaluation theory's view of intrinsic motivation, by questioning the role of competence as an antecedent of intrinsic motivation and criticize the literature for presenting intrinsic motivation as a superior form of motivation. Locke and Schattke (2019) argue that trying to excel at some activity (i.e., feeling of competence and mastery) represents achievement motivation, so it should be separated from the concept of intrinsic motivation. Thus, Locke and Schattke (2019) suggest that intrinsic motivation's definition should be limited to activities producing hedonic enjoyment. In their reply to the presented criticism, Ryan and Deci (2019) point out many of the conceptual mistakes made by Locke and Schattke (2019). According to Ryan and Deci (2019), Locke and Schattke (2019) made mistakes in their interpretation of intrinsic motivation, based their arguments on anecdotal evidence, and omitted a large pool of scientific literature that has shown the central role of competence (and autonomy) in energizing intrinsically motivated behaviors.

As the preceding brief review of the presented critique shows, the concept of intrinsic motivation faces criticism from multiple directions. To summarize, the main pieces of critique have focused on the vague conceptualization of intrinsic motivation, the existence of intrinsic motivation, and an inability to exclude unobserved extrinsic motivators or reinforcers as energizers of intrinsically motivated behaviors. Although the presented critique is thought-provoking to some degree, the presented critique's validity is open to question, as the following discussion illustrates.

[7] Bandura (1986, as cited in A. H. Kunz & Pfaff, 2002) sees a similar deficiency in cognitive evaluation theory's concept of functional significance. CET suggests that the effect of extrinsic reward on intrinsic motivation is dependent on the relative salience of the controlling versus the informational aspect of the promised reward—how a person interprets the promised reward (i.e., its functional significance). Bandura argues that because this postulated psychological mechanism is based on subjective interpretation, CET fails to provide a clear set of objective criteria for when a reward should be experienced as informational and when it should be experienced as controlling. According to Bandura (1986), this shortcoming significantly erodes CET's capability to predict how rewards affect intrinsic motivation.

To begin with, by arguing that unidentified extrinsic motivators cause intrinsic motivation, the behaviorist approach ultimately uses tautological logic to explain behavior. The behaviorist approach succumbs to using the same logic for explaining behavior, for which it criticizes the concept of intrinsic motivation in the first place. The claim about unidentified extrinsic motivators cannot be falsified. Moreover, as Ryan and Deci (2017, p. 107) point out, the behaviorist approach has difficulties convincingly explaining those spontaneous behaviors characterized by the curiosity and exploration of new and novel situations and environments.

It is necessary to point out that by focusing on critiquing, for example, the intrinsic motivation–extrinsic motivation dichotomy, the critics of intrinsic motivation have missed a major and theoretically relevant point: that intrinsic motivation or interest is not a task's objective quality (Hidi & Renninger, 2006; Ryan & Deci, 2000b). While intrinsic motivation theorists agree that some tasks have qualities (e.g., novelty, curiosity, optimal challenges) that make them, on average, inherently interesting to most people, intrinsic motivation theorists have also recognized that a certain task may not evoke interest in everyone (O'Keefe et al., 2017; Ryan & Deci, 2000b; Silvia, 2019). Thus, intrinsic motivation research is not mostly focused on studying the objective qualities of such activities. The focus is on studying the psychological phenomenon of intrinsic motivation, the experience of intrinsic motivation, and the psychological needs and processes that energize intrinsically motivated activities (Ryan & Deci, 2000b, pp. 56–57). Indeed, many views of intrinsic motivation emphasize how an individual experiences engagement in an intrinsically motivated activity. This emphasis can be seen, for example, in the recent work by Thoman, Sansone, and Geerling (2017). Thoman et al. (2017, p. 28) suggest that intrinsic motivation should be viewed as a "phenomenological experience"; when a person's actions are energized by the anticipated, sought, or actual experiences of interest, these actions can be regarded as being intrinsically motivated. Likewise, flow theory (Csikszentmihalyi, 2014; Nakamura et al., 2019, pp. 169–171) and self-determination theory (Di Domenico & Ryan, 2017; Ryan & Deci, 2017) emphasize the importance of the subjective experience of intrinsic motivation.

Moreover, by reducing intrinsic motivation simply as a behavior governed and caused by unidentified environmental stimuli as Mawhinney (1990), Skaggs et al. (1992), and Flora and his colleagues (Flora, 1990; Flora & Flora, 1999) seem to suggest, the behavioral approach basically nullifies the intrinsic motivation concept because all possible causes of behavior lie outside the individual. Essentially, the behavioral approach advocates a view that people are nothing more than passive "mechanistic automatons" (cf. Ryan & Deci, 2017, pp. 103, 107). As Ryan and Deci (2017, p. 107) state, if one accepts the premises behaviorism advocates, the concept

of intrinsic motivation may seem like an elusive psychological phenomenon with little value or explanatory power.

Additionally, the presented criticism has difficulties accounting for, for example, recent neuroscientific findings on intrinsic and extrinsic motivation showing that these two types of motivations activate different areas of the brain (Lee & Reeve, 2017; Reeve & Lee, 2019). Likewise, an abundance of psychological research on intrinsic motivation, different types of extrinsic motivations, and the antecedents and outcomes of these different types of motivations do not support the simplistic and mechanistic view of human behavior that behaviorism seems to advocate (see, e.g., Donald et al., 2021; Howard et al., 2016; Seifert & Hedderson, 2010; Van den Broeck et al., 2016). Moreover, it is necessary to point out that the question of whether intrinsic motivation exists or not is fundamentally a philosophical question of human behavior (see Deci, 1976). As the claim about unidentified extrinsic motivators cannot be falsified, and theories acknowledging the existence of intrinsic motivation offer a more parsimonious and empirically grounded explanation for causes of human behaviors, one is left to accept the notion that intrinsic motivation exists in some form.

2.4 Understanding the effects of extrinsic rewards on intrinsic motivation — predominant theoretical frameworks

Several theoretical explanations have been suggested to explain how and why extrinsic rewards affect intrinsic motivation. Cognitive evaluation theory (CET; Deci & Ryan, 1980, 1985) is perhaps the most widely applied theoretical framework that has been developed and used to understand how and why rewards affect intrinsic motivation as they do. In addition to CET, several other theoretical frameworks and mechanisms have been suggested, such as the overjustification hypothesis (Lepper et al., 1973) and the motivation crowding theory (Frey & Jegen, 2001). Next, these theoretical frameworks will be described. Because the main goal of this thesis is to meta-analytically examine the effects of extrinsic rewards on intrinsic motivation, the following review of theoretical frameworks is not exhaustive. Thus, examining the validity of different theoretical accounts is beyond the scope of this thesis.

2.4.1 Cognitive evaluation theory

Cognitive evaluation theory (Deci & Ryan, 1985) is perhaps the most influential theory in the field of research examining how extrinsic rewards affect intrinsic motivation. Cognitive evaluation theory is built on a viewpoint that intrinsic motivation is based on the feelings of self-determination/autonomy and competence.

Autonomy and competence represent psychological processes that underlie intrinsic motivation. Deci and Ryan (1985) state that CET and its conceptualization of intrinsic motivation are mainly built on White's (1959) notion about competence motivation and deCharms (1983)[8] and Heider's (1958) theoretical notion about the perceived locus of causality[9]. Succinctly stated, CET suggests that external environment and factors (e.g., reward, evaluation, performance pressure) will affect intrinsic motivation either by thwarting or enabling the satisfaction of these psychological needs for autonomy and competence (Deci et al., 1999a, p. 628).

CET is largely based on theoretical notions of personal causation (deCharms, 1983) and competence (White, 1959) as components or underlying processes of intrinsic motivation (Deci, 1976, p. 131; Deci & Ryan, 1980). The first component of intrinsic motivation is based on White's (1959) notion of competence motivation as an energizer of human behavior. According to White (1959, p. 297), competence refers to one's natural willingness and capacity to interact efficaciously with their environment. People inherently tend to be curious, explore their environment, and experience feelings of efficacy or mastery.

Cognitive evaluation theory argues that competence—a psychological nutriment of intrinsic motivation—is based on people's natural tendency to seek optimally challenging tasks and conquer them; this process is said to be continuous (Deci, 1976, pp. 131–132; Deci & Ryan, 1985, p. 32). Factors enhancing the feeling of competence strengthen intrinsic motivation, whereas those external events that reduce the perception of one's competence undermine intrinsic motivation (Deci & Ryan, 1985, p. 63). The second psychological component of intrinsic motivation—the psychological need for autonomy/self-determination—refers to the extent to which one experiences that their behavior is volitional and self-endorsed (Ryan & Deci, 2017, p. 97). The concept of autonomy is influenced by deCharms' (1983) concept of perceived locus of causality. Cognitive evaluation theory (Deci et al., 1999a; Deci & Ryan, 1985, p. 62) asserts that people have a psychological need for self-determination. When an activity is intrinsically motivated, a person's locus of causality or reason for doing the activity is internal. However, certain external events can change the locus of causality from internal to external, inhibiting the satisfaction of self-determination and causing changes in intrinsic motivation.

[8] In their work, Deci and Ryan (1985) refer to deCharms' book published in 1968. Because the author had access only to a newer version of the book published in 1983, all references to deCharms' work will be made using the 1983 edition.

[9] See Chapter 2.1 for a discussion elaborating on the role of competence and autonomy (i.e., an internal perceived locus of causality) as psychological antecedents of intrinsic motivation.

CET has three basic premises (Ryan & Deci, 2017). First, CET proposes that to the extent an extrinsic factor (e.g., a reward) pressures a person to feel, behave, or think in a certain way, the extrinsic factor will undermine the need for autonomy and, eventually, intrinsic motivation (Deci & Ryan, 1985, p. 95). In contrast, when an external event or motivator promotes a shift towards a more internal perceived locus of causality, it can enhance experienced autonomy and, consequently, intrinsic motivation (Ryan & Deci, 2017, p. 129). The second premise of CET concerns the need for competence. As discussed above, CET suggests that an extrinsic event can affect intrinsic motivation either by satisfying or thwarting the need for competence (Ryan & Deci, 2017). The third and last premise of CET relates to the issue of functional significance—how a person will interpret an external event (e.g., reward). CET postulates that an extrinsic event or factor can be experienced as controlling or informational. The controlling aspect of an external factor causes a person to feel pressure to act, think, or feel in a certain way. This controlling aspect causes a shift in the perceived locus of causality from internal to external, thus undermining autonomy satisfaction and, eventually, intrinsic motivation. In contrast, the informational aspect[10] of an external factor can enhance intrinsic motivation if it conveys positive competence information. This can occur, for example, in the form of informational feedback. (Ryan & Deci, 2017, pp. 129–130.) However, if the external informational factor is unaccompanied by a feeling of autonomy and volition, CET predicts that the external factor cannot enhance intrinsic motivation (Ryan & Deci, 2000b, p. 58). Overall, CET emphasizes the role of the psychological meaning of an external event (Ryan & Deci, 2017, p. 159).

CET postulates that extrinsic rewards and other external events can have either a negative, positive, or neutral effect on intrinsic motivation and that the effect dependent on whether an individual perceives the reward as informational or controlling (i.e., the functional significance), as previously discussed. Whether an extrinsic reward is perceived as controlling or informational depends on the type of reward contingency and the type of given reward (Deci et al., 1999a, 2017). In general, CET argues that rewards will often undermine intrinsic motivation because they are perceived to control one's behavior, thus decreasing one's autonomy and shifting the perceived locus of causality (the reason for doing a particular activity) from internal to external. (Ryan & Deci, 2002, pp. 10–12, 2017, pp. 129–130.). However, when a reward is experienced as informational, it can enhance the need for competence and, thus, intrinsic motivation (Ryan & Deci, 2017, pp. 129–130).

[10] An event or factor can be experienced as informational when it allows choice and provides a person with relevant and useful information about their competence (Deci & Ryan, 1985, p. 96; Ryan & Deci, 2017, p. 130).

At CET's core is a proposition that controlling external factors such as rewards, surveillance, or evaluation can have a detrimental effect on intrinsic motivation. As already briefly discussed, cognitive evaluation theory suggests that external events have informational, controlling, and amotivational aspects. Depending on these aspects' relative salience, an external event (e.g., reward) will have a different impact on needs for self-determination and competence and subsequently on intrinsic motivation. (Deci & Ryan, 1985, p. 63.) The reward's controlling aspect decreases an individual's experience of self-determination, which in turn leads to diminished intrinsic motivation (Deci et al., 1999a). The undermining effect occurs because rewards start controlling one's behavior, subsequently changing the perceived locus of causality—or reason for action—from internal to external (Deci & Ryan, 1985, p. 62). CET also suggests that external factors that are informational and provide choice can increase intrinsic motivation due to enhanced feelings of self-determination and competence (Gagné & Deci, 2005). According to CET, the degree of reduction in intrinsic motivation is related to how strongly external factors tend to diminish feelings of self-determination and competence. CET states that if rewards are unexpected, unrelated to some specific task, and administered in an informative manner, they tend not to undermine intrinsic motivation because they are not considered to control behavior. Conversely, this theory predicts that task-contingent and performance-contingent rewards will lead to lower intrinsic motivation. (Deci & Ryan, 1985, pp. 75–78, 82; Gagné & Deci, 2005.)

In general, CET tends to emphasize the controlling aspect more than the informational aspect of rewards. Thus, CET is inclined to predict that the use of rewards will—in most cases—undermine intrinsic motivation, resulting in a loss of interest in the activity and leading to lower quality outcomes (Deci & Ryan, 2008).

CET also suggests that the interpersonal context can affect intrinsic motivation. First, the interpersonal context can either enhance or damage intrinsic motivation, depending on whether it is perceived as informational and autonomy-supporting, neutral, or controlling and pressuring (Deci & Ryan, 1985; Ryan & Deci, 2002). Second, the interpersonal context plays a significant role in the ultimate impact of extrinsic rewards on intrinsic motivation. The social environment can enhance or diminish the controlling aspect of an extrinsic reward. While a social context that supports autonomy can neutralize or diminish the potential negative impact of an offered reward, whereas a controlling environment can strengthen the reward's effects. (Ryan & Deci, 2002, p. 13, 2017, pp. 159–160.) The above discussion highlights the significant role that authority figures (e.g., managers, teachers) have when discussing rewards' effects on intrinsic motivation; how rewards are used moderates the reward–intrinsic motivation relationship (Ryan & Deci, 2017, p. 163).

2.4.2 Attributional accounts

Another dominant theoretical framework is Lepper, Greene, and Nisbett's (1973) overjustification hypothesis—theoretically based on Bem's (1965, 1972) work on self-perception theory and Kelley's (1973) work on attribution theory. The overjustification hypothesis proposes that an individual is intrinsically motivated to such an extent that there are no salient, unambiguous, and sufficient external contingencies that could explain their actions (Lepper et al., 1973). In the absence of those extrinsic contingencies, people attribute their behavior to internal reasons (e.g., interest) (Bem, 1972; Lepper et al., 1973). However, when an extrinsic reward is introduced into one's environment, the reward can cause a decrement in intrinsic motivation if the reward provides a sufficient and salient reason for the behavior (Lepper et al., 1973, p. 130; Lepper & Greene, 1975, p. 480; Bem, 1972, p. 39). This theory suggests that unnecessary strong extrinsic pressures will lead to a subsequent decrease in intrinsic motivation because the individual will infer that external factors motivated their action. Therefore, the likelihood of an individual engaging in this activity again without external pressure is reduced. (Lepper & Greene, 1975, p. 480.) Like CET, the overjustification hypothesis suggests that when a reward signals positive information about one's competence, it can cancel part of the negative effect the reward has on intrinsic motivation (Lepper & Henderlong, 2000, pp. 262–265).

Although the overjustification hypothesis and CET share some common features, the greatest difference between these theoretical frameworks lies in the psychological mechanisms developed to explain rewards' effects on intrinsic motivation and the timing of the motivational change process. First, while CET emphasizes that intrinsic motivation is an ongoing process that will energize behavior unless other motivational processes interrupt it (Deci, 1976; Deci & Ryan, 1985, pp. 232–234), the attribution framework postulates that the undermining or enhancement of intrinsic motivation results from *post-behavioral* inference concerning the reasons why one engaged in the activity (Deci et al., 1999a, p. 630). Second, these theoretical frameworks offer somewhat different psychological mechanisms through which extrinsic rewards are suggested to affect intrinsic motivation and upon which intrinsic motivation is based, as pointed out by Deci et al. (1999a). Unlike cognitive evaluation theory (Deci & Ryan, 1985), the overjustification hypothesis does not precisely explain on which psychological processes intrinsic motivation is built; rather, the theory emphasizes inferring one's motivation in relation to reinforcing events that exist in one's environment (Lepper et al., 1973; Morgan, 1981).

Although the overjustification hypothesis by Lepper and his associates (1973) is perhaps the most well-known attributional account of the undermining effect, some other theoretical frameworks relying on the attributional approach have been created to explain this negative effect. Such theoretical accounts include, for example,

template theory (Sandelands et al., 1983) and cognitive scripts (Morgan, 1981; Porac & Meindl, 1982). These two frameworks will be described next.

Template theory (Sandelands et al., 1983) is based on the assumption that any task structure can be viewed as having an expressive (intrinsic) or instrumental (extrinsic) template. A prototypical example of an expressive task template is play: the motivation is a result of "immediate affective responses to the task itself" (Sandelands et al., 1983, p. 238). When one engages in a task, they compare perceived task structure (template) to cognitive templates in their memory (Sandelands et al., 1983, p. 237). If the current activity is found to match an instrumental template, the task will be perceived as instrumental, and the anticipation of valued outcomes (intrinsic or extrinsic) will motivate consequent behavior (Sandelands et al., 1983, p. 237). According to template theory (Sandelands et al., 1983, pp. 243–244), motivation is based on an interpretation of an event by comparing it with existing templates or cognitive schemas. This comparison process will dictate the nature of motivation. Template theory suggests that the overjustification effect occurs because extrinsic rewards can cause an instrumental template to replace an expressive template. The theory also stresses that a task must be initially experienced as expressively structured for this to happen.

Conceptually similar to the template theory is a framework of cognitive scripts. According to Morgan (1981, p. 818), a cognitive script can be described as a routine type of information that a person has learned via observation. The function of these cognitive scripts is automatic (Morgan, 1981, p. 818). This theoretical framework suggests that a reward's effect depends on how one perceives a particular task. If an individual has previously received rewards for engaging in a boring task, they may associate those feelings of boredom with a new task. Thus, offering rewards may indicate to the individual that the new task in question is dull, unpleasant, or unattractive, subsequently weakening intrinsic motivation. (Morgan, 1981, 1984, pp. 21–22.) In a way, the framework of cognitive scripts bears some resemblance to the template theory that was described previously. Both frameworks emphasize previously formed mental schemas as a possible explanation for diminished intrinsic motivation due to reward administration.

Unlike the overjustification hypothesis, cognitive scripts and template theory have received only marginal attention in the field of inquiry, albeit some studies exist. Porac and Meindl (1982) explored the role of intrinsic and extrinsic task information (cognitive scripts) in a laboratory experiment. Porac and Meindl's (1982) study showed, among other things, that cognitive scripts influence how reward affects intrinsic motivation. Their results showed that extrinsic rewards coupled with intrinsic script/information enhanced intrinsic motivation, whereas extrinsic rewards coupled with extrinsic task-information had a significant negative effect on intrinsic interest (see also Lepper et al., 1982; Pretty & Seligman, 1984).

Although the frameworks of template theory and cognitive scripts provide intriguing accounts for the extrinsic rewards–intrinsic motivation relationship, more research would be needed to establish the validity of these theoretical accounts.

2.4.3 Behavioral theories

Reinforcement theory provides an important yet conceptually very different theoretical framework (Skinner, 1953). Reinforcement theory can be considered an umbrella framework of many theoretical accounts. Its premise lies in the basic assumption that all behavior results from some kind of external reinforcement contingencies (see, e.g., Flora, 1990). The foundations of reinforcement theory lie in Skinner's (1953) work on operant conditioning, which holds a view that external stimuli control an organism's behaviors. Theoretical frameworks relying on behaviorism assume that by rewarding a particular behavior, it is possible to reinforce or strengthen the probability or frequency that the desired behavior will happen in the future (Deci & Ryan, 1980; Skinner, 1953, p. 65). This theoretical framework is based on the notion that after a reinforcing stimulus is removed, subsequent behavior will return to the original level (i.e., the baseline) (Dickinson, 1989, p. 5; Skinner, 1953, p. 69). Thus, reinforcement theory as a whole is based on a rather different view of human beings than intrinsic motivation theories, which emphasize the role of internal states as the causes of behavior (Deci, 1976) and the inherently active nature of people (Deci & Ryan, 1985, pp. 3–4).

Although some behaviorists have either denied intrinsic motivation's existence (e.g., Flora, 1990) or heavily criticized the current conceptualizations of intrinsic motivation (e.g., Reiss, 2005, 2012, 2013), as Chapter 2.3 discussed, some behaviorists accept the idea that intrinsic motivation (i.e., intrinsic reinforcers) (e.g., Cameron & Pierce, 1994) maintains some behaviors. However, theoretical accounts based on behaviorism present the phenomenon of undermining of intrinsic motivation by extrinsic motivation in a somewhat different light.

To explain the undermining of intrinsic motivation by extrinsic rewards or extrinsic reinforcement, behaviorists have suggested alternative explanations to those discussed in previous sections for why the reinforcing power of intrinsic reinforcers might diminish (Dickinson, 1989). Explanations such as the following have been proposed to explain why withdrawing extrinsic rewards (reinforcers) might cause undesired behavioral consequences: competing reinforcement (Reiss, 2005; Reiss & Sushinsky, 1975, 1976), satiation or boredom (Bates, 1979; Peters & Vollmer, 2014; Reiss, 2005), frustration and aversive feelings (Perry et al., 1977), the optimal duration of differently reinforced behaviors (Mawhinney, 1979, 1990), sensory reinforcement (W. E. Scott, 1976), the contrast effect model (Levine et al., 1983), discrimination training effect (Carton, 1996; Carton & Nowicki, 1998),

temporal contiguity (Carton, 1996) and general interest theory (Eisenberger, Pierce, et al., 1999). However, the empirical support for these theoretical explanations is mixed at best. Next, some of the aforementioned theoretical accounts will be presented. Because this thesis aims not to provide a comprehensive review of all possible (behavioral-oriented) theoretical accounts nor assess their eligibility *per se*, the following discussion is kept concise.

The first theoretical explanation that will be discussed is the *competing response hypothesis* (Reiss & Sushinsky, 1975). The competing response hypothesis is based on the assumption that introducing a reward will create a new stimulus that will attract attention; this distraction will cause the original behavior to decrease (Reiss & Sushinsky, 1975). Reiss and Sushinky (1975, p. 1118) further elaborate with an example: When one is engaged in an activity (e.g., a child playing), introducing a reward contingency will create a competing stimulus, which in turn shifts the individual's attention to the reward. The reward thus distracts engagement in the original activity. When the reward is withdrawn, the attention that had been focused on the reward will be lost, and it will not be directed back to the initial activity. Reiss and Sushinsky (1975, p. 1118) noted that a reward might interfere with the ongoing behavior and thus cause a decline in behavior. In essence, the competing response hypothesis acknowledges that reward expectancy can decrease interest, although this phenomenon seems to occur only in a situation when a single reward is given. However, when a reward is given repeatedly, and it is contingent on behavior, the competing response hypothesis does not presume a decline in behavior. Instead, it predicts increased interest in that activity (Reiss, 2013; Reiss & Sushinsky, 1975).

Regarding the eligibility of this theoretical explanation, the competing response hypothesis has received mixed support. For example, Boggiano and Ruble's (1979) study did not support this theoretical framework. Also, Scott and Miller's (1985) results did not support the notion that competing responses would explain a rewards effect on intrinsically motivated behavior (see also Smith & Pittman, 1978).

The second explanation comes from Scott (1976) as *discriminative stimuli*. Scott (1976) has proposed that behavior can be initiated and sustained by sensory stimuli that are inherent in the task. By sensory stimuli, Scott (1976) refers to such factors that can reinforce an activity without an apparent and obvious extrinsic reinforcer. This means that environment or social context can include such a stimulus or stimuli that can maintain behavior.

This model's central tenet is that when an obscure sensory reinforcer maintains behavior, conventional reinforcement (e.g., reward administration) may act as a discriminative stimulus that is incompatible with the initial stimulus that energizes the behavior. Thus, another reinforcer may disrupt the original source of stimulus and lead to a temporary decrease in behavior. Likewise, the effect of another reinforcer may be trivial or nonexistent if the behavior occurs systemically and

continuously (i.e., at a high rate). (Scott, 1976, pp. 126–127.) Scott (1976) further suggests that so-called "intrinsically motivated" behavior is nothing more than just a type of behavior that is generated and maintained by some yet unidentified sensory stimuli that reinforce the behavior. In essence, Scott's (1976) arguments echo the same (and unfounded) critique discussed in Chapter 2.3.

The third explanation comes from Carton and Nowicki (1998), who offer a *discrimination training hypothesis* (see also Carton, 1996). This hypothesis suggests that the undermining effect might not be caused by the reward *per se*. Instead, this framework hypothesizes that the negative effect is caused by an explicit announcement that the reward is no longer available. Carton and Nowicki (1998) explain that discrimination training refers to a change in a stimulus's way of operating. Carton and Nowicki (1998) point out that normal practice in experimental studies is to inform reward group subjects when the reward will no longer be available. As a reinforcing stimulus or reward has maintained the previous task engagement, the announcement informing subjects about reward withdrawal acts as discriminative stimuli. This signals that no more reinforcement will be forthcoming; therefore, the level of subsequent behavior is reduced. If no information about reward withdrawal is given or conveyed, the undermining effect should disappear. Therefore, Carton and Nowicki (1998) argue that it is not a loss of interest that causes the undermining effect.

Although Carton and Nowicki's (1998) two experiments supported the discrimination training hypothesis, it is not without problems. Although their results indicated that subjects who were rewarded but uninformed about reward withdrawal showed better performance than the other groups during a free-choice period, their interpretation that this reflects intrinsic motivation is problematic. Because the study subjects were in no way informed that rewards would no longer be given, their reason for engaging in the activity was most likely energized by extrinsic motivation (cf. Deci et al., 1999a, p. 635; Deci & Ryan, 1980, p. 56). Moreover, Carton and Nowicki's (1998) study also replicated the undermining effect when reward withdrawal was informed. Although Carton and Nowicki (1998) addressed this issue briefly, they dismissed it and interpreted that their findings support the discrimination training hypothesis (cf. also Newman & Layton, 1984). Like many other frameworks, this theoretical explanation has not received much attention in the field of intrinsic motivation research; more research is needed to assess the value of this hypothesis. Nonetheless, some experimental and quasi-experimental studies (e.g., Brockner & Vasta, 1981; Jordan, 1986) have examined this issue and demonstrated extrinsic rewards—in some cases—can undermine interest, even if there has not been any announcement of reward withdrawal. This raises a question about the plausibility of the discrimination training hypothesis. The impact of

explicit versus vague reward withdrawal will be explored further in the meta-analytical part of this thesis[11].

As well as the behavioral accounts of the undermining effect previously discussed, Carton (1996) has suggested that the operant theory can explain previous discrepant findings related to the differing effects of praise and tangible rewards on intrinsic motivation. According to Carton's (1996) analysis, three factors can explain these findings: *Temporal contiguity*, *the number of times rewards are administered*, and the above-mentioned possibility that discriminative stimuli can account for the findings showing the undermining of intrinsic motivation by extrinsic rewards. According to Carton (1996, pp. 242–243), temporal contiguity refers to a time lag between the occurrence of behavior and subsequent reward administration. Praise is typically delivered immediately after the desired behavior has occurred (i.e., during the experimental phase), while tangible rewards are typically given only after a study subject has completed all tasks. Carton (1996, p. 243) asserts that this difference may partly explain why praise has been found to have a different impact on intrinsic motivation than tangible rewards. The second issue Carton (1996) discusses concerns the number of times rewards are typically given. Research indicates that praise is given more frequently than tangible rewards, which are usually administered only once. Carton (1996, p. 237) concludes that operant theory is not only more capable of explaining why different types of rewards have differing effects on intrinsic motivation but offers a more parsimonious explanation for these differences.

Concerning Carton's (1996) hypothesis about the time lag between task engagement and subsequent reward administration, research does not seem to provide strong support for this postulate. Some studies (Hitt et al., 1992; Sarafino, 1984) have shown that while immediately given rewards decrease intrinsic motivation, delayed rewards do not. Hitt et al. (1992, p. 412) hypothesized that the delay in reward administration would lessen a reward's controlling aspect by lessening reward saliency. Hence, the focus remains more or less on the task itself. Hitt et al. (1992) argue that this may explain why people remain intrinsically motivated in their work, even though they get paid for it. A recent study by Woolley and Fishbach (2018, Study 3) showed that a delayed reward did not affect intrinsic interest in watching the news when compared to a no-reward control group, while an immediately given reward enhanced intrinsic motivation when compared to controls.

Dickinson (1989) participates in this discussion by suggesting that *repetition* and *aversive feelings* can explain the undermining of intrinsic motivation. First,

[11] see Chapter 5.3

Dickinson (1989) suggests that extrinsic reinforcement of an intrinsically motivated behavior could create a situation of overexposure to that behavior, resulting in satiation and a momentary undermining of intrinsic motivation after the reward contingency is withdrawn. For example, Peters and Vollmer (2014) showed that extended exposure to activity could decrease behavior due to satiation. Second, Dickinson (1989) suggests that sometimes rewards can acquire aversive properties. For example, a failure to attain expected performance-contingent rewards may be interpreted as a punishment, leading to a temporary undermining of intrinsically motivated behavior. It is also suggested that rewards can induce aversive feelings if they are perceived as a means of coercion. Dickinson (1989) argues that because rewards are often promised for doing uninteresting or nonpreferred activities, aversive feelings attached to rewards may deteriorate intrinsic motives. The explanation bears some resemblance to that of Snelders and Lea's (1996) economic explanation of the undermining effect[12] and Morgan's (1981) cognitive script explanation[13].

Finally, Eisenberger, Pierce, and Cameron (1999) have proposed *general interest theory* to explain rewards' effects on intrinsic motivation. General interest theory proposes that task content and context will increase intrinsic motivation when both factors convey information that one can satisfy their desires, wants, or needs through task performance. The theory also suggests that when task context and content convey information that the task is irrelevant to or incompatible with one's desires, wants, and needs, it will undermine intrinsic motivation. Based on these premises, general interest theory (Eisenberger et al., 1999a) argues that extrinsic rewards' effects on intrinsic motivation are dependent on what a person must do to attain expected rewards. According to Eisenberger et al. (1999a, p. 678), rewards can "*decrease or increase the importance of being competent, the perception of competence, and the identification with task giver's judgment of the task as important*."

A central tenet of general interest theory (Eisenberger, Pierce, et al., 1999) is that how an extrinsic reward affects intrinsic motivation depends on how it is given and what kind of information it signals: to what extent the offered reward conveys information on personal competence and task importance. When a reward is promised for meeting a specific and demanding performance standard, such will signal competence information, highlighting the importance of good performance and that the rewarder values the task. In contrast, when a reward is given only for doing the task, meeting a nonspecific performance standard, or for doing a trivial task, the reward is suggested to signal that the rewarder does not value the task, and

12 see Chapter 2.4.4.
13 see Chapter 2.4.2.

therefore the rewards will not enhance the feeling of competence. Based on this tenet, general interest theory (Eisenberger, Pierce, et al., 1999) argues that rewards offered for doing an irrelevant task (e.g., given for simple task-engagement or meeting a nonchallenging standard) will undermine intrinsic motivation, while rewards offered for meeting the requirements described above will enhance intrinsic motivation.

Although general interest theory falls into the realm of behavioral theories, it provides a somewhat different theoretical perspective on the phenomenon at hand than other reviewed behavioral approaches. Eisenberger, Pierce, and Cameron's (1999) general interest theory not only recognizes that rewards can undermine intrinsic motivation in some situations but appears to accept the concept of intrinsic motivation (cf. Deci et al., 1999a, p. 630).

A common characteristic feature of these behavioral approaches is the perspective that the possible deterioration of intrinsic motivation is only a temporary phenomenon. For example, Scott (1976, p. 127) asserts that the negative effect should disappear when an interfering reinforcing stimulus is removed. Or as Blocker and Ewards (1982, p. 262) have explicated Scott's (1976) idea more straightforwardly: "*the undermining effect should be temporary*." Other scholars have provided similar arguments (Cameron et al., 2001; Dickinson, 1989; Goswami & Urminsky, 2017)[14].

In summary, these different theoretical explanations building on reinforcement theory suggest that the possible undermining of intrinsic motivation is temporary, and the negative effect happens because the extrinsic reward either 1) distracts ongoing intrinsically motivated behavior by operating as a competing stimulus, 2) causes aversive feelings, or 3) leads to satiation via prolonged task engagement. However, it is somewhat problematic that the empirical basis of these different behavioral accounts is not very robust –at least within the field of undermining effect research. Moreover, Deci et al. (1999a) point out that many of these explanations have been developed *post hoc*. Furthermore, they do not provide clear predictions of how different reward contingencies and rewards affect intrinsic motivation (see also Deci & Ryan, 1985, pp. 180–188; Ryan & Deci, 2017, pp. 106–112).

Finally, when comparing intrinsic motivation theories and reinforcement approaches, one main difference seems to be metatheoretical by nature, as Deci (1975, 1976) asserted over four decades ago. As the preceding review highlights, reinforcement theorists assert that external reinforcement contingencies cause behavior. Therefore, the focus is on the probability that certain behaviors will manifest due to the reinforcing contingencies in the environment (Flora, 1990; Mawhinney, 1990; Scott, 1976). Conversely—as noted in Chapter 2.1—intrinsic

[14] This issue will be discussed and examined further in Chapter 5.3.

motivation theorists emphasize the role of psychological needs and internal states as antecedents or causes of subsequent behavior (Deci & Ryan, 1985; Ryan & Deci, 2017). Hence, one of the most notable differences between these two disciplines is their focus of interest: While reinforcement theorists are mainly interested in examining only *observable behaviors* (Flora, 1990), intrinsic motivation theorists focus more on the internal psychological processes that initiate and energize volitional behaviors, such as psychological needs and feelings (Deci, 1976; Deci & Ryan, 2000; Thomas & Velthouse, 1990). Another distinctive difference between these disciplines is that they hold quite different views on the fundamental nature of human beings: The theoretical framework of reinforcement theory is based more on a mechanistic and passive view of human nature, while intrinsic motivation theories hold a more organismic and active view of human nature (Deci & Ryan, 1985, 2000; Ryan & Deci, 2017). These differences are evident in the reviewed theoretical explanations of the undermining effect.

Finally, another major difference between intrinsic motivation theories and reinforcement theories is the moment when rewards' effects on intrinsic motivation should be assessed. For example, Hamner and Foster (1975, p. 402) argue that intrinsic motivation should be inferred from the performance measure while the reward contingency is still in place as reinforcement theory and expectancy theory concentrate on predicting a reward as having positive motivational effects during this period, not after the reward has been removed[15]. However, this suggestion is somewhat questionable because this type of measure reflects a mix of intrinsic and extrinsic motivations (Deci et al., 1999a, p. 635). Still, this debate concerning when rewards' effects on intrinsic motivation should be assessed highlights a major theoretical difference between these two disciplines.

2.4.4 Economic approaches

Although most research on the undermining effect derives from the field of psychology, a parallel strand of research conducted in the field of economics has begun to emerge (Festré & Garrouste, 2015). Still, the concept of intrinsic motivation and exploration of the interaction between extrinsic rewards and intrinsic motivation has received relatively little attention in the field of economics. Until quite recently, economists largely ignored the construct of intrinsic motivation (Frey & Jegen, 2001; A. H. Kunz & Pfaff, 2002). Frey and Jegen (2001, pp. 590–591) suggest that this may be because economic theory does not usually distinguish different motivation types. Moreover, economic theory is largely based on the assumption that extrinsic

[15] Some management scholars (e.g., Bartol & Locke, 2000; Donovan, 2001; Gerhart & Fang, 2014; Latham, 2012) advocate a somewhat similar view.

incentives will increase "supply" (i.e., desired behaviors). Another reason for the scarcity of research is that agency theory—a widely applied theoretical framework in the field of economics—does not recognize the concept of intrinsic motivation or the possible unbeneficial effects of providing extrinsic rewards. Agency theory, for example, predicts incentives will enhance an individual's productivity (Festré & Garrouste, 2015; A. H. Kunz & Pfaff, 2002).

Nevertheless, during the past two decades, economics has incorporated intrinsic motivation as part of its field of interest and recognized that incentives may sometimes be counterproductive (Frey & Jegen, 2001; James, 2005; A. H. Kunz & Pfaff, 2002). In economics, the negative effect of reward administration on intrinsic motivation is more commonly known as the *crowding-out effect* (Frey & Jegen, 2001). For example, Frey and Jegen (2001) suggest that intrinsic motivation is based on the psychological processes of self-determination and self-esteem and that an external intervention that causes changes in these processes will eventually affect intrinsic motivation. Thus, external rewards that are perceived as supporting these two processes will enhance or "crowd in" intrinsic motivation, whereas a crowding-out effect is predicted if a reward is perceived as controlling.

James (2005, p. 562) adds to this discussion by hypothesizing that the crowding-out effect may occur in two situations. In the first situation, an employer uses (superfluous) extrinsic rewards to motivate an intrinsically motivated individual to align their goals and interests with those of the employer without acknowledging that both parties' goals and interests are already aligned with each other. In the second situation, the total magnitude of compensation is large; large incentives increase the controlling aspect and salience of promised rewards, crowding out intrinsic motivation. Finally, Bruno (2013) suggests that the crowding-out effect results from a substitution effect and an income effect, whereas Snelders and Lea (1996) suggest that crowding-out of intrinsic motivation is caused by negative feelings associated with work and monetary compensation.

Economic research differs somewhat from psychological research tradition, as Bruno (2013) points out. Firstly, economics has adopted a broader definition of intrinsic motivation and situations in which the crowding-out effect might emerge. For example, prosocial behaviors (e.g., blood donating) and pro-environmental behaviors are regarded as representing intrinsically motivated activities in many economic studies (Bruno, 2013; for a review, see Frey & Jegen, 2001)[16]. Secondly, unlike psychological research, the field of economics is interested in exploring incentives' effects *while* they are in place, not after the rewards have been

[16] From the perspective of self-determination theory, controlled motivation (guilt, pressure, reciprocity) and autonomous motivation (value of helping, interest) can motivate prosocial behaviors (Deci & Ryan 2017, 625).

withdrawn. This is a major difference compared with traditional psychological research on intrinsic motivation that has mostly assessed rewards' effects after the reward contingency has been terminated. (Bruno, 2013, pp. 136–137.) Thirdly, economic research typically regards rewards as permanent, whereas psychological research views extrinsic rewards as temporal factors (Bruno, 2013).

Bruno (2013) has suggested an economics-based explanation accounting for the effects of temporal and permanent rewards on intrinsic motivation. First, the substitution effect can explain the negative effect of a temporal reward. When one is offered a temporal reward while doing an interesting activity, they will choose to engage in that activity more intensely to attain the reward. However, this will reduce intrinsically motivated task engagement in a situation where the reward is no longer promised. Second, when a promised reward is permanent, the substitution effect will not occur as a permanent reward will not create a competing extrinsic motivator for task engagement. Because the reward is permanent, it does not create a situation in which a person would be tempted to increase his or her work performance (i.e., extrinsic motivation) to maximize attainable rewards. Using Deci et al.'s (1999a) classification, it seems reasonable to assume that a permanent reward may leave intrinsic motivation unaffected because the reward is not tied to doing any particular task (i.e., being task-noncontingent); therefore, the reward's controlling aspect should be quite low.

Snelders and Lea (1996) offer a somewhat different theoretical explanation. Their model can be called "work dislike theory" due to the lack of an official name. Unlike many psychological theories of motivation relying heavily on the intrinsic–extrinsic taxonomy, Snelders and Lea's (1996) model approaches the undermining effect from a different angle. Work dislike theory is based on two presumptions. First, work is seen as a dislikable activity. Snelders and Lea (1996) base their assumption on the concept of scarce goods, which is derived from economic theory. In essence, work is a way of obtaining scarce goods or services. Following this logic, Snelders and Lea (1996) argue that people would work less if goods were free. Therefore, work can be interpreted as an activity that causes feelings of dislike. The second presumption concerns payment. As Snelders and Lea (1996) point out, money is an integral part of work, and the association between these two factors is tight. Basically, this theory suggests that when one is paid for doing something, it leads them to infer that this activity is work. The activity is not done anymore because it is fun or interesting; it is done for the economic consequences it provides (Snelders & Lea, 1996, p. 524). Because work is seen as dislikable, and monetary payment and work are inseparably intertwined, money will be associated with these feelings of dislike (Snelders & Lea, 1996). As such, being rewarded for doing some activity will cause this activity to be classified as work; therefore, feelings of dislike will be associated with the activity (Snelders & Lea, 1996). This observation leads

to the conclusion that if a reward is no longer given for doing something that was previously rewarded (e.g., as done in experimental studies), the lack of reward will cause a reduction in behavior (Snelders & Lea, 1996).

Thus, Snelders and Lea's (1996) conceptual framework distinguishes itself from the predominant psychological taxonomy of motivation: intrinsic motivation versus extrinsic motivation. Although classified as a theory of economics, Snelders and Lea's theoretical explanation somewhat resembles the psychological frameworks of cognitive script theory (Morgan, 1981, 1984; see also Porac & Meindl, 1982) and template theory (Sandelands et al., 1983). Each framework seems to emphasize the role of previous experiences as a possible reason for the undermining of intrinsic motivation.

All in all, this review suggests that economic theories have taken a somewhat different perspective on intrinsic motivation and the undermining effect by focusing more on rewards' effects while extrinsic incentives are still provided. Recognizing this difference is especially important when comparing the findings of controlled laboratory experiments and (nonexperimental) field studies conducted in real organizational settings. First, as Deci et al. (1999a) point out, evaluating intrinsic motivation when an extrinsic reward contingency is still in place reflects a mixture of intrinsic and extrinsic motivation. While this is not a great concern for controlled laboratory experiments assessing intrinsic motivation (covertly) after extrinsic motivators have been removed (see Ryan et al., 1991), it is definitely an issue for typical field studies. This point is highly relevant because these two fields of study evaluate the motivational effects of extrinsic incentives at different points in time while trying to determine the usefulness or harmfulness of the effects of extrinsic rewards on intrinsic motivation.

This difference has led some compensation scholars to downplay the relevance of the free-choice paradigm[17] and even the relevance of intrinsic motivation in applied settings. For instance, Bartol and Locke (2000, p. 108) have basically suggested that the undermining of intrinsic motivation by extrinsic incentives is an irrelevant concept in organizational settings because work is always performed under some type of pay system. What matters is the total amount of motivation (Gerhart & Fang, 2014). Locke and Schattke (2019) continue this line of reasoning by remarking that rewards are not removed arbitrarily in real workplaces. This has led some

[17] The free-choice paradigm represents the way most often used when measuring the behavioral manifestation of intrinsic motivation in experimental settings. Intrinsic motivation is measured covertly after a reward contingency has been withdrawn. The amount of time (i.e., free-choice behavior/persistence) a study subject remains voluntarily engaged with the experimental task following termination of the reward contingency and while thinking they are not being observed is used as a behavioral measure of intrinsic motivation.

researchers to argue that reward effects should be examined when rewards are available (Bartol & Locke, 2000; Gerhart & Fang, 2014; Hamner & Foster, 1975). Fay and Frese (2000) go a step further in their criticism of intrinsic motivation and the undermining effect by arguing that because pay and other extrinsic motivators are integral parts of organizational settings, this excludes the possibility that work motivation could truly be intrinsic. Fay and Frese (2000) further their argument by saying that without pay, people would stop working, even if they found work enjoyable. In their critique, Fay and Frese (2000) end up suggesting (at least implicitly) that the undermining of intrinsic motivation by extrinsic incentives bears little relevance to work settings.

Although the raised issues may have some merit, they are based on somewhat erroneous views of intrinsic motivation and its underlying psychological processes. First, albeit work is always done under the existence of some kind of extrinsic motivator, and hence no "free-choice period" exists in the work domain, these critics seem to forget that the free-choice paradigm is only a way of evaluating intrinsic motivation in experimental settings. The paradigm is not supposed to equate with intrinsic motivation in an actual environment (Deci & Ryan, 1985, p. 187). Deci (1987, p. 181) has clearly remarked that the psychological construct of intrinsic motivation and its operationalization by measuring free-choice persistence are "not the same thing."

Second, suggestions that intrinsic motivation is an irrelevant concept or cannot exist in work settings ignore the plenitude of research suggesting otherwise[18]. Research evidence shows that intrinsic motivation operates as an important energizer of work behaviors in many fields of work, such as R&D (Tampoe, 1993), software engineering (Beecham et al., 2008), medicine (Ratanawongsa et al., 2006), and science (Bellamy et al., 2003; Teichler et al., 2013), to name but a few. For example, via a systematic review of 62 studies, Beecham et al. (2008) found that the job itself is the primary motivator for software engineers. In turn, Kuvaas et al. (2017) showed that intrinsic work motivation was a significant predictor of variance in self-reported work performance and affective commitment after other variables (e.g., extrinsic work motivation) were statistically controlled when they studied financial sector employees, gas station managers, and employees of a medical technology organization.

Moreover, arguments that intrinsic motivation cannot exist in the work context because people receive a salary or would not work if not paid represent a somewhat straw man type of argument and overly simplistic and fallacious logic. First, there is evidence shows that task-noncontingent rewards (i.e., fixed salary) and intrinsic

[18] See Chapter 2.2.

motivation are not necessarily antagonistic (Deci et al., 1999a; S. Tang & Hall, 1995), enabling the coexistence of intrinsic motivation and extrinsic incentives in some situations. Just because people are being paid to work does not mean they are not or could not be intrinsically motivated.

Second, the above-presented critique seems to ignore a key theoretical proposition of cognitive evaluation theory: the effect of an extrinsic reward on intrinsic motivation depends on the reward's functional significance—how one interprets the given reward, not so much on the reward *per se* (Ryan & Deci, 2017, pp. 130, 159; see also Cerasoli et al., 2014). Because the importance of the functional significance of rewards was established long ago (Deci, 1975; Deci & Ryan, 1980; Ryan et al., 1983), the presented critique seems somewhat misplaced and lacking validity.

Third, arguments that without pay, even intrinsically motivated people would not work—while technically correct—seem to be a rather naïve attempt to dismiss intrinsic motivation's importance at the workplace. As Ryan and Deci (2017, p. 544; see also Deci, 1973) have pointed out, it paying people to keep them in their workplaces is necessary. Moreover, even common logic dictates that pay is an important factor because it enables people to satisfy their most basic *physiological* needs (e.g., food) (cf. Maslow, 1943). Because intrinsically motivated behavior is an ongoing process that can be interrupted by external factors (e.g., reward, hunger, threat) (Deci, 1975, p. 100; Deci & Ryan, 1985, pp. 232–234), it seems only natural to think that a sudden withholding of salary might cause an interruption to intrinsically motivated (work) behavior and arouse safety needs. This withholding would likely cause a person to stop working as this new situation would force them to concentrate their efforts on how to survive and feed their family[19]. However, when this temporary interruption would cease to exist, it seems only logical to assume that intrinsic motivation would continue to energize behavior—namely, previously intrinsically rewarding work activities (Deci, 1975, p. 101).

[19] The presented argumentation receives indirect support from Basyouni and El Keshky's (2021) recent study, who examined the relationship between financial anxiety, job insecurity, and intrinsic work motivation during the COVID-19 pandemic in 2020. As expected, Basyouni and El Keshky's (2021) results showed that experience of financial anxiety and job insecurity were negatively associated with intrinsic work motivation when they surveyed a sample of private and public sector employees in Saudi Arabia. Based on Basyouni and El Keshky's (2021) findings, it is only logical to assume that a sudden withdrawal of salary would have a similar negative effect on intrinsic motivation.

2.5 Proposed mediating and moderating variables

A review of the literature suggests that the field of undermining effect studies has become more diversified and complex compared to its early days. While the first studies (Deci, 1971, 1972a, 1972b; Greene & Lepper, 1974; Kruglanski et al., 1971; Lepper et al., 1973) concentrated on exploring the direct relationship among different types of extrinsic rewards and intrinsic motivation, subsequent studies have investigated the role of different moderating and mediating variables and boundary conditions (Lepper et al., 1999). More recent studies have focused on finding out how different personal, contextual, or situational factors might contribute to this interaction between reward and intrinsic motivation.

Many studies have sought to identify those conditions or types of rewards that reverse or nullify the rewards' effect (Lepper et al., 1999). Perhaps the most prominent explored factor is reward contingency. From early on, studies (e.g., Deci, 1971, 1972a; Harackiewicz, 1979; Lepper et al., 1973; Salancik, 1975) have demonstrated the importance of reward contingency (for what the rewards are given) when trying to understand how rewards affect intrinsic motivation. Indeed, reward contingency—alongside reward type and reward expectancy—is one of the most important moderator variables in the upcoming empirical (i.e., meta-analytical) part of this thesis. Past meta-analytical research (e.g., Deci et al., 1999a; S. Tang & Hall, 1995) has established this variable's importance.

In addition to reward contingency, past experimental research has explored multiple mediators and moderators while trying to understand the cause-effect relationship between extrinsic rewards and intrinsic motivation. The role of such factors as positive and negative affect (Fabes et al., 1988; Pretty & Seligman, 1984), task-congruent rewards (Marinak & Gambrell, 2008; Steiner, 2011), causality orientations (Hagger et al., 2015; Hagger & Chatzisarantis, 2011; Thill et al., 1998; see also Rummel & Feinberg, 1990), affective autonomy (Houlfort et al., 2002; see also Cameron et al., 2005), reward-associated messages (Dollinger, 1979), extrinsic and intrinsic cue information (Brennan & Glover, 1980; Pittman et al., 1977; Porac & Meindl, 1982), the timing of reward administration (Porac & Meindl, 1982; Sarafino, 1984; see also Tripathi, 1991; Tripathi & Agarwal, 1984; Woolley & Fishbach, 2018), reward salience (Ross, 1975; see also Hendijani & Steel, 2020), perceived competence (Houlfort et al., 2002; Vallerand & Reid, 1984, 1988), symbolic cue value (Harackiewicz et al., 1984) and performance pressure (Eisenberger & Aselage, 2009) have been examined, to name just a few. Recently, some researchers have begun to examine the neural correlates of the extrinsic rewards–intrinsic motivation relationship (Albrecht et al., 2014; Marsden et al., 2015; Murayama et al., 2010; for a review, see Hidi, 2016). Additionally, recent nonexperimental organizational research has suggested that factors such as managerial discretion in bonus allocation (Hewett & Leroy, 2019), distributive

justice (Thibault Landry, Gagné, et al., 2017), and locus of control (Malik et al., 2015) may operate as moderator variables.

Because a comprehensive review is beyond the scope of this study, the role of a few selected and theoretically interesting variables will be discussed. These variables are: affective states (positive/negative), task-congruent rewards, and affective autonomy. These variables were selected because they represent theoretically relevant and understudied variables in the field of reward effects on intrinsic motivation. Finally, an argument is made for a more thorough examination of CET's main postulates when trying to understand the effects of rewards on intrinsic motivation.

The first reviewed factor is the experience of affect, which has been proposed to serve as a psychological mediator between rewards and intrinsic motivation (Pretty & Seligman, 1984). Affect is a relevant and interesting variable because research suggests that positive affective experiences are closely associated with intrinsically motivated behaviors (Isen & Reeve, 2005; Vandercammen et al., 2014) and seem to accompany extrinsically motivated behaviors also (Erez & Isen, 2002). Additionally, some evidence suggests that negative affective experiences relate to the experiences of intrinsic motivation and extrinsic motivation (Gillet et al., 2013; Howard et al., 2021; Thibault Landry et al., 2020). While only two papers in the reviewed literature have empirically examined affect's role as a mediator (Fabes et al., 1988; Pretty & Seligman, 1984), also others have suggested that negative affect may play a critical role in the extrinsic rewards–intrinsic motivation relationship (Reiss, 2005). For example, Hidi (2016) speculates that terminating previously given rewards may elicit feelings of disappointment, possibly explaining the negative relation between rewards and intrinsic motivation.

As mentioned, Pretty and Seligman (1984) and Fabes et al. (1988) have experimentally examined the role of affective experiences in the extrinsic rewards–intrinsic motivation relationship. Pretty and Seligman (1984) explored the role of positive and negative affect as possible psychological antecedents of the undermining effect. By means of two controlled experiments, they found that negative affect and intrinsic motivation closely paralleled. The undermining of study participants' intrinsic motivation by expected rewards led to higher negative affect scores. In contrast, Pretty and Seligman (1984) showed that positive affect manipulation could nullify the undermining of intrinsic motivation by engagement-contingent rewards. Fabes, Eisenberg, Fultz, and Miller (1988) conducted another investigation on affect's role. Unlike Pretty and Seligman (1984), who induced the affect manipulation only after the study participants had completed the experimental task, Fabes et al. (1988) manipulated affect (negative, neutral, positive) before the study participants engaged in the experimental activity. Fabes et al.'s (1988) results showed that the effect of initially induced negative mood on intrinsic motivation

paralleled the effect of an engagement-contingent reward with initial neutral mood manipulation. Both the no-reward/negative affect and engagement-contingent reward/neutral affect groups showed similar undermining of free-choice persistence compared to the control group, which received a neutral affect manipulation. Fabes et al. (1988) concluded that the undermining of intrinsic motivation partly be partly caused by the negative emotional response that a rewarded activity produces.

The second factor is the task–reward congruency. One published study (Marinak & Gambrell, 2008) and one unpublished doctoral dissertation (Steiner, 2011) have empirically examined this issue. Marinak and Gambrell (2008) and Steiner (2011) suggest that rewards that are directly related to the task at hand (i.e., task-congruent rewards) should be less detrimental to intrinsic motivation than task-incongruent or less proximal rewards. For example, a puzzle given as a reward for doing a puzzle task or a book for doing a reading task represent task-congruent rewards; these rewards are directly associated with the task. In contrast, money, for example, would represent a task-incongruent reward in these situations because the reward is not intrinsically related to the task. Marinak and Gambrell's (2008) and Steiner's (2011) experimental studies showed that while task-incongruent rewards undermined free-choice persistence, task-congruent rewards had either no effect or, in one case (Steiner, 2011, Exp. 3), even had a positive effect on free-choice persistence.

The third and final factor is affective autonomy. Although cognitive evaluation theory (Deci & Ryan, 1985) suggests that perceived autonomy (i.e., need for autonomy) is a focal mediating psychological process between the causal relationship between rewards and intrinsic motivation, Deci et al. (1999a) remark that relatively few studies have directly examined the role of this psychological construct. Moreover, Deci et al. (1999b) point out that some studies tended to confound perceived autonomy (internal perceived locus of causality), for example, with Rotter's (1966) concept of locus of control (see, e.g., Carton & Nowicki, 1998). Houlfort et al. (2002) add to this discussion by remarking that another problem relates to some studies' tendency to conceptualize and measure autonomy as decisional latitude (see, e.g., Eisenberger, Rhoades, et al., 1999; Fang & Gerhart, 2012; Kuvaas & Dysvik, 2009; Nordgren Selar et al., 2020) while missing the phenomenological side of autonomy that more closely represents the essence of perceived autonomy (i.e., need for autonomy) as conceptualized in CET. In CET, perceived autonomy refers to doing something out of volition and self-endorsement, not because of external pressures (Ryan & Deci, 2017, pp. 97–98)[20].

[20] deCharms' (1983, Chapter 10) early work on the qualitative differences of being an origin of one's own behavior or a pawn to some external pressures bears conceptual similarity to the discussion on the phenomenological side of autonomy.

Two experimental laboratory studies by Houlfort et al. (2002) and Cameron et al. (2005) have empirically examined this issue (see also Reeve et al., 2003). Both studies showed that performance-contingent rewards undermine affective autonomy but not decisional autonomy. These findings seem to suggest that when investigating autonomy as a mediating psychological construct between rewards and intrinsic motivation, autonomy should be conceptionally understood and subsequently operationalized as an experience of volition and absence of pressure (i.e., the experience of affective autonomy)[21].

The empirical evidence based on these three mediating and moderating variables is scarce; more research is needed to establish their role in the extrinsic rewards–intrinsic motivation relationship. Still, these studies highlight the complexity associated with the phenomenon, especially when trying to understand what psychological mechanisms mediate or what conditions moderate rewards' effect on intrinsic motivation. By doing so, these studies offer interesting and important avenues for future research. From a practical standpoint, the task-congruent reward hypothesis is especially interesting. Further research would help us understand when expected contingent rewards could be used without the risk of detrimental effects on intrinsic motivation[22].

The discussion above concentrated on three potentially interesting variables, of which one (viz. affective autonomy) represents a core explanatory mechanism of cognitive evaluation theory. Examining the identified mediator and moderator variables jointly with the psychological mechanisms postulated in cognitive evaluation theory (Deci & Ryan, 1985) is encouraged.

Moreover, although empirical research has established that the three psychological needs (viz. autonomy, competence, and relatedness) are focal mediating mechanisms between influences of social context and intrinsic motivation (see, e.g., Olafsen et al., 2017; Ryan & Deci, 2017), the extrinsic rewards–intrinsic motivation literature has seldom tested the role of these needs or examined them jointly with other theoretically interesting variables. Experimental studies examining simultaneously to what extent changes in psychological needs for autonomy and competence (and relatedness[23]) explain the reward effects on intrinsic motivation are

21 For further discussion on the concept of autonomy, see Deci and Ryan (1987), and Reeve, Nix and Hamm (2003).

22 One interesting avenue for future research would be to examine the functional significance of task-congruent rewards (perceived controlling vs. informational aspects), given that the reviewed evidence suggests that this reward type might be less harmful.

23 It is noteworthy that the role of relatedness as a mediating mechanism has not been systematically studied in the extrinsic rewards–intrinsic motivation literature, albeit some studies do exist (Corduneanu, 2020; Hewett, 2014). This may stem from the fact

especially needed. Fortunately, some recent experimental research has begun to explore this issue (see Thibault Landry et al., 2020; for earlier research, see Cameron et al., 2005; Houlfort et al., 2002).

It is also necessary to highlight the role of a reward's functional significance. Although its role was discussed in Chapter 2.4.1, a recapitulation of its role is important for understanding how rewards affect intrinsic motivation. As postulated in CET (Deci & Ryan, 1985; Ryan & Deci, 2017), a reward's functional significance plays a key role in how the reward will impact intrinsic motivation. When a reward is perceived as controlling, the reward is suggested to undermine the need for autonomy and, subsequently, intrinsic motivation. In contrast, when a reward is perceived as informational (i.e., it conveys competence information in the absence of external pressure), it is suggested to enhance the need for competence and, consequently, intrinsic motivation. However, experimental research on this topic is scarce, albeit some studies exist (see, e.g., Fisher, 1978; Thibault Landry et al., 2020). Given the relative scarcity of experimental research, there is a need for further experimental investigation. Fortunately, organizational research has recently shown interest in studying the effects of rewards' functional significance on intrinsic motivation (see, e.g., Kuvaas et al., 2020; Thibault Landry, Forest, et al., 2017).

Additionally, given that rewards' controlling and informational aspects are theorized to have opposite effects on intrinsic motivation, it would be interesting to investigate their relative effects, for example, regarding the longevity of the effects. For example, Ryan and Moller (2017, pp. 221–224) discuss that while informationally given competence feedback can support intrinsic motivation, feedback focusing on normative standards may have less optimal or even detrimental effects. Moreover, Ryan and Moller (2017, p. 221) state that "even successfully meeting challenges in controlling context will feel less satisfying," suggesting that the competence information conveyed by reward attainment may elicit less beneficial effects than generally assumed. Based on their discussion, an interesting avenue for future research would be examining to what extent competence-related information conveyed by extrinsic rewards can offset the loss of autonomy caused by the reward's controlling aspect in the long run.

Given that autonomy need satisfaction is of paramount importance for the maintenance of intrinsic motivation (Ryan & Deci, 2000b, p. 58, 2017, pp. 96–98), one is left to wonder whether the undermining of autonomy can be "substituted" by

> that self-determination theory or its sub-theory CET (Deci & Ryan 1985; Ryan & Deci 2017) have not formally theorized how this psychological need could be affected by extrinsic rewards. However, given that self-determination theory sees the need for relatedness as one of the universal antecedents of intrinsic motivation (and autonomous extrinsic motivation), examining the role of this psychological need is warranted.

the enhancement of competence—especially if the reward contingency (or the environment) is pressuring and controlling. Or will it lead to a gradual loss of intrinsic motivation (despite the competence-affirming information) and substitution with ego-related motives (i.e., introjected regulation) (see R. Butler, 1987, 1988; Ryan et al., 1991; Vansteenkiste & Deci, 2003). However, this question is yet to be examined as the author is not aware of studies specifically designed to explore this issue.

Nonetheless, Ryan and Deci's (Ryan & Deci, 2000b, 2017, pp. 129–130) theorizing and Pulfrey, Darnon, and Butera's (2013) empirical research offers some insight into this issue. Ryan and Deci (2000b, p. 58, emphasis in original) argue that "feelings of competence will *not* enhance intrinsic motivation unless they are accompanied by *a sense of autonomy*", providing support for this possibility. In their more recent work, Ryan and Deci (2017, p. 129) continue with a similar line of theorizing by suggesting that if an extrinsic contingency thwarts one's autonomy need satisfaction, then the effect of competence-affirming information is less likely "to be truly conducive to intrinsic motivation." Additionally, Pulfrey et al.'s (2013) experimental research provides indirect evidence for this hypothesis. Pulfrey et al. (2013) showed that while a performance-contingent reward (viz. grade) resulted in better task performance, which enhanced self-reported interest, the reward did not enhance continuing (intrinsic) motivation for the task. Conversely, autonomy satisfaction explained both self-reported task interest and continuing motivation for the task.

Based on Pulfrey et al.'s (2013) empirical findings and Ryan and Deci's (2000b, 2017) theorizing, a cautious inference can be made which suggests that autonomy (viz. affective autonomy) could be a more important explanatory mechanism than competence for understanding the overall and long-term effects of rewards' controlling and informational aspects on intrinsic motivation (especially when the rewards are given more than once). Because this is a theoretically important question, further research is needed to understand the long-term (competing) effects of rewards' controlling and informational aspects on autonomy and competence need satisfaction and intrinsic motivation.

2.6 A brief review of the early studies and the beginning of the debate

As Chapter 1 mentioned, the starting point for studying intrinsic motivation and the undermining effect can be traced back to Deci's (1971), Kruglanki et al.'s (1971), and Lepper et al.'s (1973) original experiments, as these studies were the first to empirically explore whether extrinsic incentives could diminish intrinsic interest. Although Woodworth (1918, as cited in Deci & Ryan, 1985, p. 12), White (1959),

and deCharms (1983)[24], among others, had discussed the nature of intrinsic motivation and how external factors might influence intrinsic interest, it was the above-mentioned empirical studies that initiated a wider interest in this line of research.

Deci's (1971) seminal study initiated the discussion and empirical investigation regarding the interplay between reward and intrinsic motivation. Through one laboratory experiment (experiment 1) and one small-scale field experiment (experiment 2), Deci (1971) examined the impact of monetary reward given either for each successfully completed Soma puzzle (experiment 1) or written news headline. In the third experiment, Deci (1971) examined the effect of positive feedback on intrinsic motivation using the Soma puzzle design. In experiments 1 and 3, the duration of puzzle engagement when the subjects thought that they were not monitored was used as the behavioral measure of intrinsic motivation, while the speed of headline writing served as a measure of intrinsic motivation in experiment 2. Deci (1971) showed that when contingently given reward groups were compared to the no-reward control groups, given rewards undermined college students' free-choice persistence (Experiment 1) and led to worse performance on the headline writing task (Experiment 2). In contrast, positive verbal feedback enhanced free-choice persistence (Experiment 3).

Lepper et al. (1973) furthered these initial studies by examining the effects of expected and unexpected rewards on nursery school children's free-choice intrinsic motivation for drawing. Their results indicated that children who received a good player award for doing the experimental activity displayed a lower level of intrinsic motivation than those who received no rewards (i.e., the control group) or received the good player award unexpectedly (i.e., the unexpected reward group).

Finally, Kruglanski, Friedman, and Zeevi (1971) examined how task-noncontingent rewards were related to high school students' performance quality and enjoyment of the task. The students were promised a reward for participating in the experiment or received no reward. Kruglanski et al. (1971) employed tasks that evaluated either recall of details or creativity. Their results showed that those students who were rewarded displayed less enjoyment of the experimental task than the non-rewarded subjects. Additionally, the rewarded subjects performed worse on both tasks than the non-rewarded subjects.

After these initial studies, the field's focus shifted. Studies became theoretically more complex as the focus shifted to examining the conditions moderating rewards' effects on intrinsic motivation (Lepper et al., 1999). Some focused on examining the effects of specific reward contingencies, while others tried establishing limiting

[24] Original work published in 1968.

conditions, as discussed in Chapter 2.5. For example, Pittman, Cooper, and Smith (1977) found that giving intrinsic cue information (emphasizing interest as a reason for task engagement) with a performance-contingent reward was able to protect self-reported interest but not free-choice persistence. Others found that extrinsic rewards did not erode very high intrinsic motivation (Arnold, 1976, 1985) or that giving praise could nullify the detrimental effect of engagement-contingent rewards (Swann & Pittman, 1977).

From early on, these findings caused turmoil and fierce resistance, especially among behaviorists. As Sansone and Harackiewicz (2000, pp. 3–4) remark, the findings showing the undermining of intrinsic motivation by extrinsic rewards were openly challenged. For example, Scott (1976) critiqued not only the undermining effect and the studies demonstrating this deleterious phenomenon but also the construct of intrinsic motivation. In turn, Calder and Staw (1975a) argued that especially Deci's (1971, 1972a, 1972b) early studies were methodologically flawed. More recently, Akin-Little and Little (2009, p. 86) stated that the detrimental effects of extrinsic reinforcement are easy to avoid, while Flora (2004) downright rejects the whole phenomenon. Other major pieces of criticism were (and still are) directed at the possibility that a ceiling effect might be responsible for the scarcity of studies reporting intrinsic motivation's enhancement by extrinsic rewards (Mawhinney, 1979; Reiss, 2005, 2013), the usage of between-group designs with single-trial rewarding procedures (Peters & Vollmer, 2014; Reiss, 2005; Reiss & Sushinsky, 1975), and the interchangeable use of the terms "reward" (i.e., non-reinforcing stimuli) and "reinforcement" (i.e., reinforcing stimuli) (Brennan & Glover, 1980; Bright & Penrod, 2009; Reitman, 1998).

Because of the controversial nature of the phenomenon under study and the highly complex nature of the field of research (Deci et al., 1999b; Lepper et al., 1999; Sansone & Harackiewicz, 2000), the undermining of intrinsic motivation by extrinsic rewards remains contested by some (e.g., Flora, 2004; Cameron et al., 2001).

2.7 Partially mixed findings in previous meta-analytical studies and the emergence of a new debate in organizational settings

The long-lasting debate on how rewards affect intrinsic motivation has spurred several literature reviews and meta-analytical studies – although producing somewhat contradictory results. Although many narrative reviews of the literature have been conducted that provide insight into the development of the field and the debate (Bates, 1979; Blocker & Edwards, 1982; Deci & Ryan, 1985; Dickinson, 1989; Fair & Silvestri, 1992; Morgan, 1984; Workman & Williams, 1980; see also

Cameron & Pierce, 2002; Promberger & Marteau, 2013; Sansone & Harackiewicz, 2000), the debate is especially associated with the somewhat mixed results of the previous meta-analytical studies. Next, these previous meta-analyses and their results will be briefly reviewed and compared.

To date, 11 meta-analytical studies have examined the undermining effect's existence, nine of which have investigated the phenomenon directly (Cameron et al., 2001; Cameron & Pierce, 1994; Deci et al., 1999a; Eisenberger, Pierce, et al., 1999; Eisenberger & Cameron, 1996, 1998; Rummel & Feinberg, 1988; Wiersma, 1992), while three of the most recent studies (Cerasoli et al., 2014; Kim et al., 2022; Weibel et al., 2010) contribute to the discussion only indirectly. Rummel and Feinberg (1988) conducted the first meta-analysis. Unlike later meta-analyses, Rummel and Feinberg (1988) concentrated on studies in which rewards had been used in a controlling fashion, thus separating their meta-analysis from the more recent meta-analytical studies. This allowed them to evaluate and test the propositions of cognitive evaluation theory. Rummel and Feinberg's (1988) meta-analysis included 45 studies. Based on their meta-analysis results, Rummel and Feinberg (1988) concluded that rewards utilized in a controlling fashion do indeed undermine intrinsic motivation, thus giving support to CET's propositions. The second meta-analysis by Wiersma (1992) was somewhat narrower in its focus because Wiersma only included studies using monetary rewards and university students. Thus, only a sample of 20 studies was included in Wiersma's (1992) meta-analysis. Of these 20, only 16 examined the effects of rewards on intrinsic motivation after a reward contingency was withdrawn[25]. Based on 16 studies, Wiersma (1992) found that contingent rewards had a moderate negative impact on free-choice intrinsic motivation (d = –0.50; 95% CI = –0.67 to –0.33).

Somewhat unexpectedly, the third, fourth, and fifth meta-analyses by Cameron and Pierce (1994), Tang and Hall (1995), and Eisenberger and Cameron (1996) reached quite different conclusions. Like, Rummel and Feinberg (1988) and Wiersma (1992), also Tang and Hall (1995) found a significant undermining of intrinsic motivation by task-contingent and performance-contingent rewards while showing that positive feedback, task-noncontingent rewards, and unexpected rewards do not generally pose a threat to intrinsic motivation. Based on their results, Tang and Hall (1995, p. 379) concluded that the undermining effect "*has been consistently demonstrated in situations when it should be expected to occur*." In contrast, meta-analyses by Cameron and Pierce (1994) and then Eisenberger and Cameron (1996) reported that accumulated evidence does not support a conclusion that expected, contingent rewards are detrimental to intrinsic motivation. Based on

[25] Wiersma (1992) also examined the effect of extrinsic rewards on performance while the reward contingency was still in effect.

the evidence, Eisenberger and Cameron (1996, p. 1154) stated that extrinsic rewards' detrimental effects occur under situations that are "highly restricted" and "easily avoidable." Subsequently, several researchers (Lepper, 1995; Lepper et al., 1996, 1999; Ryan & Deci, 1996) argued that these results should be interpreted with caution due to methodological errors that Cameron and Pierce (1994) and Eisenberger and Cameron (1996) made in their meta-analyses. Lepper et al. (1996) and Ryan and Deci (1996) criticized these meta-analyses, for example, for combining both interesting and boring task conditions in the same analysis.

Subsequent meta-analyses by Eisenberger and Cameron (1998) and Eisenberger, Pierce, and Cameron (1999) focused solely on performance-contingent rewards. Eisenberger and Cameron (1998) analyzed six studies using a measure of self-reported interest and four studies using a measure of free-choice behavior. They found that rewards given for exceeding demanding and explicit performance standards (e.g., performing better than 80% of other participants) significantly enhanced both free-choice behavior ($d = 0.26$) and self-reported interest ($d = 0.27$). Eisenberger, Pierce, et al. (1999) advanced this analysis by including substantially more studies in their analyses. Their meta-analysis showed that free-choice intrinsic motivation and self-reported interest are enhanced when a person is rewarded for exceeding others. The only statistically significant negative effect that Eisenberger, Pierce et al. (1999) found was for a situation where a performance-contingent reward is given for exceeding a vague performance standard. However, Deci et al. (1999b) raised many issues they believe undermine the validity of Eisenberger, Pierce, et al.'s (1999) conclusions, such as a selective exclusion of studies and the usage of improper control groups.

The most cited meta-analysis to date is that of Deci, Koestner, and Ryan (1999a)[26]. They analyzed 128 experiments, finding strong support for the deleterious effects of rewards. Deci et al. (1999a) reported, for example, that engagement-contingent and completion-contingent rewards undermine both free-choice persistence and self-reported interest, while performance-contingent rewards cause a decrease in free-choice behavior but not in self-reported interest and enjoyment. Additionally, Deci et al.'s (1999a) meta-analysis demonstrated that, on average, positive feedback enhances intrinsic motivation regardless of how it is measured, while task-noncontingent rewards and unexpected rewards leave it unaffected. Interestingly, Deci et al. (1999a) also showed that the undermining of intrinsic motivation by contingently given extrinsic rewards is quite durable, thus questioning

[26] According to Google Scholar, Deci et al.'s (1999a) meta-analysis received 9731 citations by November 30, 2021. The second most frequently cited meta-analysis is Cameron and Pierce's (1994), with 2274 citations.

claims that the effect dissipates soon after reward withdrawal (Mawhinney et al., 1989).

The most recent meta-analysis contributing directly to the debate comes from Cameron, Banko, and Pierce (2001). For the most part, Cameron et al.'s (2001) analysis included the same set of studies as Deci et al. (1999a) but used a partially different reward contingency classification. Cameron et al. (2001) replicated Deci et al.'s (1999a) findings regarding the effects of positive feedback, task-noncontingent rewards, and unexpected rewards on intrinsic motivation. Conversely, they reported somewhat different results for 1) rewards offered for finishing a task (i.e., completion-contingent rewards) and 2) rewards given either for surpassing an absolute standard or performing better than others (i.e., performance-contingent rewards). Unlike Deci et al. (1999a), who reported that, for the most part, these reward contingencies undermined intrinsic motivation, Cameron et al. (2001) reported mostly neutral effects or positive effects for these reward contingencies, concluding that "*our results suggest that in general, rewards are not harmful to motivation to perform a task*" (p. 1).

The most recent meta-analyses by Weibel, Rost, and Osterloh (2010), Cerasoli, Nicklin, and Ford (2014) and Kim, Gerhart, and Fang (2022) contribute to this discussion, albeit in a somewhat indirect and limited fashion because these meta-analyses concentrated primarily on examining the relationships among rewards, performance, and intrinsic motivation. Additionally, these three meta-analytical studies used largely different sets of studies in their analyses. Nonetheless, the overall results of Weibel et al.'s (2010) and Cerasoli et al.'s (2014) meta-analyses suggest that performance-contingent rewards tend to weaken the relationship between intrinsic motivation and performance. Weibel and her colleagues' (2010) meta-analysis of 20 studies showed that performance-contingent rewards undermine work performance when tasks are interesting ($r = –0.13$, $p < 0.01$). Somewhat similarly, Cerasoli et al. (2014) showed that the intrinsic motivation–performance relationship was weaker when a clear and direct link existed between incentives and performance ($\rho = 0.30$; 80% PI = 0.10, 0.50) than when the link was indirect ($\rho = 0.45$; 80% PI = 0.14, 0.77)[27].

[27] A closer examination of Cerasoli et al.'s (2014) meta-analysis revealed that their classification of rewards as indirectly performance-salient or directly performance salient is somewhat unclear and partially inconsistent. For example, they classified Reeve's (1989) study as employing directly salient incentives while the study subjects (university students) received only extra course credit for participating in the experiment but no other incentives during the actual experimental phase. In contrast, Turban et al.'s (2007) study was classified as providing indirect performance-salient rewards while the participating students only received credit for their participation. An analysis of Senko and Harackiewicz's (2005) paper demonstrates that subjects (i.e.,

In contrast, Kim et al. (2022) came to a different conclusion. Kim et al. (2022) found that the relationship between monetary incentives and performance was positive for interesting tasks ($\rho = 0.26$; 80% PI = 0.05, 1.11). Based on this finding they concluded that financial incentives have a positive effect on performance in interesting tasks. Albeit an intriguing finding, Kim et al.'s (2022, p. 158) decision to code a task as interesting when the task was "…complex, nonrepetitive, creative, and/or cognitively [more] engaging" is not unproblematic given the nature of intrinsic motivation discussed in Chapter 2[28].

Although the debate on the detrimental or beneficial effects of extrinsic rewards on intrinsic motivation was long constricted to the field of psychology, during the past two decades, organizational behavior and compensation scholars have also become interested in the issue. Because the evidence base is mainly based on laboratory experiments, some scholars have questioned the practical relevancy of the findings for work settings (Bartol & Locke, 2000; Donovan, 2001; Gerhart & Fang, 2014, 2015, 2017; Rynes et al., 2005). As already discussed in Chapter 1, the practical relevancy of the undermining effect and, to some extent the value of intrinsic motivation as a useful concept in work settings have been questioned.

Despite the criticism, it is noteworthy that empirical research examining the relationship between intrinsic motivation and extrinsic incentives in organizational

students) received extra credit for participating , but they did not receive any *tangible* incentives during the experimental phase—only performance feedback. Still, Cerasoli et al. (2014) coded the study's reward contingency as directly performance-salient, which is somewhat problematic as contingent rewards and feedback have been shown to have opposite effects on intrinsic motivation (Deci et al., 1999a; see also Chapter 6.1.4). Finally, Cerasoli et al. (2014) coded Kuvaas's (2006) study as not containing any incentives. This is a mistake because Kuvaas (2006) reported correlations among base pay, bonuses, intrinsic work motivation, and self-reported work performance.

[28] Kim et al. 's (2022) coding scheme for the task interest variable is somewhat ambiguous, at least when examined from the point of view of intrinsic motivation. Although Kim et al.'s (2022) decision to classify complex, cognitively engaging, creative, and complex tasks as interesting is understandable on the grounds that theoretical and empirical work (e.g., Anshel et al., 1992; Chen et al., 2001; Hackman & Oldham, 1975; Wimperis & Farr, 1979) has associated these types of task characteristics with interest/intrinsic motivation, this decision is not unproblematic. As discussed in Chapter 2, intrinsic motivation is not an objective quality of a task, thus questioning the logic Kim and colleagues (2022) used. Additionally, it is somewhat questionable to what extent Kim et al. 's (2022) classification scheme is accurate. For example, they coded Locke et al.'s (1968, Exp. 2) task as interesting. However, one could as easily argue that the task was noninteresting because the task required experimental participants to assemble identical objects (see Daniel & Esser, 1980; Hitt et al., 1992). Another example comes from a study by Daniel and Esser (1980). Kim et al. (2022) classified all participants of Daniel and Esser's (1980) study into the category "interesting task," even though Daniel and Esser (1980) also included a boring task condition in their study.

settings has been quite scarce until recently. Indeed, the pace of empirical research has increased substantially only in the latter half of the 2010s (see, e.g., Kuvaas et al., 2016, 2020; Malik et al., 2015, 2019; Thibault Landry et al., 2019; Thibault Landry, Forest, et al., 2017; Thibault Landry, Gagné, et al., 2017; Wenzel et al., 2019). Partly because of the scarcity of research, views about the existence and relevancy of the undermining of intrinsic motivation by extrinsic rewards in organizational settings have relied on a limited (and somewhat scattered) pool of evidence. For example, in their literature review, Gerhart and Fang (2015, p. 489) concluded that evidence for the detrimental effects of performance-based rewards on intrinsic motivation in organizational settings is lacking. However, they failed to provide convincing empirical evidence to support their claim.

In fact, it seems somewhat characteristic for the field of organizational research[29] to rely (more) on indirect evidence to advance one's argument[30]. Especially, when discussing (and arguing for) the beneficial effects of rewards on intrinsic work motivation, the authors advocating the use of extrinsic incentives often base their arguments on studies examining the rewards–performance relationship (see, e.g., Garbers & Konradt, 2014; Gerhart & Fang, 2014, 2015). This is problematic because job performance is determined by multiple factors such as a person's skills, knowledge, ability, and external resources; (intrinsic) motivation is only one component contributing to work performance (Kanfer, 2012, p. 456). Ryan, Sheldon, Kasser, and Deci (Ryan et al., 1996, p. 7) have also succinctly noted that "all goals are not created equal." For example, meta-analyses by Jenkins et al. (1998) and Cerasoli et al. (2014) show that monetary rewards tend to promote performance quantity, not performance quality (see also T. E. Becker et al., 2018; Kallio et al., 2016; Kallio & Kallio, 2014). Thus, deducing incentives' deleterious or beneficial effects on intrinsic work motivation by simply examining the rewards–performance

29 The term "field of organizational research" refers to studies examining the extrinsic rewards–intrinsic motivation relationship in work settings.

30 An examination of two reviews of the literature by Gerhart and Fang (2015) and Deci, Olafsen, and Ryan (2017) illustrates this point. Although the focus of these papers is not limited to discussing the incentives–intrinsic work motivation relationship, both papers touch on the topic. While arguing for the beneficial effects of performance-based incentives on intrinsic work motivation, Gerhart and Fang (2015) base their argument only on three published empirical studies examining the relationship between performance-based rewards and intrinsic motivation at work, one of which was their own paper. Likewise, in their discussion about the role of pay in work settings, Deci et al. (2017) cite only two empirical investigations directly examining the rewards–intrinsic work motivation relationship in the workplace. Both Gerhart and Fang (2015) and Deci et al. (2017) end up building an argument for incentives' positive or negative effects using indirect evidence.

relationship without actually knowing to what extent intrinsic motivation energizes work performance in that particular activity is insufficient.

The debate is also fueled by somewhat contradictory interpretations of the existing (indirect) pool of evidence. While Kuvaas et al. (2020) and Deci et al. (2017) interpret that Cerasoli et al.'s (2014) meta-analytical results support the view that rewards undermine intrinsic motivation, Shaw and Gupta (2015) argue that Cerasoli et al.'s (2014) study illustrates the beneficial effects of rewards on intrinsic motivation. Thus, it seems somewhat characteristic for this field of inquiry to interpret evidence as supporting one's own theoretical viewpoint.

As the preceding discussion and this chapter highlight, the debate on extrinsic rewards' effects on intrinsic motivation is all but over. Partially mixed past meta-analytical results and differing conclusions call for a new quantitative synthesis of the research evidence stemming from laboratory experiments. Moreover, the debate has expanded from controlled laboratory experiments to applied settings. To the author's best knowledge, no systematic attempt to quantitatively synthesize the organizational literature on the relationship between intrinsic work motivation and extrinsic rewards has been made. Thus, a clear need for such a study exists. This thesis utilizes a meta-analytical approach to synthesize evidence from controlled experimental laboratory studies and observational studies conducted in work settings to bring clarity to the ongoing debate.

3 Research questions

The main goal of this thesis is to examine the effects of extrinsic rewards on intrinsic motivation both in controlled laboratory experiments and organizational settings. Special interest is put into examining those rewards and reward contingencies under which rewards undermine intrinsic motivation. Regarding experimental studies, the meta-analysis conducted in this thesis is a conceptual replication and extension of Deci et al.'s (1999a) and, to some extent, Cameron et al.'s (2001) meta-analytical studies. The aim is to shed light on the long-lasting debate on rewards' effects on intrinsic motivation. Especially the aim is to find out whether the undermining of intrinsic motivation by extrinsic rewards is as pervasive as shown by Deci et al. (1999a) or whether the undermining effect is a "myth" and limited phenomenon as argued by Cameron and her colleagues (Cameron et al., 2001; Eisenberger, Pierce, et al., 1999; Eisenberger & Cameron, 1996) or something in between. Moreover, by synthesizing studies conducted in organizational settings separately, this thesis aims to advance the understanding of the relationship between extrinsic rewards and intrinsic motivation in work settings. By doing this, the present thesis contributes to an emerging debate, specifically concerning the relationship between performance-based pay and intrinsic work motivation.

Overall, this meta-analytical review tries to broaden the understanding of rewards' (deleterious) effects. Although an old debate, Van den Broeck, Carpini, and Diefendorff (2019, p. 513) point out that the undermining of intrinsic motivation by extrinsic rewards "*remains contentious and highly debated in the 21st century,*" thus warranting further investigation. This study will focus on answering the following questions:

1. Under what reward contingencies and populations will extrinsic rewards have a negative effect, no effect, or positive effect on intrinsic motivation in controlled laboratory experiments? What is the magnitude of the effect?
2. What is the association between extrinsic rewards and intrinsic motivation in organizational settings? How strong is this association?

These research questions will be answered by conducting separate meta-analyses for experimental and observational studies. The first meta-analysis will examine rewards' effects in randomized controlled laboratory experiments. The aim is to

clarify previous meta-analytical findings that have been partially conflicting and reached different conclusions (see Deci et al., 1999a; Cameron et al., 2001; Tang & Hall, 1995; Cameron & Pierce, 1994; Eisenberger & Cameron, 1996; Cerasoli et al., 2014). Because two decades have passed since the last meta-analyses were conducted, and new research evidence has accumulated since, this warrants further examination of this issue. Special interest is directed at examining the effects of so-called contingent rewards, which have been at the heart of the debate. This reward category includes rewards contingent on doing or completing a task or performing well at one.

Using an analysis framework Deci et al. (1999a) utilized, extrinsic rewards' effects on intrinsic motivation are analyzed using a hierarchical approach. Separate meta-analyses will be conducted for free-choice intrinsic motivation (i.e., free-choice behavior/persistence) and self-reported interest/enjoyment. As this thesis draws heavily on Deci et al.'s (1999a) meta-analytical review, for example, by using a similar classification system of different reward contingencies, this study is a conceptual replication of Deci et al.'s (1999a) meta-analytical study.

As well as these main goals, the meta-analysis of controlled experiments will also explore two partially controversial issues via two supplementary meta-analyses. First, the longevity of the expected rewards' effects on free-choice intrinsic motivation will be examined. Thus, the present meta-analytical review follows an analysis framework established by Deci et al. (1999a). This supplementary meta-analysis represents an attempt to create a conceptual replication and extension of Deci et al.'s (1999a) meta-analytical findings showing that the detrimental effect of expected tangible rewards is persistent. The issue of longevity will be investigated by examining the effect of expected contingent rewards on free-choice intrinsic motivation at four different time points (immediately after reward withdrawal, within one week, between one to three weeks, and over three weeks after withdrawal of the reward contingency).

The second supplementary analysis relates to the possibility of a methodological artifact or methodological confounding. Some researchers (e.g., Carton, 1996; Carton & Nowicki, 1998) have suggested that the undermining of intrinsic motivation is not caused by extrinsic rewards *per se* but by an explicit announcement that rewards will be withdrawn. Additionally, some uncertainty exists on whether the timing of reward administration (before a free-choice period or after) may affect the outcome, for example, by creating negative feelings (Carton, 1996; Reiss, 2005, 2013; Reiss & Sushinsky, 1975). A supplementary analysis will be done to examine the possibility that a methodological artifact might be responsible for the findings. Studies using expected contingent rewards will be divided into four categories based on the explicitness of reward withdrawal (explicitly informed vs. implicitly informed) and the timing of the reward (before vs. after the free-choice period).

The meta-analysis of observational studies will examine the association between extrinsic rewards and self-reported intrinsic motivation at work. As already discussed, several compensation scholars (Gerhart, 2017; Gerhart & Fang, 2014, 2015; Gupta & Shaw, 1998; Latham, 2012; Rynes et al., 2005; Shaw & Gupta, 2015) have been highly critical of research evidence demonstrating the undermining of intrinsic motivation by extrinsic rewards because most evidence stems from experimental laboratory studies using nonwork study subjects and tasks. Despite criticism, researchers in the field of inquiry have not produced a meta-analysis on the issue. This lack of meta-analytical evidence can be considered a shortcoming because it continues to fuel the academic debate on how rewards affect intrinsic work motivation in organizational settings as the evidence provided by individual studies is used to make often mutually opposite conclusions. This also reduces the practical value and usefulness of produced knowledge because practitioners using scientific information are bombarded with (partially) conflicting information. Therefore, the second aim of this study is to examine and statistically synthesize how rewards are associated with intrinsic work motivation in organizational settings. The focus is especially on examining the association between performance-based rewards and intrinsic work motivation. This reward contingency is at the focal point of the academic debate between intrinsic motivation scholars and compensation scholars (see, e.g., Deci et al., 2017; Gerhart & Fang, 2015).

This thesis aims to clarify the ongoing debates on the undermining effect's existence, extent, and magnitude via three primary meta-analyses, as discussed above. First, by producing a quantitative synthesis of experimental findings (randomized controlled studies), this study not only examines to what extent previous meta-analytical findings of Deci et al. (1999a) can be replicated but also aims to provide new insight into the issue of how extrinsic rewards affect intrinsic motivation. Second, by synthesizing research on the relationship between rewards and intrinsic work motivation in organizational settings and highlighting the field's weaknesses, this study seeks to broaden the field of discussion, provide more ecologically valid evidence, and create avenues for future research.

Because this study will consist of three separate primary meta-analyses relying on different data types (controlled experiments vs. correlational data) and measures of intrinsic motivation, ensuring the text's traceability and readability is necessary. Therefore, the following terms are used to refer to a specific meta-analysis: 1) *free-choice meta-analysis* is used to denote a meta-analysis of controlled experimental studies using a free-choice behavior measure of intrinsic motivation, 2) *self-report meta-analysis* is used to denote a meta-analysis of controlled experimental studies using a self-report interest/enjoyment measure of intrinsic motivation, and 3) *observational meta-analysis* is used when referring to a meta-analysis of nonexperimental (observational) studies conducted in organizational settings and

using a self-reported measure of intrinsic work motivation. Finally, the terms *meta-analytical review* and *thesis* are used interchangeably when discussing the overall meta-analytical findings of this study.

4 Methodology

4.1 Meta-analysis

This study utilizes a meta-analytical approach to synthesize data. Simply stated, a meta-analysis is a statistical synthesis of findings from a set of multiple past studies (Borenstein et al., 2009, p. XXI). In a meta-analytical study, an effect size is calculated for each individual study (Lipsey & Wilson, 2001). Effect size represents the strength of an association between two variables or the magnitude of an effect between a treatment group and a control group that is caused by experimental manipulation of an independent variable (Borenstein et al., 2009, p. 3). Based on these individual effect sizes, a composite (summary) effect size is calculated that reflects the overall weighted effect. The overall results of a meta-analysis are presented in the form of the composite effect size. In the present meta-analysis, effect size estimates represent either the *causal* impact of extrinsic reward on intrinsic motivation (controlled experimental studies) or the association between extrinsic rewards and intrinsic work motivation (observational studies).

Statistical analysis and synthesis of data were chosen for this study partly because of the inherent difficulties in objectively synthesizing such a vast, complex, multifaceted, and contradictory field of research using a more traditional, qualitative synthesis of the literature (cf. Borenstein et al., 2009). Moreover, meta-analysis avoids the problem of vote counting – a traditionally used method to determine the existence of an effect in narrative reviews (Borenstein et al., 2009, pp. 251–253). Meta-analysis also possesses other strengths compared to a traditional narrative review. Through creating a statistical synthesis of the data by combining individual effect sizes into a composite effect size estimate, meta-analysis has more power to detect statistically significant effects or relationships between variables. (Lipsey & Wilson, 2001, p. 6.)

Nonetheless, some authors in the field of intrinsic motivation research have criticized the meta-analytical method for its tendency to "clump together" studies with different characteristics, meaningful theoretical conditions, or procedural variations in searching for the main effect (Lepper et al., 1999; Lepper & Henderlong, 2000, p. 269). Lepper and Henderlong (2000, p. 269) and Lepper et al. (1999) elaborate this problem by remarking that after the initial studies examining

and establishing the existence of the main effect were conducted, more complex experimental designs appeared using various moderator variables or other procedures designed to eliminate the undermining of intrinsic motivation by extrinsic rewards—partly so that the authors could get their findings published. As Lepper et al. (1999) point out, this led to studies including experimental conditions specifically designed to nullify or even reverse the expected (negative) effect. Because of the theoretical and empirical complexities of the field of inquiry, Lepper et al. (1999) argue that the meta-analytical method is not necessarily an ideal method for synthesizing (experimental) literature on how extrinsic rewards affect intrinsic motivation. Despite these valid pieces of critique, this study's author feels a meta-analysis is the most suitable method for synthesizing such vast literature.

4.1.1 Data search

The data for this meta-analysis were systematically searched from seven electronic databases. The searches were conducted in three distinct phases between 2013 and 2020. The first search phase was conducted in the fall of 2013; a supplementary search was conducted in the summer of 2014. Additionally, an updated search was performed in the summer of 2018 and again in the summer of 2020. Included databases were 1) PsycINFO (ProQuest), 2) Business Source Complete (EBSCO), 3) Emerald Journal (Emerald), 4) Science Direct, 5) ABI/INFORM Complete (ProQuest), 6) Wiley Online Library, and 7) SocINDEX (EBSCO). These databases were searched for peer-reviewed journal articles examining the effects of extrinsic rewards on intrinsic motivation. These databases were chosen because they represent the focal databases in the fields of organizational behavior research and social psychology research.

Multiple search terms and combinations of them were used to conduct the systematic search, including, for example, the following terms: intrinsic motivation, extrinsic reward, reinforcement, effect, affect, undermining, overjustification, praise, positive feedback, performance-contingent reward, incentive, and pay. A wildcard symbol "*" was used to increase hits in those databases where usage of wildcards and truncation symbols were possible. An example of a search phrase is the following: "intrinsic motivation" AND "ext* rew*" AND effect*. During the 2018 literature search, a new search term, "pay for performance," was included. This decision was made to find those studies that had been conducted in work settings. For the same reason, additional terms of "performance-based pay," "performance-related pay," "bonus," and "merit pay" were added and used in the last search conducted in 2020. The search terms are presented in Appendix 6.

The search processes used three different search fields: title, abstract, and keywords. The following example illustrates the search protocol. First, keywords

"intrinsic motivation" AND "ext* rew* AND effect*" were entered in all three selected search fields. A Boolean operator, "*OR,*" was used between different search fields. After the search was completed, this phase was repeated with other search terms.

Additional studies were identified by searching the references of previous meta-analytical studies by Deci et al. (1999a) and Cameron et al. (2001). Moreover, potential papers were identified through other sources (e.g., suggestions given by reference software, identifying possible studies from the bibliographies of primary studies, or locating studies just by chance). Altogether, 45 possibly relevant papers were identified through these means.

These searches produced over 4500 hits; these potential studies were subsequently imported for initial screening. After duplicates were excluded, 2332 studies were selected for abstract analysis. Of these, 1838 were excluded due to irrelevancy: the remaining 487 were included in a full-text analysis phase. A total of 329 studies were excluded after the full-text review phase. The most common reasons for exclusion were the following: lack of a no-reward control group (53 studies), nonempirical study (53 studies), irrelevant study (36 studies), duplicate study (19 studies), or not written in English (19 studies). Additionally, some studies were excluded for flawed methodology, unclear or invalid manipulation of the independent variable, ambiguous or irrelevant reward measure, insufficiently reported statistical information, or because the target behavior was not intrinsically motivating.

Ultimately, 158 peer-reviewed journal articles met the inclusion criteria and were included in the meta-analytical phase, of which 124 papers were included in the two meta-analyses of randomized controlled laboratory studies; the remaining 35 papers were included in the meta-analysis of observational studies. Included studies are listed in Appendices 1–3. Two papers (Eisenberger, Rhoades, et al., 1999; Eisenberger & Aselage, 2009) were included in both meta-analyses because these papers included controlled experiments and observational studies. Figure 1 illustrates the systematic search flow diagram.

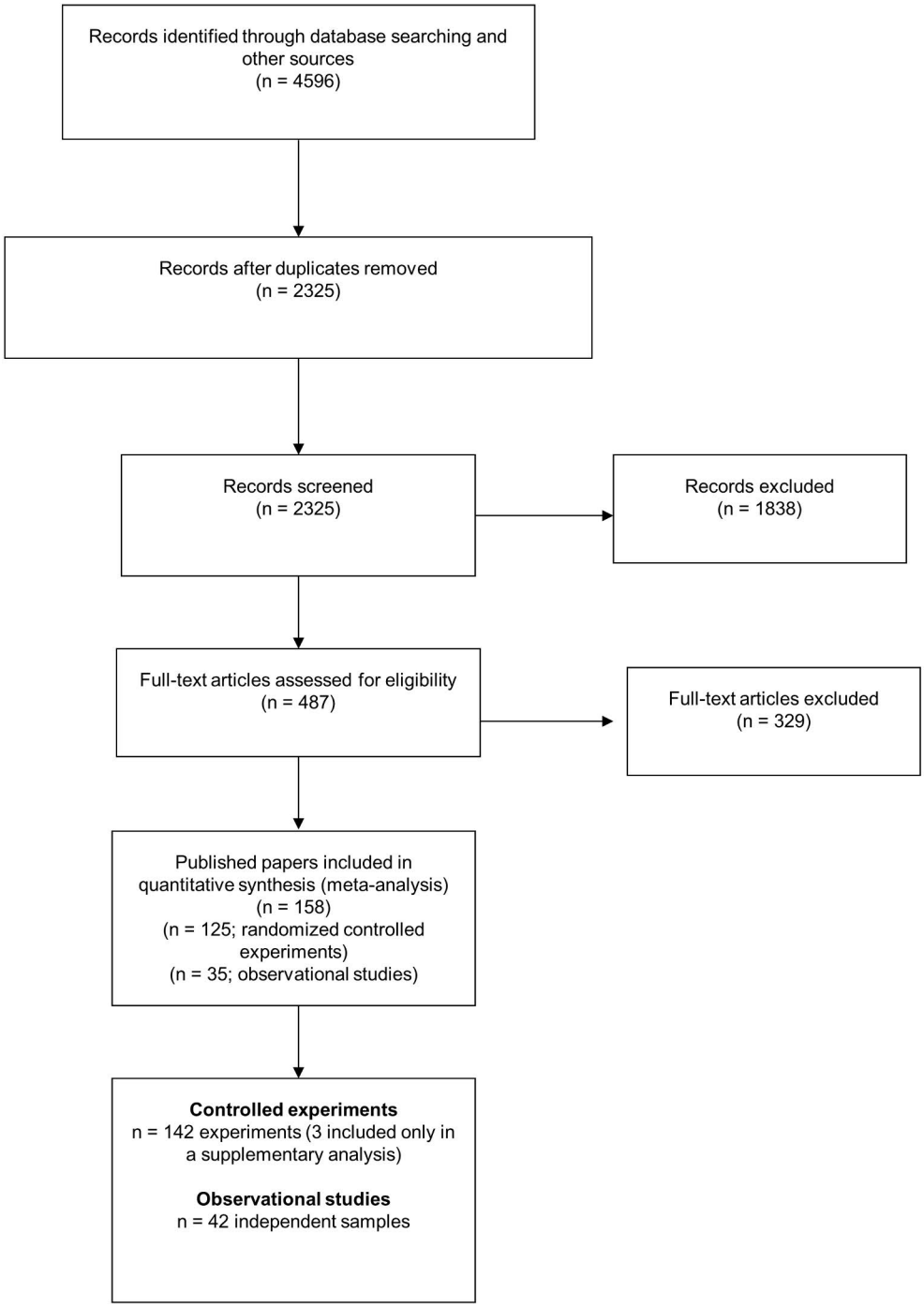

Figure 1 Systematic search flow chart (adapted from Slemp et al., 2018).

4.1.2 Inclusion criteria

A study had to fulfill several criteria to be included in the meta-analysis. First, the general criteria are presented, after which the specific criteria for experimental studies and observational studies are presented separately. Regarding the general criteria, a study had to be a primary study and contain statistical (empirical) data to be included in the meta-analysis. Thus, this choice excluded theoretical and conceptual papers, previous literature reviews (narrative reviews and meta-analyses), and qualitative studies examining the phenomenon under study.

The second general inclusion criterion related to language. Only studies published in English were included in the meta-analysis. The third general criterion was related to a study's publication status. Only published, peer-reviewed journal articles were included. Thus, the data of this meta-analytic review is comprised of articles published in scholarly journals. It was chosen to include only studies that have been published and scrutinized by a peer-review process because such studies (may) provide more validated and higher quality data than their non-evaluated counterparts that have not been subjected to a peer-review process (Bedeian, 2004; Crossan & Apaydin, 2010; Lipsey & Wilson, 2001, p. 19; Podsakoff et al., 2005). Peer review represents a mechanism of quality control (Bedeian, 2004), albeit others have noted such does not guarantee high-quality research (Lipsey & Wilson, 2001, p. 19).

Although the decision to include only peer-reviewed studies might mean these studies may be of higher quality, this decision may potentially create a problem of publication bias (Sutton, 2009) that can bias the pooled mean effect size estimates. According to Sutton (2009, p. 436), including only published studies may distort the results because a systematic difference may exist between published and unpublished studies. This can mean that included studies may not be a representative sample of all possible studies examining the phenomenon of interest (Greenhouse & Iyengar, 2009). Greenhouse and Iyengar (2009, p. 428) elaborate that studies with statistically significant findings have a higher chance of being published than those with nonsignificant findings. This, in turn, can bias the results, for example, by superfluously inflating the composite effect size estimates (Schäfer & Schwarz, 2019). The decision to include only published studies also meant that the meta-analytical results for controlled experiments are not entirely comparable with the previous meta-analyses by Deci et al. (1999a) and Cameron et al. (2001) because the aforementioned meta-analytical studies included unpublished doctoral dissertations. Next, the specific inclusion criteria for experimental and observational studies are presented.

Experimental studies

First, an experimental study had to contain a no-reward control group to be included in the analysis. Reward groups were compared with no-reward control groups to infer the magnitude and direction of an effect. Multiple studies were excluded because they failed to meet this first criterion. Many studies examined the relative effects of one type of reward compared to another (e.g., Enzle et al., 1996; Fisher, 1978; Parker et al., 2019) or provided (monetary) rewards to all participants, including the control group participants. Some recent studies (e.g., Goswami & Urminsky, 2017; Hendijani et al., 2016; Murayama et al., 2010; Saether, 2020; Woolley & Fishbach, 2018) were excluded for the abovementioned reasons. For example, Gosmawi and Urminsky (2017) provided a monetary incentive of $1.75 to all participants for participating in the study, while Hendijani et al. (2016) compared the relative effects of performance-contingent pay to fixed pay.

The second inclusion criterion was related to task interest. Following Deci et al.'s (1999a) suggestion, only studies using intrinsically motivating/interesting tasks were included; boring and uninteresting tasks were excluded. As Deci et al. (1999a, p. 633) state, *"…the undermining phenomenon has always been specified as applying only to interesting tasks insofar as with boring tasks there is little or no intrinsic motivation to undermine*." Two criteria were utilized to assess a particular task's intrinsically motivating nature, thus following Deci et al.'s (1999a) procedure. First, if a study reported that a task was intrinsically interesting or intrinsically motivating, it was included in the meta-analysis. Respectively, tasks explicitly stated as uninteresting or boring were excluded. Sometimes, studies used pilot testing to confirm the intrinsically motivating nature of the chosen task, while occasionally, the experimental task was only assumed to be intrinsically motivating. Second, when a study reported self-reported task interest, this measure was used as an alternative eligibility criterion. Only those tasks (and studies) that reported a mean interest score above the scale midpoint were included; others were excluded (e.g., Hendijani & Steel, 2020).

From time to time, using subjective interpretation to infer whether a task was interesting enough was necessary because the interest level was not explicitly stated in the paper (e.g., Marinak & Gambrell, 2008). Likewise, in some cases, subjective choices had to be made on whether to calculate an effect size based on free-choice task engagement on old versus new puzzles (Vansteenkiste & Deci, 2003) due to a possibility of ego-driven task involvement (Ryan et al., 1991)[31].

[31] Regarding a study by Vansteenkiste and Deci (2003), the effect sizes were calculated based on the free-choice time spent on new puzzles because the authors of the study hypothesized that time spent on the old puzzles would represent ego-involved persistence.

The third criterion concerned the utilized *dependent measures of intrinsic motivation*. A study had to use a free-choice behavior measure of intrinsic motivation or a measure of self-reported interest to be included in the analysis. This criterion was used to keep comparability of results with Deci et al.'s (1999a) and Cameron et al.'s (2001) meta-analyses. The free-choice measure of intrinsic motivation is a behavioral measure of intrinsic motivation, normally measured covertly after the reward contingency is terminated and the study subject is left alone. This is done so that the study subject does not feel external pressure to engage in any activity. The amount of time an individual spends engaged in the experimental activity (e.g., a puzzle-solving task) during this free-choice phase is used to infer the intrinsic motivation. (Ryan & Deci, 2017, p. 126.) Most studies using the free-choice measure of intrinsic motivation have measured task persistence (i.e., time), although some studies inferred intrinsic motivation from task performance during the free-choice period (e.g., Parker et al., 2017; Pittman et al., 1977; Smith & Pittman, 1978; Weiner & Mander, 1978).

Another measure of intrinsic motivation is self-reported interest in and enjoyment of the experimental activity. Attitudinal measures of intrinsic interest typically include different kinds of items measuring task interest, liking, enjoyment, or reasons for engaging in an activity, thus allowing an individual to reflect his or her feelings. A review of the literature shows that a wide range of measures has been used to measure self-reported intrinsic interest ranging from single-item measures (e.g., Morgan, 1981; Sarafino, 1984; Turnage & Muchinsky, 1976) to multiple-item scales (e.g., Eisenberger & Aselage, 2009; Hagger et al., 2015; Thill et al., 1998; Vansteenkiste & Deci, 2003).

The last inclusion criterion relates to using randomization. Only those studies in which study subjects were assigned to experimental and control conditions using a random assignment were included. In some cases, judgment had to be used on whether a particular study had used random assignment because such was not explicitly mentioned in the paper. For example, Thill et al. (1998) did not explicitly mention this issue, while Pittman et al. (1977, p. 280) described their assignment procedure only by stating that "*males and females were evenly distributed across conditions*." In such cases, additional information was gleaned from the paper, and the decision to include or exclude the study was made based on the author's best judgment.

Observational studies

Regarding observational studies (i.e., nonexperimental field studies), several criteria were used to assess eligibility. First, a study's sample of respondents or participants had to be comprised of working adults, meaning studies using student or nonworking

samples were excluded. Second, a study had to be conducted in a *real* work environment, meaning that studies using hypothetical situations (i.e., vignettes and scenario experiments) were excluded (e.g., Jacobsen & Jensen, 2017; J. Kunz & Linder, 2012). These decisions were made to ensure that included samples represented working populations, so the results would reflect how extrinsic rewards interact with *actual* intrinsic work motivation.

Third, a study had to include a measure of extrinsic rewards; the utilized measure had to be appropriate and sufficiently unambiguous. If a study did not include a measure of extrinsic rewards, it had to indicate otherwise that a reward contingency was in effect. Some studies (e.g., Jordan, 1986) compared subjects receiving fixed pay to subjects receiving a combination of fixed pay and performance-based pay. A measure of extrinsic rewards was deemed appropriate and unambiguous if it measured one of the following aspects: 1) pursuit of extrinsic rewards or reward expectancy (e.g., Eisenberger & Aselage, 2009), 2) measured to what extent one's compensation depends on work performance, 3) indicated belonging to a group that worked under an incentive plan (e.g., merit pay), 4) reported the absolute amount of received rewards (e.g., amount of base salary), 5) reported the average percentage of received rewards (e.g., performance-based rewards) compared to base salary, 6) measured the functional significance (i.e., psychological meaning) of rewards, or 7) measured perceptions of received feedback. Some studies were excluded because they failed to meet the outlined criteria, for example, by measuring satisfaction with pay or other types of rewards (e.g., Kao & Chen, 2016). In other cases, some specific variables or studies were excluded for imprecise reporting. For example, Eisenberger, Rhoades, et al. (1999, Study 3) reported each employee's annual earnings but failed to specify to what extent the proportion of annual earnings was based on performance-contingent rewards and base salary.

The fourth criterion dealt with the measurement and level of intrinsic motivation. Only those studies which employed a self-report measure of intrinsic work motivation were included in the meta-analysis. Thus, some studies were excluded from the pool of studies as they used, for example, work performance or the number of weekly work hours as a proxy of intrinsic motivation (e.g., Bareket-Bojmel et al., 2017; Huffman & Bognanno, 2018; Markova & Ford, 2011). Like in the case of the experimental studies, only those observational studies in which the level of respondents' self-reported intrinsic work motivation was at a sufficiently high level were included. The level of self-reported intrinsic motivation had to be above the scale midpoint for a study to be included.

A few studies reported a correlation coefficient between extrinsic rewards and autonomous motivation. Autonomous motivation represents a combination of intrinsic motivation and internalized and integrated forms of extrinsic motivation (Deci et al., 2017; Gagné & Deci, 2005). Several studies have shown high correlation

coefficients between intrinsic motivation and different types of autonomous extrinsic motivation (i.e., integrated regulation, identified regulation), ranging from 0.57 to 0.80 (Gagné et al., 2015; Tremblay et al., 2009; Van den Broeck et al., 2021). So, it was decided to include studies reporting a relationship between extrinsic rewards and autonomous motivation and use extracted correlation coefficients between extrinsic rewards and autonomous motivation as a proxy for the relationship between rewards and intrinsic work motivation. This decision can be further justified on the grounds that autonomous forms of extrinsic motivation share many characteristics with intrinsic motivation (Ryan & Deci, 2000a). However, this decision is not unproblematic. Because autonomous extrinsic motivation is not based on experiencing an activity inherently enjoyable and interesting but is based on the value and importance of an activity (Gagné & Deci, 2005; Ryan & Deci, 2020), it seems likely that reported correlations are weaker, and therefore more conservative than what they otherwise would have been (cf. Van den Broeck et al., 2021, p. 23). Supporting this line of thinking, a doctoral dissertation by Hewett (2014) showed that the relationship between high merit pay level and intrinsic work motivation was not only negative but also stronger ($r = –0.15$, $p < 0.05$) than the relationship between high merit pay and integrated regulation ($r = –0.06$, $p = n.s.$) or identified regulation ($r = –0.08$, $p = n.s.$).

4.1.3 Dependent measures

As mentioned in the preceding sub-section, intrinsic motivation is the focal construct of interest and the dependent variable of this meta-analytical review. Regarding controlled experimental studies, free-choice behavior and self-reported interest/enjoyment represent the dependent measures of intrinsic motivation. The terms "free-choice behavior," "free-choice persistence," and "free-choice intrinsic motivation" are used interchangeably throughout this thesis. Regarding observational studies, self-reported intrinsic work motivation is the only dependent measure.

Time spent engaging in an experimental activity (e.g., solving puzzles) during a free-choice period was the primary and by far the most often used measure of free-choice intrinsic motivation. This measure was developed by Deci (1971). Free-choice persistence is measured covertly when a study subject is left alone and the reward contingency has been terminated. The amount of time spent engaged in the experimental activity is used as an indicator of intrinsic motivation. However, in some studies (e.g., Carr et al., 1996; McLoyd, 1979; Warneken & Tomasello, 2008), the experimenter remained in the same room during the free-choice period. In these cases, a study subject was made to believe the experimenter was busy with other work; in reality, the experimenter recorded the amount of time the study subject

spent on the experimental activity. Some studies utilized alternative ways to measure intrinsic motivation during the free-choice period. Measures such as the number of found errors (Houlfort et al., 2002, Exp. 1), successfully decoded words (Weiner & Mander, 1978), or found words in a word search puzzle (Carton & Nowicki, 1998) during the free-choice period were used.

Regarding the measure of self-reported interest, study subjects typically reported how interesting and/or enjoyable the target activity was. In some cases, the utilized scales measured task satisfaction (Arnold, 1976; Staw et al., 1980) or task liking (e.g., Arkes, 1979; Hennessey, 1989; Morgan, 1983). Self-reported interest, as a rule, was measured after the free-choice period. As already mentioned, the length of utilized scales varied from one item (e.g., Houlfort et al., 2002, Exp. 2) to over 20-item scales (Thill et al., 1998).

As mentioned above, the dependent measure in observational studies was self-reported intrinsic work motivation. Included studies utilized many different scales to measure self-reported intrinsic work motivation. While some studies (e.g., Hewett & Leroy, 2019) used psychometrically sound measures such as the Multidimensional Work Motivation Scale (MWMS) (Gagné et al., 2015), others provided less information about the validity of the utilized measures of intrinsic work motivation (e.g., Daley, 1987; Kominis & Emmanuel, 2007). A common feature of these intrinsic work motivation scales is their level of measurement. Typically, the scales measure intrinsic motivation at the level of the whole work, as the following item from Kuvaas et al.'s (2020, p. 528) study exemplifies: "*Sometimes I become so inspired by my job that I almost forget everything else around me."*

4.1.4 Coding of included studies

All potential studies were first skimmed through; if a study met the eligibility criteria, it was read through. Various pieces of information were coded and extracted from the included studies. Regarding experimental studies, the following pieces of information were coded: 1) name of author(s), 2) name of journal, 3) publication year, 4) type of reward contingency, 5) operationalization of intrinsic motivation (free-choice behavior, self-reported interest/enjoyment, 6) study population, 7) type(s) of used reward(s), 8) reward-conditions, 9) presence of a no-reward control group, 10) whether the authors conducted a pretesting of intrinsic motivation, 11) what kind of task the study used, 12) the intrinsically motivating nature of the task, and 13) statistical information (e.g., group means and standard deviations). When a study administered performance-contingent rewards, whether the given reward was 14) maximum or less-than maximum and 15) which type of a control group the study had utilized (positive feedback control, no feedback control, negative feedback control) was also coded. Each experimental study using the free-choice measure of

intrinsic motivation was also coded regarding 16) whether reward withdrawal was explicitly announced in the paper and 17) whether the reward was given before the free-choice period.

Regarding the observational studies, mostly identical pieces of information were extracted. However, some coding differences were evident due to intrinsic differences between observational and experimental studies. For example, observational studies did not have no-reward control groups, so this information was not coded. Second, it was coded whether the utilized reward measure was subjective, objective, or a combination of these two measures. Whether all or only some study respondents were under a performance-contingent reward (PCR) plan was also coded. In addition, the response rate was also coded whenever this information was reported in a study. Finally, whether a study was cross-sectional or longitudinal was also coded. All longitudinal studies were simply coded as "longitudinal" to simplify the analysis phase and ensure each category had enough studies. No further differentiation between different types of longitudinal study designs was made.

Reward types and reward contingencies

One major question in the coding of selected studies was related to coding different reward types and reward contingencies. As the results of previous meta-analytical studies (Cameron et al., 2001; Deci et al., 1999a; Eisenberger, Pierce, et al., 1999) have shown, this choice can have drastic effects on the results. A decision was made to code rewards based on CET's typology (Deci et al., 1999a; Ryan et al., 1983) because this typology provides a clear, theoretically driven, and consistent way of coding different types of rewards and reward contingencies.

Rewards were classified into the following reward contingencies: positive verbal rewards, negative verbal rewards, task-noncontingent rewards, unexpected rewards, engagement-contingent rewards, completion-contingent rewards, performance-contingent rewards and competitively contingent rewards. In contrast to previous meta-analyses by Deci et al. (1999a) and Cameron et al. (2001), two additional reward contingencies were included: negative verbal rewards (i.e., negative feedback) and competitively-contingent. However, the latter was subsumed into the category of performance-contingent rewards due to the low number of relevant studies. Furthermore, rewards were classified as verbal or tangible. Tangible rewards were also classified as expected rewards and unexpected rewards, aligning with Deci et al.'s (1999a) typology. This classification framework was used to classify rewards and reward contingencies in experimental and observational studies.

However, classifying reward contingencies utilized in observational studies was challenging at times. Gagne and Forest (2008, p. 226) have noted that categorizing real-world reward structures using CET's typology is difficult because real-life

compensation schemes are often more nuanced. Some real-life performance-based reward schemes (e.g., sales commission) share qualities with completion-contingent rewards and performance-contingent rewards (Deci et al., 2017). A decision was made to classify all types of pay-for-performance incentives as simply performance-contingent rewards. Base salaries were classified as task-noncontingent rewards (see Deci et al., 2017, p. 33). In order to keep the discussion of meta-analytical findings as clear as possible and to avoid confusion, the term "performance-based rewards (PBRs)" is used to denote performance-contingent rewards in observational studies (i.e., studies conducted in work settings). For the same reason, the term "base salary" is used to denote task-noncontingent rewards in observational studies.

Next, these different types of reward contingencies will be described starting with positive feedback. *Positive feedback* (i.e., positive verbal rewards, praise) refers to a class of verbal rewards that are usually "given" to indicate good performance at a certain task. Cognitive evaluation theory (Deci & Ryan, 1985; Ryan & Deci, 2017) postulates that due to this tendency, positive feedback often conveys positive information about one's competence, and therefore, positive feedback can support the psychological need for competence and eventually enhance intrinsic motivation via this psychological mechanism. Although positive feedback is often viewed as having a more salient competence affirming (i.e., informational) aspect than the controlling aspect, research has hypothesized and shown that positive feedback can be experienced as an external controlling force of one's behavior (Deci et al., 1999a; see also Henderlong & Lepper, 2002). For example, Kast and Konnor's (1988) study demonstrated that while controlling feedback significantly undermined children's self-reported interest (d = –1.02) relative to a no-feedback control group, informational feedback had the opposite effect (d = 0.42). Although some studies have concentrated on examining the specific nuances or dimensions of positive feedback, such as mastery feedback and social-comparison feedback (Corpus et al., 2006), a decision was made to examine only the main effect of positive feedback in this thesis.

Conversely, *negative feedback* refers to negative evaluation that usually concentrates on one's performance or attributes (Fong et al., 2019, p. 122). Like positive feedback, negative feedback can affect intrinsic motivation primarily by affecting the psychological need for competence (Ryan & Deci, 2017, p. 156). While cognitive evaluation theory (Ryan & Deci, 2017, p. 156) suggests that negative feedback can signal incompetence, thwarting the need for competence, and eventually undermine intrinsic motivation, the theory also recognizes that a modest amount of negative feedback can serve as a positive motivator that challenges/motivates a person to stretch his or her abilities. Fong, Patall, Vasquez, and Stautberg (2019) also acknowledge the possibility of the enhancement effect as

negative feedback can serve as an input of information that allows a person to learn from his or her mistakes and thus improve future performance.

Unexpected rewards refer to rewards that are given as a surprise only after one has completed a given task. Therefore, people receiving unexpected rewards were unaware of the reward when they started the task (see, e.g., Orlick & Mosher, 1978). The lack of knowledge of a pending reward is the central feature of unexpected rewards. Thus, unexpectedly given rewards generally do not cause feelings of pressure or external control (Ryan & Deci, 2017, p. 138).

Task-noncontingent rewards refer to rewards that are typically given for participating in an event (e.g., an experiment) (Deci et al., 1999a; Ryan et al., 1983). A central characteristic of task-noncontingent rewards is that attaining this type of reward does not depend on engaging in or completing a specific activity (Ryan & Deci, 2017, p. 132). Because of this characteristic, no clear instrumental link exists between a task-noncontingent reward and an activity. Instrumentality is often perceived as an important factor in determining rewards' motivating power (Kuvaas et al., 2016; Pinder, 2008). The controlling and informative aspects of task-noncontingent rewards are suggested to be quite low because of a lack of instrumentality (Deci et al., 1999a; Ryan et al., 1983). Ryan et al. (1983) and, more recently Deci et al. (2017) and Olafsen et al. (2015) have equated this type of reward to base salary. As Olafsen et al. (2015, p. 3) point out, people do not view themselves as being paid for doing some specific activities (lack of clear means-end instrumentality); people view that they are "paid for doing their jobs." Therefore, observational studies reporting an association between base salary and intrinsic work motivation were classified into this category.

Engagement-contingent rewards represent rewards given for doing a task. Perhaps the most notable characteristic of engagement-contingent rewards is that attaining this type of reward does not require good performance or completing the task. Because this type of reward is contingent on task engagement (i.e., working on an activity), there exists a clear instrumental link between the reward and activity; therefore, the controlling aspect of this type of reward is argued to be highly salient (Deci et al., 1999a; Ryan et al., 1983; Ryan & Deci, 2017). Additionally, because an engagement-contingent reward is offered for simply doing a task, it does not convey much relevant competence information: therefore, the informational (i.e., competence-affirming) aspect of this type of reward is low or nonexistent (Deci et al., 1999a).

Completion-contingent rewards are extrinsic rewards promised for completing a certain task or activity (Deci et al., 1999a). Unlike engagement-contingent rewards given regardless of the quality of performance, completion-contingent rewards are given only for the successful completion of a task (Deci et al., 1999a). An example of this reward contingency comes from a study by Vasta and Strirpe (1979). Vasta

and Strirpe (1979) promised to give a symbolic gold star to the children in the reward condition. The reward was promised for every three math tasks a study subject completed. In a more recent example, Hagger and Chatzisarantis (2011) gave £1 for every completed SOMA puzzle (see also Deci, 1971). Like engagement-contingent rewards, completion-contingent rewards tend to have a strong controlling aspect (Deci et al., 1999a). Also, completion-contingent rewards can sometimes convey competence-affirming information, especially if the task at hand is challenging (Deci et al., 1999a). However, Deci and his colleagues (1999a) argue that the controlling aspect is likely to be significantly stronger than the informational aspect.

Performance-contingent rewards (PCRs) refer to rewards offered and given for attaining an ex-ante established performance requirement, standard, or norm (Ryan et al., 1983; Ryan & Deci, 2017). As performance-contingent rewards are given for performing well, they tend to have quite salient controlling functional significance (Ryan & Deci, 2017, p. 133). These standards can include normative (e.g., perform better than 80% of other study participants or co-workers) or absolute standards (e.g., surpass a score of 6 to get the reward) (Eisenberger, Pierce, et al., 1999; Houlfort et al., 2002; Ryan & Deci, 2017). A recent example of performance-contingent rewards comes from Parker et al.'s (2017) study in which subjects in the reward group were told that they could earn a maximum of $7 if their qualitative and quantitative performance on the experimental task were sufficient.

This type of reward contingency differs somewhat from engagement-contingent rewards and completion-contingent rewards because the attainment of a performance-contingent reward can convey very concrete and positive competence feedback (Deci et al., 1999a; Ryan et al., 1983). This positive competence information can neutralize some of the negative effects stemming from the controlling aspect of PCRs (Ryan & Deci, 2017, p. 133); therefore, considering how these rewards are administered and what the social context (pressuring vs. autonomy-supportive) is in which these rewards are offered is necessary (Ryan et al., 1983; Ryan & Deci, 2017, p. 133).

Competitively contingent rewards can be viewed as representing a special class of performance-contingent rewards. A distinguishing feature of competitively contingent rewards is that this type of reward is awarded only to the best performer (i.e., winner) while other competitors are left unrewarded or receive rewards that are, for example, less valuable (Ryan et al., 1983; Ryan & Deci, 2017, p. 132). Vansteenkiste and Deci (2003) elaborate that because competitively contingent rewards are given only to the best performing person or a few top performers, this reward contingency can have a strong controlling component. Due to an innate characteristic of competition, winning a competitively contingent reward can convey very positive competence information, while losing a competitive situation can signal incompetence and thus undermine intrinsic motivation.

Another central feature of competitively contingent rewards is that competitive situation in itself has been shown to undermine intrinsic motivation (Deci et al., 1981; Reeve & Deci, 1996; see also Epstein & Harackiewicz, 1992; McAuley & Tammen, 1989; Tauer & Harackiewicz, 1999; Vallerand et al., 1986). As Vansteenkiste and Deci (2003) note, the interpersonal context (pressuring vs. non-pressuring), in which competitively contingent rewards are given, can influence how these rewards affect intrinsic motivation. Because only one study (Vansteenkiste & Deci, 2003) included[32] in the primary meta-analyses examined the effects of competitively contingent rewards, this particular reward contingency was merged with the category of performance-contingent rewards as these two types of rewards share many similarities (e.g., reward attainment is dependent on performance).

Regarding performance-contingent rewards (including competitively contingent rewards), a highly relevant question pertains to what constitutes an appropriate control group for this reward contingency. Although there are some dissenting views on this issue (see Deci et al., 1999a, 1999b; Harackiewicz et al., 1984, 1987), a four-category classification framework that Deci et al. (1999a) used was adopted. Performance-contingent rewards were categorized based on whether the reward was maximum or less-than maximum and whether the no-reward control group members received or did not receive comparable performance feedback conveyed by reward attainment (i.e., no feedback, positive feedback, or negative feedback). As in Deci et al.'s (1999a) meta-analysis, the following categories were used: 1) maximum rewards / no-feedback control group, 2) less-than maximum rewards / no-feedback control group, 3) maximum rewards / positive feedback control group, and 4) less-than maximum rewards / negative feedback control group.

As well as the above-presented classification, studies were also classified into more broad classes of rewards based on the type of extrinsic reward (verbal or tangible) and whether rewards were unexpected or expected. In the case of one observational study (Reychav & Sharkie, 2010), the utilized reward expectancy scale could not be classified beyond the classification of "tangible incentives." This study was included only in the aggregate level analyses (all rewards and tangible rewards/incentives).

[32] Burroughs et al. (2011) and Pritchard et al. (1977) also utilized competitively contingent rewards. However, in both studies, only some subjects in the reward group managed to attain rewards; therefore, these two studies were included only in the supplementary analysis examining the effect of (partial) reward nonattainment on intrinsic motivation.

4.1.5 Effect size calculations

Calculations of individual effect sizes were performed using online software *Practical Meta-Analysis Effect Size Calculator* (Lipsey & Wilson, 2001; Wilson, 2021) or *Comprehensive Meta-Analysis* (CMA) software (v.3.3) (Borenstein, 2019; Borenstein et al., 2009). CMA was used to carry out the meta-analyses. Cohen's *d* (standardized mean difference) was used as the effect size estimate for controlled experimental studies, while the correlation coefficient was the effect size estimate for observational studies.

In the case of the experimental studies, individual effect sizes (Cohen's *d)* were calculated by comparing a control group with a treatment group (i.e., the reward group). The standardized mean difference is calculated by subtracting the control group's sample mean from the sample mean of the experimental treatment group and dividing the resulting mean difference by the pooled standard deviation of these two groups (Borenstein et al., 2009, pp. 25–26; Salkind, 2010, p. 181). A negative effect size estimate (*d*) means the reward group's intrinsic motivation is lower than the control group's intrinsic motivation. Thus, a negative *d* denotes that a reward has deteriorated or undermined intrinsic motivation. In contrast, a positive effect size means the effect on intrinsic motivation is positive. (Lipsey & Wilson, 2001, p. 49.) Because the present meta-analysis includes two dependent measures of intrinsic motivation (i.e., free-choice behavior and self-reported interest), separate effect sizes were calculated for these measures. As such, the present study followed similar procedures as previous meta-analyses in the field of inquiry.

Individual effect size estimates were mainly calculated using means, standard deviations, and sample sizes of reward and control groups whenever these statistics were reported. When some of the aforementioned statistical information was not reported (e.g., standard deviations), effect size estimates were calculated primarily by using 1) t-statistic, experimental and control group means and group sample sizes, 2) t-statistic and group sample sizes, 3) F-statistic and group sample sizes, or 4) F-statistic, group means, and group sample sizes. In some cases, alternative methods were used to calculate effect sizes. In such cases, the effect size estimates were based either on reward and control group sample sizes and reported or estimated p-value (e.g., Shanab et al., 1981; Vallerand & Reid, 1984), the number or frequency of events (e.g., Boggiano & Ruble, 1979; Marsden et al., 2015; Pallak et al., 1982), or the point-biserial correlation coefficient (Parker et al., 2017).

Sometimes, included studies did not report all necessary statistics; in these cases, approximate values were used to calculate the effect sizes. When a study reported in writing that a statistically significant difference existed between a reward group and a control group, but the study did not report the exact p-value, a p-value of 0.049 was used. This method produces a conservative effect size estimate (Matt & Cook, 2009, p. 546). Likewise, if a study only reported that a p-value was < 0.10, a p-value of

0.099 was used in effect size calculations. When no p-value was reported, but the paper reported group means for the experimental and control groups, a p-value of 0.101 was used. For example, Turnage and Mushinksy (1976) did not report p-values for all between-group comparisons, so a p-value of 0.101 was used to calculate the effect size. In some cases (e.g., Deci et al., 1975), studies reported only that the main effect was $F < 1.0$. In these cases, an F-statistic of 0.99 was used. However, for Karniol and Ross's (1977) study, randomly assigned F-values were used in the effect size calculations. Likewise, when a study failed to report an exact t-statistic and only reported that the t-statistic was <1.0, a t-statistic of 0.99 was used to calculate the effect size.

Some effect sizes were extracted from two previous meta-analytical studies by Deci et al. (1999a) and Cameron et al. (2001) when a certain paper was inaccessible (e.g., not available at all or unavailable due to the lack of monetary funds). Regarding the analysis of free-choice intrinsic motivation, 12 effect sizes were extracted from seven published papers. For the analysis of self-reported interest/enjoyment, eight effect sizes from five papers were extracted. Appendix 1 highlights the effect sizes that were extracted from Deci et al.'s (1999a) or Cameron et al.'s (2001) meta-analytical studies.

When an effect size could not be calculated because of the missing statistical information, an effect size of $d = 0.00$ was imputed. Hence, the present meta-analytic review followed the same procedure employed in previous meta-analyses examining the effects of extrinsic rewards on intrinsic motivation. According to Pigott (2009, p. 408), the rationale behind this decision relies on the assumption that a missing effect size is likely statistically nonsignificant; therefore, replacing it with a value of 0.00 is a conservative effect size estimate for the missing effect size. For studies using the free-choice measure of intrinsic motivation, only seven effects out of 143 effect sizes of the main analysis were missing; thus, these missing effects were replaced with an effect size of $d = 0.00$. Regarding supplementary analyses of free-choice behavior, one missing effect size was substituted with $d = 0.00$. Regarding the self-report measure of intrinsic motivation, considerably more missing effects were evident. Altogether, 32 effects of 123 effects had to be substituted with a value of $d = 0.00$ because necessary statistics were not reported. All imputed effect sizes are highlighted with a superscript. Although this method for handling missing data has drawn some criticism from statisticians (Pigott, 2009), this was chosen to maintain comparability with the previous meta-analytical studies.

In the case of the observational studies, the effect sizes were almost exclusively calculated from reported correlation coefficients and sample sizes. In three cases (Jordan, 1986; Lopez, 1981; Van der Hauwaert & Bruggeman, 2015), reported means, standard deviations, and the number of respondents per group were used to

calculate the effect sizes. An effect size of 0.00 was assigned to one study (van Herpen et al., 2005) because the statistics were reported ambiguously.

4.1.6 Analysis of data

The meta-analysis was performed using Comprehensive Meta-Analysis software (CMA; see Borenstein, 2019, pp. 215–234; Borenstein et al., 2009, pp. 395–398). As mentioned, the standardized mean difference (Cohen's *d*) was chosen as the effect size estimate for controlled experimental studies, while the Pearson correlation coefficient (*r*) was utilized when synthesizing the results of observational studies. Regarding a statistical approach, CMA uses the Hedges and Olkin (1985) approach to synthesize individual effect sizes (Kepes et al., 2013). This statistical approach to data synthesis was used in the two meta-analyses of experimental studies and the meta-analysis of observational studies. Although a psychometric meta-analytical approach is often utilized in the analysis of correlational data in the field of organizational sciences (Kepes et al., 2013), the Hedges and Olkin approach was deemed preferable for synthesizing correlational (i.e., observational) data. As Rosenthal (1991, as cited in Kepes et al., 2013, p. 132) points out, the Hedges and Olkin approach is a more appropriate choice when a meta-analysis aims at uncovering the observed relationship between two variables and is not so much interested in what the relationship "might be" if methodological flaws (e.g., measurement error) were eliminated.

It was chosen to analyze the data using a random-effects model. In the random-effects model, each effect size is *"weighted by the inverse of its variance"* (Borenstein et al., 2009, p. 73). The random-effects model is recommended when included studies differ regarding study characteristics (e.g., study subjects, type of intervention) so assuming that all included studies would share a true, identical effect size estimate is not reasonable (Borenstein et al., 2009; Borenstein, 2019; Hedges, 2009). Because the field of reward effects on intrinsic motivation is characterized by quite significant variations in utilized procedures (Lepper et al., 1999; Lepper & Henderlong, 2000), the use of the random-effects model was warranted (Lipsey & Wilson, 2001, p. 117).

The random-effects model assumes *"there may be different effect sizes underlying different studies"* (Borenstein et al., 2009, p. 69). In essence, the random-effects model is based on the assumption that included studies represent a random sample of all potential studies in a particular universe of studies (Borenstein, 2019; Hedges, 2009). Therefore, the random-effects model enables generalizing results beyond the included studies (Hedges, 2009, pp. 38–40). Unlike in the fixed-effect model in which the only factor causing variability in observed effects is the sampling error (i.e., within-study variance), the random-effects model considers that study

characteristics also cause variation in observed effect sizes (i.e., between-study variance) (Borenstein et al., 2009; Hedges, 2009). Choosing the random-effects model means that standard errors are larger and confidence intervals (CIs) will be wider than in a fixed-effects model (Borenstein et al., 2009, p. 80).

A 95% confidence interval of the summary effect size was examined to determine whether a calculated summary effect (i.e., the composite effect size estimate) was statistically significant. When the 95% confidence interval of a composite effect does not contain a value of zero, it can be inferred that the composite effect size is significantly different from zero ($p < 0.05$); thus, the null hypothesis of no relationship can be rejected (Cooper, 2015, p. 197; Lipsey & Wilson, 2001, p. 114). Therefore, p-values are not reported when reporting the statistical significance of reported effect sizes. Only the 95% confidence intervals will be reported.

As already mentioned, the analysis of experimental data will follow the hierarchical framework that Deci et al. (1999a) set. Separate analyses will be conducted for the behavioral indicator of intrinsic motivation (i.e., free-choice behavior) and attitudinal indicator of intrinsic motivation (i.e., self-reported interest/enjoyment). The analysis will proceed from the general level of analysis (i.e., examining the effect of all rewards) to more specified levels (e.g., examining the effect of tangible rewards or a specific reward contingency). A similar hierarchical approach will be used in the meta-analysis of observational studies. Altogether, three meta-analyses will be conducted: 1) reward effects on free-choice behavior (controlled experimental laboratory studies), 2) reward effects on self-reported interest and enjoyment (controlled experimental laboratory studies), and 3) reward association with intrinsic work motivation (observational studies). The meta-analytical findings of experimental studies and observational studies are presented separately.

One relevant issue in statistical data synthesis relates to the issue of how many effect sizes will be calculated and included from a single study. This question is relevant because some studies included two or more reward groups all of which were compared to a single no-reward control group. For example, Vansteenkiste and Deci (2003) compared different types of competitively contingent reward groups to a single control group, while Warneken and Tomasello (2008) compared the effects of positive feedback and engagement-contingent rewards to a single no-reward control group. Although treating each comparison as an independent effect size estimate has the advantage of maintaining all relevant information in the analysis (Cooper, 2015, pp. 128–132; Lipsey & Wilson, 2001, p. 123), it violates a prerequisite of meta-analysis about the independence of the effect sizes (Gleser & Olkin, 2009). This violation can lead to biased effect size estimates (Matt & Cook, 2009, p. 546).

Two different approaches were used in data synthesis. In the first approach, an averaged effect size was calculated and included in relevant higher-level analyses of all rewards, (all) verbal rewards, tangible rewards, and expected rewards. This approach was utilized whenever an individual study made multiple comparisons against a single no-reward control group to ensure the independence of effect sizes. A similar approach was taken when analyzing the overall effect of a specific type of reward or reward contingency if a study reported multiple comparisons against the same no-reward control group.

In the second approach, some analyses were performed, treating each comparison as an independent effect size in the analyses. So, if a study had, for example, three reward groups (e.g., engagement-contingent rewards, completion-contingent rewards, performance-contingent rewards) and one control group, three different effect sizes were calculated and used in relevant analyses. This approach was mainly used in moderator analyses.

The chosen approach will be illustrated using two examples, namely studies by Pretty and Seligman (1984) and Rosenfield et al. (1980). Pretty and Seligman (1984, Exp. 1) examined the effects of engagement-contingent rewards, unexpected rewards, positive feedback, and negative feedback on intrinsic motivation using only one control group. Four different effect sizes were calculated for the purposes of the present meta-analysis: i) the engagement-contingent rewards group vs. the control group, ii) the unexpected rewards group vs. the control group, iii) the positive feedback group vs. the control group, and iv) the negative feedback group vs. the control group. Each effect size was included only in the relevant analysis. For example, the individual effect size for engagement-contingent rewards was included only in the analysis of the effects of engagement-contingent rewards on intrinsic motivation. For higher-level analyses, only one averaged effect size was calculated and included in a particular analysis. For example, for examining all rewards on free-choice behavior, the four reward groups in Pretty and Seligman's (1984) study were averaged and compared with the single no-reward control group. For the analysis of all verbal rewards on intrinsic motivation, the effect of positive and negative feedback was averaged and compared with the no-reward control group. Likewise, only one averaged effect size was included in the analysis of tangible rewards (the control group was compared with the combined engagement-contingent rewards and the unexpected rewards group). A similar method was used for observational studies when a study reported more than one correlation coefficient.

It must be noted that the approach of averaging effects was used only when a study used a single control group. For example, Rosenfield et al. (1980) examined the effects of maximum and less-than maximum performance-contingent rewards on free-choice behavior. These two reward groups were compared with two separate control groups; therefore, two different effects were included in all analyses.

4.1.7 Heterogeneity of effects, outliers, and moderator analyses

At each level of analysis, a test for heterogeneity will be conducted to examine if a set of effects is homogeneous. A test for heterogeneity assesses whether the effect sizes are equal in two or more populations (Matt & Cook, 2009, p. 554). The existence of heterogeneity is determined based on the *Q*-statistic and p-value (Lipsey & Wilson, 2001, pp. 115–116). A within-group goodness-of-fit statistic (Q_w) was used to examine the homogeneity assumption within the set of studies (Konstantopoulos & Hedges, 2009). As Lipsey and Wilson (2001, p. 115) note, the distribution of *Q*-statistic follows a chi-square distribution with $k - 1$ degrees of freedom. The number of effect sizes is denoted with the letter *k*. A set of effects is regarded as homogeneous if a test for heterogeneity produces a nonsignificant p-value ($p > 0.05$) (Borenstein et al., 2009). If the p-value is less than 0.05, it indicates that the null hypothesis of homogeneity of effects is rejected. In this case, the variability of effect sizes exceeds the variability that is caused by sampling error alone. (Lipsey & Wilson, 2001, pp. 115–116.) If the heterogeneity of effects exists, then moderator analyses are performed to examine if a hypothesized or post hoc moderator(s) might explain the observed heterogeneity. A between-group goodness-of-fit-statistic (Q_b) was used to examine whether the mean effect sizes in different classes of a moderator variable were homogeneous (Konstantopoulos & Hedges, 2009, pp. 282–283; Sitzmann, 2011). A statistically nonsignificant p-value ($p > 0.05$) indicates that the mean effect sizes between the chosen moderator's different groups do not vary, while a statistically significant p-value suggests there are significant differences in mean effect size across different groups (Konstantopoulos & Hedges, 2009, pp. 282–283; Sitzmann, 2011).

Regarding experimental studies, reward contingency and the type of reward (tangible vs. feedback) were used as moderator variables, thus following the hierarchical framework Deci et al. (1999a) used. As described in Chapter 4.1.6, the analysis progressed from a higher level to a more detailed analysis of reward effects. The age group of subjects was also used as a moderator variable. The age group was chosen as a moderator variable because Deci et al.'s (1999a) meta-analysis showed that, in some cases, age moderated rewards' effects on intrinsic motivation in experimental studies[33]. When the age group of subjects was not responsible for the observed heterogeneity in experimental studies, the set of effects was examined for possible outliers.

[33] The moderating effect of age groups was examined only at the lower levels of the hierarchical analysis. Thus, the moderating effect of age was not examined in the following conditions: all rewards, all verbal rewards and tangible rewards.

A study was deemed a clear outlier if the study's 95% confidence interval (CI) did not overlap with the composite effect's 95% CI (Cumming & Finch, 2005). In such a case, the two effects significantly differ, and the corresponding p-value is less than 0.01 (Cumming & Finch, 2005). Additionally, some studies were identified as outliers and removed even when a slight overlap existed between the confidence interval of a particular study and that of the composite effect size (see Cumming & Finch, 2005, p. 176). In the latter case, excluded studies' effect sizes were considerably larger or smaller than the composite effect size. This was only done if the removal of evident outliers—namely, those studies in which the 95% confidence intervals had no overlap with the 95% confidence interval of the composite effect size—did not result in a homogeneous set of effects.

Regarding the observational studies, the same general procedure was used. However, except for the reward contingency variable, no other *a priori* moderator variables were hypothesized. Thus, all other moderator analyses were *post hoc*. Examined post hoc moderators were 1) the type of performance-based reward (objective vs. subjective) and 2) the type of study design (cross-sectional vs. longitudinal). Also, a supplementary subgroup analysis was conducted to examine the impact of performance-based reward's functional significance (controlling vs. informational). This analysis can be regarded as being partly post hoc and partly theoretically driven. While it was not an initial goal of this meta-analysis (thus being post hoc) to conduct this particular subgroup analysis, the analysis was based on the theoretical postulates of cognitive evaluation theory (Deci & Ryan, 1985).

4.1.8 Assessment of publication bias

Following the guidelines for addressing publication bias (Borenstein et al., 2009), the potential existence of publication bias was assessed by visual inspection of funnel plots and utilizing two statistical tests—Rosenthal's (1979) fail-safe N and Duval and Tweedie's (2000) trim-and-fill method. The first method relied on visually inspecting funnel plots. A funnel plot is a graphical representation of the association between the estimated effect size and a study sample size. Studies with large sample sizes are grouped quite tightly at the top of the funnel plot, while small studies at the bottom of the funnel plot show more dispersion of effect sizes due to a higher sampling error. If no evidence of publication bias exists, the distribution of effect sizes should be symmetrical and resemble the shape of a funnel. (Borenstein et al., 2009, p. 282; Greenhouse & Iyengar, 2009, pp. 428–429.) The second utilized method was Rosenthal's fail-safe N—a statistical way of evaluating the presence of publication bias. The fail-safe N method assesses statistically how many missing studies with an effect size of zero should be included in the analysis so that the statistically significant effect size would become nonsignificant. (Borenstein et al.,

2009, pp. 284–285; Rosenthal, 1979.) The third and last method relied on Duval and Tweedie's (2000) *Trim and Fill* method. According to Borenstein et al. (2009, pp. 284–287), the advantage of this method is that it can indicate the magnitude of the bias by producing an adjusted and unbiased composite effect size estimate. More weight was given to the described statistical tests because visually inspecting and interpreting a funnel plot can be prone to subjective biases.

A decision was made to assess publication bias predominantly at the lower levels of the hierarchical analysis. This means that no publication bias assessments were performed at the most global levels of analyses (all rewards, verbal rewards and tangible rewards). This was decided because this study's overarching goal was not to examine the main effect; instead, the aim was to examine under what reward contingencies and types of extrinsic rewards have negative effects, no effects or positive effects on intrinsic motivation. Moreover, as past research has shown that different rewards and reward contingencies can have quite different effects on intrinsic motivation, assessing publication bias at the most global level of analysis would most likely have led to biased results. Therefore, it was deemed unnecessary to assess the possibility of publication bias at the most global levels (e.g., all rewards, verbal rewards tangible rewards); the assessment was conducted separately for each reward type and reward contingency.

5 Results

This chapter describes the results of the conducted meta-analyses. First, the main meta-analytical results of controlled laboratory experiments will be presented. Two separate meta-analyses were performed. The first examined the effects of extrinsic rewards on the free-choice behavioral measure of intrinsic motivation (free-choice meta-analysis), while in the second meta-analysis, the dependent variable was self-reported interest/enjoyment (self-report meta-analysis). The meta-analytical results for these two dependent variables of intrinsic motivation are presented in tandem. In addition, two supplementary analyses were conducted. These supplementary analyses will be presented after the primary findings. Finally, the meta-analytical results concerning the relationship between extrinsic rewards and self-reported intrinsic work motivation in organizational settings will be presented (observational meta-analysis).

5.1 Results from the meta-analyses of experimental studies

Next, the meta-analytical results of controlled experimental studies will be presented. Presentation of meta-analytical results follows a hierarchical analysis framework that has been used in some prior meta-analyses (see Cameron & Pierce, 1994; Deci et al., 1999a; Eisenberger & Cameron, 1996), meaning the analysis flows from an aggregate level of analysis (i.e., effects of all rewards on intrinsic motivation) to a more detailed analysis of rewards effects. Moreover, the results will be presented separately for the free-choice behavioral measure of intrinsic motivation and the self-reported interest/enjoyment measure, albeit these results will be presented in tandem. After presenting the results of a specific reward type or reward contingency (e.g., positive feedback), an analysis of publication bias is carried out. However, the publication bias analyses will be limited to specific reward contingencies, and no assessment of publication bias will be performed at the aggregate levels of analysis (all rewards, all verbal rewards, tangible rewards).

After the primary analyses, two supplemental meta-analyses are presented. The first supplemental meta-analysis examines the duration of rewards' effects on free-choice intrinsic motivation. The second supplementary analysis concentrates on

examining whether the timing of reward administration (before or after the free-choice period) or the explicit announcement of reward withdrawal operate as methodological artifacts.

5.1.1 All rewards

Free-choice intrinsic motivation. The first phase of analysis examined the overall effect of all extrinsic rewards on free-choice persistence. At this stage of analysis, a total of 104 studies were included in the analysis. The result showed the overall effect size was negative and statistically significant, $d = –0.28$ (95% CI = –0.40, –0.17). This finding demonstrates that rewards, in general, significantly undermine intrinsic motivation. As expected, the included set of studies was found to be heterogeneous, $Q_w(103) = 529.33$, $p < 0.0001$, $I^2 = 80.54\%$. This heterogeneity is further highlighted by the width of the 95% prediction interval, –1.33 to 0.76, suggesting the true effect size in comparable populations varies extensively. Expectedly, reward contingency moderated this effect, $Q_b(6) = 38.40$, $p < 0.0001$.

Self-reported interest and enjoyment. Next, the overall effect of all extrinsic rewards on self-reported intrinsic motivation was analyzed. Altogether, 94 studies were included in the analysis. The results showed that the effect was not statistically significant, $d = 0.04$ (95% CI = –0.04, 0.12). The composite effect size showed significant heterogeneity, $Q_w(93) = 236.59$ $p < 0.0011$, $I^2 = 60.69\%$. The 95% prediction interval is –0.55 to 0.63. The reward contingency variable also moderated the results in this case, $Q_b(6) = 18.17$, $p = 0.006$.

These findings show that at the highest level of analysis, extrinsic rewards significantly undermine free-choice intrinsic motivation but do not affect the attitudinal expression of intrinsic motivation. Compared to previous meta-analytical studies, the current results are most comparable with those Deci et al. (1999a) reported. Regarding free-choice persistence, Deci et al. (1999a) included 101 studies in their analysis and reported a statistically significant effect size of $d = –0.24$. The free-choice effect size Deci et al. (1999a) reported is highly comparable to the composite effect size of the current meta-analytical study. Cameron et al. (2001) reported a somewhat smaller but statistically significant negative effect of all rewards on free-choice persistence ($d = –0.09$, k = 115 studies), while Cameron and Pierce (1994) reported a nonsignificant effect size of $d = –0.06$ (k = 61 studies).

Regarding the self-report measure of intrinsic motivation, Deci et al. (1999) reported a nonsignificant positive effect size for self-reported interest ($d = 0.04$, k = 84 studies) as did Cameron et al. (2001) ($d = 0.12$, k = 98 studies), while Cameron and Pierce (1994) reported a significant enhancement of self-reported interest/enjoyment ($d = 0.15$, k = 64 studies). In general, the current result for self-reported interest is comparable with the findings of previous meta-analytical studies.

Although Cameron and Pierce (1994) found a positive effect for all rewards on self-reported interest and enjoyment, some authors have argued that Cameron and Pierce's results should be interpreted with caution due to methodological errors (see Lepper, 1995; Lepper et al., 1996, 1999; Ryan & Deci, 1996).

5.1.2 All verbal rewards

From early on, research (e.g., Deci, 1971; Koestner et al., 1987; Shanab et al., 1981) has shown that feedback can affect intrinsic motivation—often positively. Exploring feedback's effects on intrinsic motivation has continued to interest scholars in this field of inquiry (e.g., Albrecht et al., 2014; Hagger et al., 2015; Haimovitz & Henderlong Corpus, 2011; see also Abbas & North, 2018). Unlike the previous meta-analyses, the present study synthesizes the effects of positive and negative feedback on intrinsic motivation. The analysis starts from a higher level of analysis (all verbal rewards), which will proceed to separate analyses of positive and negative feedback effects. Results for the free-choice behavior measure of intrinsic motivation are presented first. All studies included in the analyses are presented in Table 1.

Free-choice intrinsic motivation. Overall, nineteen studies (N = 1090) examined the effect of feedback on intrinsically motivated free-choice behavior. Of these 19 studies, only two studies (Pretty & Seligman, 1984; Shanab et al., 1981) included negative feedback conditions. The overall composite effect size estimate for these 19 studies was 0.29 (95% CI = 0.10, 0.48; 95% PI = –0.39, 0.97) indicating that, on average, feedback enhances free-choice intrinsic motivation. However, this set of studies was heterogeneous, $Q_w(18) = 40.79$, p = 0.002, $I^2 = 55.87\%$. Therefore, a moderator analysis using the feedback type (positive vs. negative) as a moderator was conducted. The results demonstrated that no statistically significant differences existed between the effects of positive and negative feedback on free-choice persistence when the effects were compared with no-feedback control groups, $Q_b(1) = 1.98$, p = 0.16.

Nonetheless, performing separate analyses for positive and negative feedback conditions was decided to keep the results more comparable with previously conducted meta-analyses, which included only positive feedback conditions. Moreover, there is a theoretical reason to conduct separate analyses. The literature suggests that negative feedback can signal to an individual that they are incompetent at the activity they are doing, which can diminish the satisfaction of the need for competence and eventually lead to the deterioration of intrinsic motivation (Ryan & Deci, 2017, p. 156). For example, studies by Elliot et al. (2000), Senko and Harackiewicz (2002), and Tang and Sarsfield-Baldwin (1991) have shown that positive feedback enhances intrinsic motivation in relation to negative feedback, suggesting a need for separately examining the effects of positive and negative

feedback (for a recent meta-analysis, see Fong et al., 2019). The analysis will proceed as follows. First, the results for the effect of positive feedback on free-choice intrinsic motivation will be presented, and afterward, the analysis proceeds to present the results for negative feedback. The results are reported in a similar order for the self-report measure of intrinsic motivation (i.e., self-reported interest/enjoyment). in.

Positive feedback. Regarding the effects of positive verbal feedback on *free-choice intrinsic motivation*, a total of 19 studies (yielding 19 effect sizes) (N = 1068) examined this phenomenon. Positive feedback was found to significantly enhance intrinsic motivation, d = 0.33 (95% CI = 0.15, 0.50; 95% PI = –0.26, 0.91). According to Cohen (1988), the magnitude of this effect is between small and medium. Figure 2 depicts a forest plot of all studies included in the analysis of positive feedback effects on free-choice behavior.

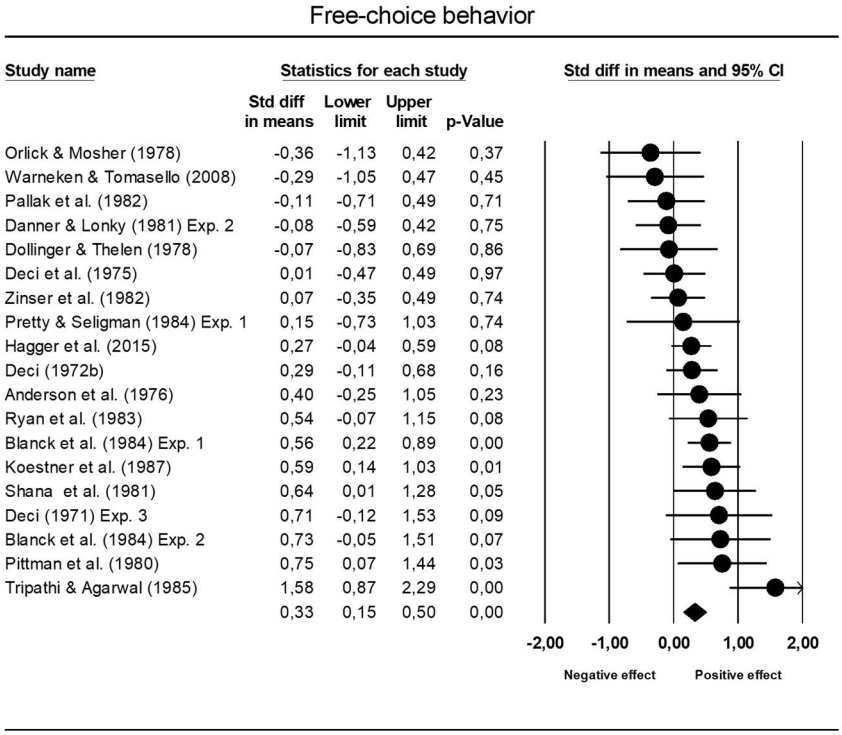

Figure 2 The forest plot for the effects of positive feedback on free-choice behavior.

Because a previous meta-analysis by Deci et al. (1999a) indicated that the effect is different for children than for university students, a moderator analysis was carried

out. A test of heterogeneity showed that the effect was not homogeneous $Q_w(18) = 34.37$, p = 0.011, $I^2 = 47.63\%$. Consequently, it was examined whether the mean effect of positive feedback on children's and university students' intrinsic motivation was significantly different. The results show that the mean effect size was significantly different for children and university students, $Q_b(1) = 11.46$, p = 0.001. A closer analysis revealed that on average, positive feedback did not affect children's free-choice intrinsic motivation, $d = –0.03$ (95% CI = –0.25, 0.20; 95% PI = –0.32, 0.27), and the composite effect size was homogeneous, $Q_w(6) = 3.15$, p = 0.79, $I^2 = 0\%$. In contrast, an analysis of 12 studies showed that for university students, positive feedback had a significant positive effect on free-choice behavior, $d = 0.51$ (95% CI = 0.31, 0.70; 95% PI = –0.01, 1.02). This set of studies was homogeneous, $Q_w(11) = 17.99$, p = 0.08, $I^2 = 38.86\%$. This finding showing that positive feedback has a positive effect on free-choice persistence essentially replicates previous meta-analytical findings. Likewise, by showing that positive feedback has a different influence on university students' than on children's intrinsically motivated behavior, the present meta-analysis replicated Deci et al.'s (1999a) finding.

Negative feedback. Only two studies (Pretty & Seligman, 1984, Exp. 1; Shanab et al., 1981) were identified that compared negative feedback with no-feedback controls resulting in a nonsignificant composite effect size of $d = –0.52$ (95% CI = –2.87, 1.83, N = 60). Naturally, this set of two effects was very heterogeneous, $Q_b(1) = 15.04$, p = 0.0001, $I^2 = 93.35\%$[34]. A closer look at these studies shows that while Pretty and Seligman's (1984) experiment produced a substantial negative effect ($d = –1.75$), Shanab et al. (1981) reported a positive effect size ($d = 0.64$). Therefore, the mean effect size must be interpreted with caution due to a minimal number of studies and the heterogeneity of effect sizes. Figure 3 depicts a forest plot of all studies in the negative feedback analysis of free-choice behavior.

[34] Some researchers (e.g., Borenstein, 2019, pp. 131–132; Hardy & Thompson, 1998; von Hippel, 2015) have cautioned that estimates of variance may not be reliable when the number of studies in the analysis is small.

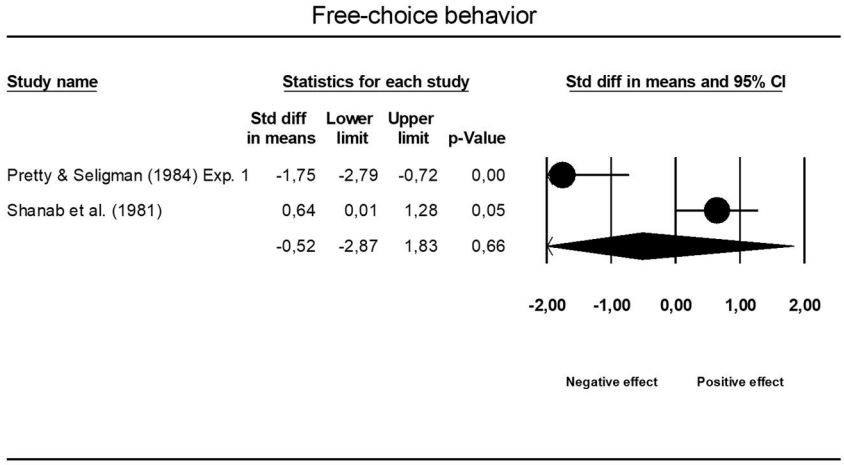

Figure 3 The forest plot for the effects of negative feedback on free-choice behavior.

Self-reported interest and enjoyment. A total of 26 studies (N = 1979) were included in the analysis of all verbal rewards. Unlike the previous meta-analytical studies that had excluded negative feedback conditions, negative feedback effects on self-reported interest were included in the present meta-analysis. The composite effect for all studies showed that verbal feedback has a significant positive effect on self-reported interest (d = 0.23, 95% CI = 0.03, 0.42; 95% PI = –0.68, 1.14). Because this set of studies included experiments containing positive and negative feedback conditions, this set of effects was expectedly heterogeneous, $Q_w(25) = 106.24$ p < 0.0001, $I^2 = 76.47\%$. Therefore, whether a difference existed between the effects of positive and negative feedback on self-reported interest and enjoyment was tested. The results showed a statistically significant difference between these two types of feedback, $Q_b(1) = 4.74$, p = 0.03. As in the case of free-choice behavior, results are presented separately for negative and positive feedback.

Positive feedback. Altogether, 25 studies (N= 1691)[35] yielding 25 effect sizes examined the effects of positive feedback on *self-reported interest*. The results show that positive feedback enhances self-reported interest and enjoyment, d = 0.31 (95% CI = 0.11, 0.52; 95% PI = –0.612, 1.26). While the composite effect size was statistically significant, this set of effects showed signs of heterogeneity, $Q_w(24) = 96.80$, p < 0.0001, $I^2 = 75.21\%$. Therefore, the age group of subjects—children, university students, and adults—was used as a moderator variable in the next

[35] These effect sizes were extracted from 23 published papers.

analysis phase. However, a test for heterogeneity showed that the age group did not moderate the effect of positive feedback on self-reported interest, $Q_b(2) = 1.405$, p = 0.50. The result remained the same when the only study using adult study subjects (Albrecht et al., 2014) was excluded from the test for age effect, $Q_b(1) = 0.012$, p = 0.91[36].

Next, possible outliers were searched for. Three studies (R. Butler, 1987; Kast & Connor, 1988; Vallerand, 1983) were identified as outliers based on examining the 95% confidence intervals. While Kast and Connor's (1988) study showed an exceptionally large negative effect of positive feedback on self-reported interest (d = –0.47), studies by Vallerand (1983) and Butler (1987) showed unexpectedly large positive effects (d = 1.90 and d = 1.40, respectively). Excluding these studies resulted in a homogeneous set of effect sizes, $Q_w(21) = 26.19$, p = 0.20, I^2 = 19.83%. The remaining 22 studies show a significant enhancement of self-reported interest by positive feedback, d = 0.26 (95% CI = 0.14, 0.39). Examining the 95% prediction interval shows that the effects range from –0.07 to 0.60, showing that for comparable populations, positive feedback most likely enhances self-reported interest in and enjoyment of a task, but the effect varies quite a bit. Figure 4 depicts a forest plot of all studies analyzing positive feedback's effects on self-reported interest and enjoyment.

[36] An analysis was performed in which the study by Albrecht et al. (2014) was included in the group of university students. The results did not differ: $Q_b(1) = 0.089$, p = 0.765.

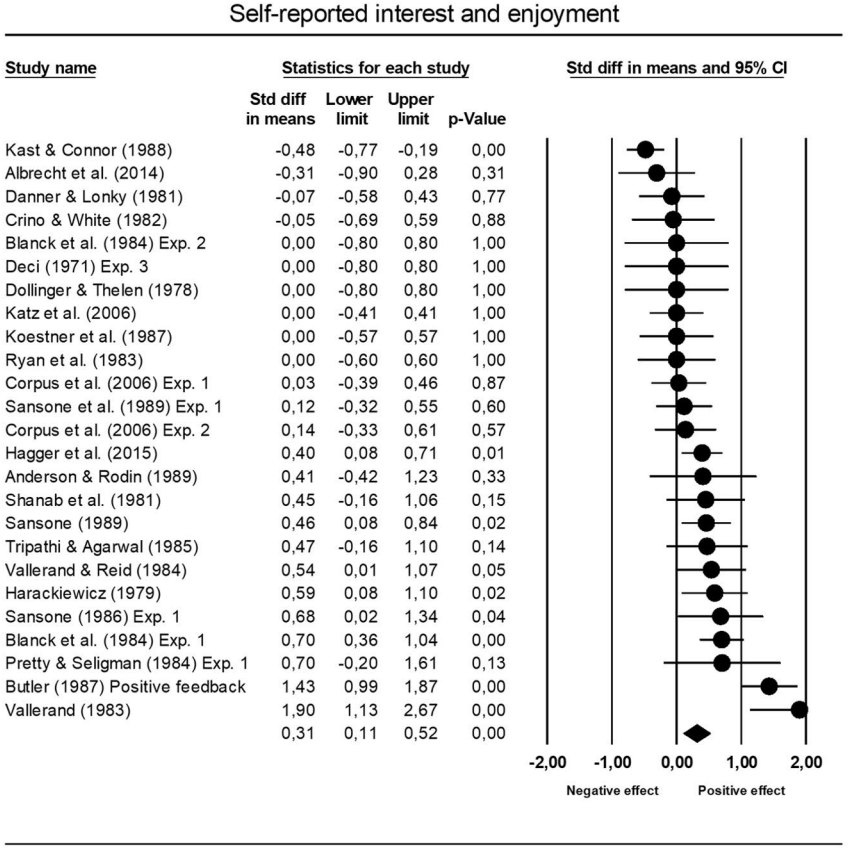

Figure 4 The forest plot for the effects of positive feedback on self-reported interest and enjoyment.

Negative feedback. For the set of 6 studies (N = 326)[37] examining negative feedback's effects on self-reported interest, the composite effect size was negative but nonsignificant, $d = –0.23$ (95% CI = –0.72, 0.25; 95% PI = –1.70, 1.34). This set of effects was also heterogeneous, $Q_w(5) = 20.69$, p = 0.001, $I^2 = 75.83\%$. The subjects' age group was initially considered a possible moderator variable for examining a possible reason for this heterogeneity. However, because all included studies had used university students as study subjects, this variable could not be used as a moderator. Therefore, potential outliers were searched for. Subsequently, Pretty and Seligman's (1984, Exp. 1) study was excluded because the 95% confidence

[37] Extracted from six published papers.

interval of Pretty and Seligman's (1984) effect size did not overlap with the composite effect's confidence interval. However, the set of effects remained heterogeneous, $Q_w(4) = 10.87$, $p = 0.028$. Consequently, Anderson and Rodin's (1989) study was excluded due to a somewhat extreme effect size. This resulted in a homogeneous sample of effect sizes, $Q_w(3) = 6.09$, $p = 0.13$, $I^2 = 47.05\%$. The pooled effect size for negative feedback for these four studies was nonsignificant, indicating that negative feedback does not affect self-reported intrinsic motivation, $d = –0.18$ (95% CI = –0.51, 0.15; 95% PI = –1.38, 1.02). Figure 5 depicts a forest plot of all studies analyzing positive feedback effects on self-reported interest and enjoyment.

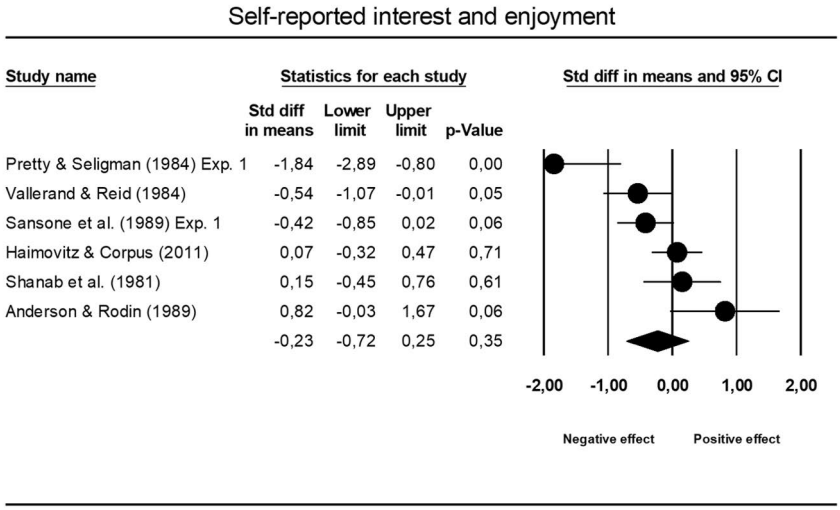

Figure 5 The forest plot for the effects of negative feedback on self-reported interest and enjoyment.

Table 1 The effects of positive and negative verbal feedback on intrinsic motivation.

Positive and negative feedback's effects on intrinsic motivation

Study name	Sample[a]	N_E / N_C[b]	Free-choice behavior *(d)*	Lower 95% CI	Upper 95% CI	Self-reported interest *(d)*	Lower 95% CI	Upper 95% CI	Type of feedback[d]
Albrecht et al. (2014)	3	23/19	–	–	–	–0.31	–0.90	0.28	1
Anderson, R. et al. (1976)	1	18/19	0.40	–0.25	1.05	–	–	–	1
Anderson, S. et al. (1989)	2	10/10	–	–	–	0.41	–0.42	1.23	1
Anderson, S. et al. (1989)	2	10/10	–	–	–	0.82	–0.03	1.67	2
Blanck et al. (1984) Exp. 1	2	70/69	0.56	0.22	0.89	0.70	0.36	1.04	1
Blanck et al. (1984) Exp. 2	2	12/12	0.73	–0.05	1.51	0.00[c]	–0.80	0.80	1
Butler (1987)	1	50/50	–	–	–	1.43	0.99	1.87	1
Corpus et al. (2006) Exp. 1	1	64/32	–	–	–	0.03	–0.39	0.46	1
Corpus et al. (2006) Exp. 2	1	51/26	–	–	–	0.14	–0.33	0.61	1
Crino & White (1982)	2	20/5	–	–	–	–0.05	–0.72	0.63	1
Danner & Lonky (1982) Exp. 2	1	30/30	–0.08	–0.59	0.42	–0.07	–0.58	0.43	1
Deci (1971) Exp. 3	2	12/12	0.71	–0.12	1.53	0.00[c]	–0.80	0.80	1
Deci (1972b)	2	48/48	0.29	–0.11	0.68	–	–	–	1
Deci et al. (1975)	2	32/32	0.01	–0.47	0.49	–	–	–	1

Dollinger & Thelen (1978)	1	12/12	–0.07	–0.83	0.69	0.00[c]	–0.80	0.80	1
Hagger et al. (2015)	2	80/80	0.27	–0.04	0.59	0.40	0.08	0.71	1
Haimovitz & Corpus (2011)	2	72/38	–	–	–	0.07	–0.32	0.47	2
Harackiewicz (1979)	1	28/30	–	–	–	0.72	0.19	1.25	1
Kast & Connor (1988)	1	180/60	–	–	–	–0.48	–0.77	–0.19	1
Katz et al. (2006)	1	46/45	–	–	–	0.00[c]	–0.41	0.41	1
Koestner et al. (1987)	2	35/36	0.59	0.13	1.04	0.00[c]	–0.57	0.57	1
Orlick & Mosher (1978)	1	11/12	–0.36	–1.13	0.42	–	–	–	1
Pallak et al. (1982)	1	30/12	–0.11	–0.71	0.49	–	–	–	1
Pittman et al. (1980)	2	24/12	0.75	0.07	1.44	–	–	–	1
Pretty & Seligman (1984) Exp. 1	2	10/10	0.15	–0.73	1.03	0.70	–0.20	1.61	1
Pretty & Seligman (1984) Exp. 1	2	10/10	–1.75	–2.79	–0.72	–1.84	–2.89	–0.80	2
Ryan et al. (1983)	2	32/16	0.54	–0.07	1.15	0.00[c]	–0.60	0.60	1
Sansone (1986) Exp. 1	2	44/11	–	–	–	0.68	0.02	1.34	1
Sansone (1989)	2	82/41	–	–	–	0.46	0.08	0.84	1
Sansone et al. (1989) Exp. 1	2	40/40	–	–	–	0.12	–0.32	0.55	1
Sansone et al. (1989) Exp. 1	2	40/40	–	–	–	–0.42	–0.85	0.02	2
Shanab et al. (1981)	2	20/20	0.64	0.01	1.28	0.45	–0.16	1.06	1
Shanab et al. (1981)	2	20/20	0.64	0.01	1.28	0.15	–0.45	0.76	2
Tripathi & Agarwal (1985)	2	20/20	1.58	0.87	2.29	0.47	–0.16	1.10	1
Vallerand (1983)	1	40/10	–	–	–	1.90	1.13	2.67	1

Vallerand & Reid (1984)	2	28/28	–	–	–	0.54	0.01	1.07	1
Vallerand & Reid (1984)	2	28/28	–	–	–	–0.54	–1.07	0.01	2
Warneken & Tomasello (2008)	1	12/12	–0.29	–1.05	0.47	–	–	–	1
Zinser et al. (1982)	1	64/32	0.07	–0.35	0.49	–	–	–	1

Note.

[a] Number 1 indicates the subjects (Ss) were children, 2 indicates the Ss were university students, and 3 indicates the Ss were adults.

[b] N_E is the sample size for the experimental group; N_C is the sample size for the control group.

[c] The effect size was set to 0.00 because the statistics needed were not reported in the paper.

[d] 1 = positive feedback; 2 = negative feedback

The table was adapted from Deci et al. (1999a).

When comparing the results of this meta-analysis to those reported in previous meta-analyses, it can be concluded that the present study's findings are quite comparable with the previous meta-analytical studies. To summarize, the findings of this meta-analysis show that positive feedback significantly enhances both free-choice persistence (d = 0.33) and self-reported interest (d = 0.26). By comparison, Eisenberger and Cameron (1996) reported significant positive effects for free-choice behavior (d = 0.38) and self-reported interest (d = 0.26). Likewise, Deci et al. (1999a) found that positive feedback had a significant positive effect on free-choice behavior (d = 0.33) and self-reported interest (d = 0.31). Cameron et al. (2001) also reported similar effect sizes for free-choice behavior (d = 0.31) and self-reported interest (d = 0.32). Finally, Tang and Hall (1995) did not find an overall effect of positive feedback on free-choice intrinsic motivation but found that positive feedback significantly enhanced self-reported interest/enjoyment (d = 0.39, k = 20 studies).

Regarding the age differences, both Deci et al. (1999a) and Cameron et al. (2001) reported that positive feedback has a stronger effect on university students' than children's free-choice persistence (see also S. Tang & Hall, 1995). However, while Deci et al. (1999a) found that positive feedback only enhanced university students' intrinsic motivation, Cameron et al. (2001) reported a significant enhancement of intrinsic motivation also for children. The present meta-analytical results are mostly aligned with the results Deci et al. (1999a) reported. Like Deci et al. (1999a), the current results demonstrate that the composite effect size for university students is positive and statistically significant for the free-choice behavior measure of intrinsic motivation. Conversely, the composite effect is nonsignificant for studies using children as subjects.

Regarding negative feedback's effects on intrinsic motivation, the results are harder to compare to the previous meta-analyses by Deci et al. (1999a) or by Cameron and her colleagues (Cameron et al., 2001; Cameron & Pierce, 1994; Eisenberger, Rhoades, et al., 1999; Eisenberger & Cameron, 1996), which did not include negative feedback conditions. Still, some comparisons can be made between the present study and meta-analyses by Tang and Hall (1995) and Fong, Patall, Vasquez, and Stautberh (2019). For the time spent engaged in the task during the free-choice period and self-reported interest, Tang and Hall (1995) reported nonsignificant effects (d = –0.218 and d = 0.336, respectively). Fong et al. (2019) examined the effect of negative feedback on intrinsic motivation. Based on an analysis of 45 effects, they found that negative feedback had a small but nonsignificant negative effect on intrinsic motivation compared to a combined neutral feedback/no feedback group. However, because Fong et al. (2019) combined self-report and behavioral measures of intrinsic motivation into a single measure, included unpublished literature and studies that did not necessarily measure or reflect

only the construct of intrinsic motivation (see, e.g., Geen, 1981; Guay et al., 2008), the results are not entirely comparable.

Assessment of publication bias

The possibility of publication bias was assessed using three different methods: 1) visually examining the funnel plots, 2) using Rosenthal's fail-safe N, and 3) using Duval and Tweedie's (2000) trim-and-fill method (Borenstein et al., 2009). Regarding the effect of positive feedback on free-choice persistence and self-reported interest, the small number of imputed missing studies in both cases suggests that publication bias is not a major concern. Regarding negative feedback studies, the trim-and-fill method indicated no signs of publication bias. A summary of positive and negative feedback's effects on both measures of intrinsic motivation and adjusted effect sizes are presented in Table 2. Figures 23–25 display the funnel plots (see Appendix 4).

Table 2 Summary of the results on the effects of positive and negative feedback on intrinsic motivation and assessment of the potential impact of publication bias.

Feedback	*k*	Effect size *(d)*	95% CI	Fail-safe N	Number of imputed studies	Adjusted effect size (trim-and-fill)	Adjusted 95% CI
Positive feedback							
Free-choice behavior							
All pos. feedback studies (het.)	19	0.33	0.15, 0.50	108	1	0.35	0.18, 0.53
Children (hom.)	7	–0.03	–0.25, 0.20	0	2	0.04	–0.17, 0.24
University students (hom.)	12	0.51	0.31, 0.70	127	3	0.40	0.18, 0.62
Self-reported interest							
All positive feedback studies (het.)	25	0.31	0.11, 0.52	185	6	0.46	0.24, 0.68
Positive feedback (outliers excl; hom.)	22	0.26	0.14, 0.39	87	3	0.32	0.19, 0.45
Negative feedback							
Free-choice behavior							
[a]All negative feedback studies (het.)	2	0.52	–2.87, 1.83	–	–	–	–
Self-reported interest							
All neg. feedback studies (het.)	6	–0.23	–0.72, 0.25	0	1	–0.41	–0.93, 0.11
Neg. feedback (outliers excl; hom.)	4	–0.18	–0.51, 0.15	0	–	–	–

Note.
k = number of studies
d = Cohen's d
CI = confidence interval
het = heterogeneous set of effects
hom = homogeneous set of effects
outliers excl. = outliers have been excluded from the analysis
– = no adjustment
[a] = As only two free-choice effects were included in the analysis, examining the effect of publication bias was impossible.

5.1.3 Tangible rewards

Free-choice intrinsic motivation. The effects of tangible rewards on free-choice persistence were analyzed. Altogether, 95 studies were included in the analysis. The results showed a significant undermining of free-choice intrinsic motivation by tangible rewards, d = –0.39 (95% CI = –0.51, –0.27; 95% PI = –1.41, 0.64). As expected, the analyzed set of effect sizes was not homogeneous, $Q_w(94) = 449.91$, $p < 0.0001$, I^2 =79.11%. Based on the findings of previous primary research (e.g., Deci, 1972a; Lepper et al., 1973), meta-analytical studies (Cameron et al., 2001; Deci et al., 1999a; S. Tang & Hall, 1995), and theoretical arguments (Ryan et al., 1983), this was expected. For example, several previous meta-analyses have shown that the effects of expected and unexpected rewards on intrinsic motivation differ (Cameron et al., 2001; Deci et al., 1999a; S. Tang & Hall, 1995). As planned, subsequent analyses were performed separately. Somewhat unexpectedly, a test for heterogeneity yielded a nonsignificant p-value indicating that the effects of expected and unexpected tangible rewards were not different, $Q_b(1) = 2.08$, $p = 0.15$. However, Borenstein (2019, pp. 121, 125) points out that a nonsignificant p-value does not necessarily mean that there would not be heterogeneity between estimated effect sizes. Therefore, conducting analyses separately for unexpected and expected rewards was chosen. Furthermore, a supplementary analysis using a reward contingency variable as a moderator suggests the effects differ among different reward contingencies, $Q_b(4) = 13.35$, $p = 0.01$.

Self-reported interest and enjoyment. A total of 75 studies examined the effects of tangible rewards on self-reported interest. The results show that tangible rewards do not affect self-reported interest, d = –0.03 (95% CI = –0.12, 0.05; 95% PI = –0.55, 0.48). As expected, this set of effects was heterogeneous, $Q_w(74) = 153.15$, $p < 0.0001$, I^2 = 51.68%. Next, a moderator analysis using reward expectancy (expected vs. unexpected) as the moderator variable was conducted. The analysis demonstrated no statistically significant difference in effects between expected and unexpected tangible rewards, $Q_b(1) = 0.22$, $p = 0.63$. Despite this finding, subsequent analyses were conducted separately for the expected and unexpected rewards for the reason previously outlined.

Some differences emerge when comparing this study's results to previously conducted meta-analyses. For the behavioral measure of intrinsic motivation (i.e., free-choice persistence), the results of this meta-analysis align well with previous findings. Like studies by Deci et. (1999a), Eisenberger and Cameron (1996), and Cameron et al. (2001), which all reported significant undermining of free-choice intrinsic motivation by tangible rewards, the present meta-analysis replicated these findings by showing a significant undermining of free-choice intrinsic motivation. The composite effect size of –0.39 is quite close to the effect size of –0.34 that Deci et al. (1999) reported in their paper but differs slightly from the results that

Eisenberger and Cameron (1996) (d = –0.21) and Cameron et al. (2001) (d = –0.17) reported.

For the self-reported interest measure, the nonsignificant effect size (d = –0.03, k = 75 studies) of this meta-analysis falls more or less in the middle when compared to the findings of previous meta-analyses. While Deci et al. (1999a) found a significant negative effect of all tangible rewards on self-reported interest (d = –0.07), Eisenberger and Cameron (1996) reported a nonsignificant effect size of 0.05, while Cameron et al. (2001) reported a significant enhancement of self-reported interest by all tangible rewards (d = 0.08). Based on the findings of the current synthesis of research evidence and previous meta-analytical studies, it seems that when expected and unexpected rewards are treated as a single group of rewards, this group of rewards does not enhance or undermine self-reported task enjoyment but undermines one's task engagement after rewards are no longer given (i.e., free-choice behavior).

5.1.4 Expected tangible rewards

Free-choice intrinsic motivation. The category of expected tangible rewards consists of task-noncontingent rewards, engagement-contingent rewards, completion-contingent rewards and performance-contingent rewards. Altogether, 95 studies were included in the analysis. The overall effect for all expected rewards showed that expected rewards have a significant negative effect on free-choice behavior and that the magnitude of this effect is moderate, d = –0.41 (95% CI = –0.53, –0.28; 95% PI = –1.46, 0.65). Because previous meta-analytical studies have shown that the effect of task-noncontingent rewards on free-choice behavior differs from the effects of other expected tangible reward contingencies (see, e.g., Deci et al. 1999), it was not an unexpected finding that this set of studies was heterogeneous, $Q_w(94)$ = 453.47, p < 0.0001, I^2 = 79.27%. Two moderator analyses were conducted using the age group and reward contingency as moderators to further examine this issue. The moderator analysis of the age effects showed a statistically significant difference in the mean effect size between university students and children, $Q_b(1)$ = 3.90. p = 0.048[38]. For both groups, expected tangible rewards significantly undermine free-choice behavior, albeit the effect is stronger for children (d = –0.52, 95% CI = –

[38] It was decided to conduct the analysis using only those studies that had employed university students and children as subjects because only one study (Marsden et al., 2015) had used adults. When this study was included in the moderator analysis, the results showed a homogeneous set of effects, $Q_b(2)$ = 4.06, p = 0.13. When this study was subsumed in the age group of university students, the test for homogeneity showed a statistically significant difference between children and the combined university students–adults group, $Q_b(2)$ = 4.05, p = 0.044.

0.687, –0.355; k = 52 studies) than university students (d = –0.27, 95% CI = –0.45, –0.10; k = 42 studies). Next, the type of reward contingency was used as a moderator variable. As expected, the results showed that reward contingency moderated the effect of expected rewards on free-choice intrinsic motivation, $Q_b(3) = 10.91$, p = 0.01. This means that the direction and magnitude of the effect depend on the type of reward contingency.

Self-reported interest and enjoyment. For the 74 studies included in the analysis, the results showed that at this level of analysis, expected tangible rewards overall do not have a significant effect on self-reported intrinsic interest, d = –0.03 (95% CI = –0.12, 0.05; 95% PI = –0.53, 0.46). Unsurprisingly, these effects were heterogeneous, $Q_w(73) = 145.15$, $p < 0.0001$, $I^2 = 49.71\%$. Next, a moderator analysis using the age group of study subjects as a moderator variable was performed, showing that the difference in mean effects among children, university students, and adults was statistically significant, $Q_b(2) = 6.63$, p = 0.04. The results showed that while expected rewards undermine children's self-reported interest (d = –0.17, 95% 0.30, –0.04; k = 28 studies), the composite effect was nonsignificant for university students (d = 0.04, –0.06, 0.15; k = 44 studies) and adults (d = 0.16, 95% CI = –0.37, 0.68; k = 2 studies). Because there were only two studies using adult subjects (Albrecht et al., 2014; Marsden et al., 2015), additional analyses were performed without these two studies and by subsuming these two studies in the age group of university students. Whether adult subjects were excluded from the analysis [children vs. university students; $Q_b(1) = 6.08$, p = 0.014] or combined with university students [children vs. university students/adults; $Q_b(1) = 6.53$ p = 0.011], the result remained basically the same. As with free-choice behavior, whether the effect of reward contingency moderated the results was also examined. This analysis's outcome was not statistically significant, $Q_b(3) = 4.65$, p = 0.20. Nonetheless, it was chosen to perform subsequent analyses separately for different reward contingencies.

To summarize, the findings show that compared to no-reward control groups, expected rewards have an overall negative effect on free-choice behavior (d = –0.41) while having a nonsignificant effect on self-reported interest (d = –0.03). Both analyses also showed that the impact of expected rewards is stronger for children than for university students. For children, expected tangible rewards undermined free-choice intrinsic motivation and self-reported interest/enjoyment, while for university students, the composite effect size was negative only for free-choice behavior. Compared to the previous meta-analytical studies, the present results are more closely aligned with the results Deci et al. (1999a) reported than those that Cameron and her colleagues (Cameron et al., 2001; Eisenberger & Cameron, 1996) reported. Deci et al. (1999a) found a statistically significant undermining of free-choice behavior (d = –0.36) and self-reported expression of interest and enjoyment

(d = –0.07). While Cameron et al. (2001) and Eisenberger and Cameron (1996) showed somewhat smaller, albeit statistically significant negative mean effects for free-choice behavior (d = –0.18 and d = –0.25, respectively), the mean effect size estimates for self-reported interest were positive in both cases (d = 0.08 and d = –0.07, respectively). However, only Cameron et al.'s (2001) finding was statistically significant.

Assessment of publication bias

The possibility of publication bias was assessed using three methods: 1) visual examination of the funnel plots, 2) using Rosenthal's fail-safe N, and 3) using Duval and Tweedie's (2000) trim-and-fill method (Borenstein et al., 2009). For the analysis of the *free-choice behavior* studies, Rosenthal's fail-safe N method showed that over 3700 missing studies with an average effect size of 0.00 would be needed to make the mean effect size statistically nonsignificant. Duval and Tweedie's (2000) trim-and-fill method indicated that the funnel plot was asymmetric and that 24 studies might be missing from the right side of the mean effect size. The adjusted pooled effect size is substantially smaller, d = –0.16, albeit still statistically significant.

Regarding *self-reported interest*, the trim-and-fill method demonstrated that studies might be missing from the left side of the mean effect. Two additional studies should be included to achieve a symmetrical funnel plot. The fact that the trim-and-fill method found missing studies for both dependent measures is not surprising given the category of expected rewards consists of four different reward contingencies that have been shown to have differing effects on intrinsic motivation (see Deci et al., 1999a). Altogether, these analyses show that the undermining of free-choice intrinsic motivation by extrinsic motivation is quite robust, even if publication bias would have affected the analyses. All analyses are presented in Table 3.

Table 3 Summary of the results on the effects of expected rewards on intrinsic motivation and assessment of the potential impact of publication bias.

Expected rewards	*k*	Effect size *(d)*	95% CI	Fail-safe N	Number of imputed studies	Adjusted effect size (trim-and-fill)	Adjusted 95% CI
Free-choice behavior							
All expected reward studies (het.)	95	–0.41	–0.53, –0.28	3724	24	–0.16	–0.29, –0.02
Self-reported interest							
All expected reward studies (het.)	74	–0.03	–0.12, 0.05	0	2	–0.06	–0.14, 0.03

Note.
k = number of studies.
d = Cohen's d
CI = confidence interval
het = heterogeneous set of effects
hom = homogeneous set of effects; possible outlier removed

5.1.5 Unexpected rewards

As the name suggests, the main feature of this reward contingency is the unexpectedness of given rewards. Because unexpected rewards are only administered after the task is completed, they generally do not motivate behavior. This means that unexpected rewards are unlikely to cause a shift in the perceived locus of causality; thus, their effect on intrinsic motivation should be minimal (Deci et al., 1999a). Altogether, eight studies used a free-choice measure of intrinsic motivation, while four used a measure of self-reported interest. All studies included in the analyses are presented in Table 4.

Free-choice intrinsic motivation. A total of eight studies (N = 297) examined the effect of unexpected rewards on free-choice persistence. The mean effect size was not statistically significant, $d = –0.04$ (95% CI = –0.39, 0.31; 95% PI = –0.99, 0.91). A test for heterogeneity showed that the included effect sizes were homogeneous, $Q_w(7) = 13.27$, p = 0.07, $I^2 = 47.24\%$. Thus, it can be concluded that unexpected rewards do not affect free-choice persistence when compared with no-reward control groups. Figure 6 depicts a forest plot of all studies analyzing unexpected rewards' effects on free-choice behavior.

Self-reported interest and enjoyment. Four included studies investigated the effects of unexpected rewards on self-reported interest. The mean effect size (*d*) for these studies was 0.06 (95% CI = –0.48, 0.59, N = 219), showing that, on average, unexpected rewards do not affect self-reported interest. However, this set of studies was heterogeneous, $Q_w(3) = 11.90$, p = 0.008, $I^2 = 74.79\%$. Because no evident statistical outliers could be identified, the accuracy of the reported composite effect size should be interpreted with some caution. This caution is corroborated by assessing the 95% prediction interval, which is very wide (–2.28, 2.39). Figure 7 depicts a forest plot of the studies in the unexpected reward analysis.

Table 4 Effects of unexpected rewards on intrinsic motivation.

Effects of unexpected rewards on intrinsic motivation

Study name	Sample[a]	N_E / N_C[b]	Free-choice behavior *(d)*	Lower 95% CI	Upper 95% CI	Self-reported interest *(d)*	Lower 95% CI	Upper 95% CI
Eisenstein (1985)	1	10/10	0.33	–0.55	1.21	–	–	–
Greene & Lepper (1974)	1	29/14	0.16	–0.48	0.80	–	–	–
Harackiewicz et al. (1984) Exp. 2	2	15/15	0.45	–0.28	1.17	0.15	–0.57	0.87
Kruglanski et al. (1972)	1	36/33	–	–	–	–0.66	–1.13	–0.18
Lepper et al. (1973)	1	18/15	0.11	–0.55	0.77	–	–	–
Orlick & Mosher (1978)	1	12/12	–1.35	–2.19	–0.51	–	–	–
Pallak et al. (1982)	1	15/12	–0.41	–1.26	0.44	–	–	–
Pretty & Seligman (1984) Exp. 1	2	30/30	0.06	–0.43	0.56	0.40	–0.10	0.90
Pretty & Seligman (1984) Exp. 2	2	30/30	0.05	–0.81	0.91	0.36	–0.14	0.86

Note.

[a] Number 1 indicates that the subjects (Ss) were children; 2, that Ss were university students; and 3, that Ss were adults.

[b] N_E is the sample size for the experimental group; N_C is the sample size for the control group.

d = Cohen's d

CI = confidence interval

The table was adapted from Deci et al. (1999a).

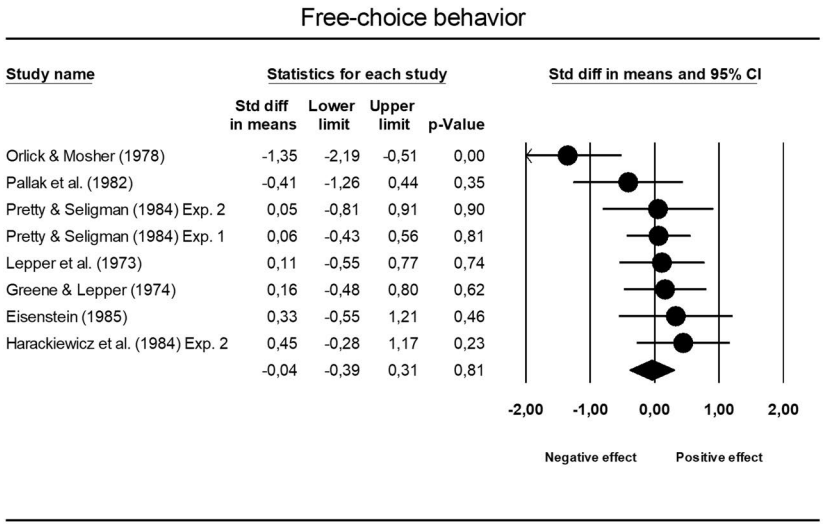

Figure 6 The forest plot for the effects of unexpected rewards on free-choice behavior.

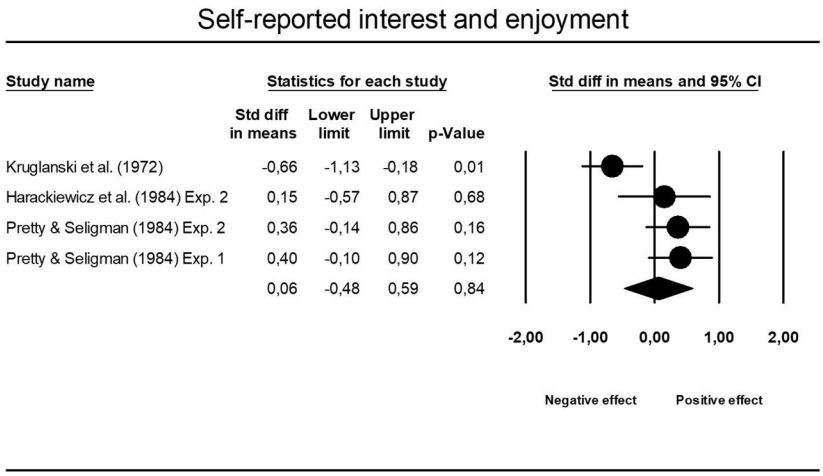

Figure 7 The forest plot for the effects of unexpected rewards on self-reported interest and enjoyment.

Overall, the results indicate that unexpectedly given rewards do not affect intrinsic motivation. These results align with those reported by Deci et al. (1999a), who reported nonsignificant effects for free-choice behavior (d = 0.01) and self-reported interest (d = 0.05). Similarly, Cameron et al. (2001) found that unexpected rewards affected neither free-choice behavior (d = 0.02) nor self-reported interest (d = 0.03). Two earlier meta-analytical studies by Eisenberger and Cameron (1996) and Tang and Hall (1995) also reported that unexpectedly given rewards do not affect intrinsic motivation.

Assessment of publication bias

As in previous cases, the possibility of publication bias was assessed by visually inspecting the funnel plots and using two statistical tests: Rosenthal's (1979) fail-safe N and Duval and Tweedie's (2000) trim-and-fill method. Based on the assessment, no clear indication of publication bias exists. Although the trim-and-fill method suggests that a single study might be missing from both analyses, the effect on the results is negligible. Table 5 provides a summary of the results. Figures 26 and 27 display the funnel plots (see Appendix 4).

Table 5 Summary of the results on the effects of unexpected rewards on intrinsic motivation and assessment of the potential impact of publication bias.

Unexpected rewards	*k*	Effect size *(d)*	95% CI	Fail-safe N	Number of imputed studies	Adjusted effect size (trim-and-fill)	Adjusted 95% CI
Free-choice behavior							
All unexpected reward studies (hom.)	8	–0.04	–0.39, 0.31	0	1	–0.11	–0.46, 0.23
Self-reported interest							
All unexpected reward studies (het.)	4	0.06	0.48, 0.59	0	1	–0.06	–0.53, –0.40

Note.
k = number of studies
d = Cohen's d
CI = confidence interval
het = heterogeneous set of effects
hom = homogeneous set of effects
outliers excl. = outliers have been excluded from the analysis
– = no adjustment

5.1.6 Task-noncontingent rewards

Ryan et al. (1983) define task-noncontingent rewards as rewards given to subjects of an experimental study simply for participating in the study. Thus, task-noncontingent reward attainment does not require task engagement, completion, or good performance; therefore, the controlling and informational aspects are relatively weak. Studies included in the analyses are presented in Table 6.

Free-choice intrinsic motivation. Seven studies (N = 278) examined the effects of task-noncontingent rewards on free-choice behavior. The results show that these types of rewards do not have a statistically significant effect on free-choice behavior. The standardized mean difference is 0.10 (95% CI = –0.26, 0.45; 95% PI = –0.86, 1.06). A test for heterogeneity showed that the included effect sizes were homogeneous, so no further analyses were carried out, $Q_w(6) = 11.40$, p = 0.08, I^2 = 50.85%. Figure 8 depicts a forest plot of the studies in the task-noncontingent rewards analysis.

Self-reported interest and enjoyment. Six studies (N = 198) examining the effect of task-noncontingent rewards on self-reported enjoyment and interest yielded a nonsignificant effect size of d = –0.02 (95% CI = –0.34, 0.29; 95% PI = –0.67, 0.62). A test for heterogeneity showed that this set of studies was homogeneous, Q_w (5) = 6.079, p = 0.299, I^2 = 17.75%. Figure 9 depicts a forest plot of the studies in the task-noncontingent rewards analysis.

Table 6 Effects of task-noncontingent rewards on intrinsic motivation.

Effects of task-noncontingent rewards on intrinsic motivation

Study name	Sample[a]	N_E / N_C[b]	Free-choice behavior *(d)*	Lower 95% CI	Upper 95% CI	Self-reported interest *(d)*	Lower 95% CI	Upper 95% CI
Deci (1972a)	2	24/16	0.07	—0.56	0.70	—	—	—
Earn (1982) Exp. 2	2	40/20	—0.28	—0.80	0.25	0.18	—0.35	0.70
Kruglanski et al. (1971)	1	16/16	—	—	—	—0.69	—1.40	0.02
Okano (1981) Exp. 2	1	11/11	—0.47	—1.32	0.38	—0.27	—1.11	0.53
Pittman et al. (1982) Exp. 1	1	30/30	0.26	—0.48	1.00	0.00[c]	—0.88	0.88
Ross et al. (1976)	1	12/12	0.49	—0.28	1.26	—	—	—
Swann & Pittman (1977) Exp. 1	1	20/20	—0.22	—0.82	0.38	—	—	—
Turnage & Muchinsky (1976)	2	16/16	0.98	0.24	1.71	0.00[c]	—0.69	0.69
Wimperis & Farr (1979)	2	16/16	—	—	—	0.46	—0.24	1.16

Note.

[a] Number 1 indicates that the subjects (Ss) were children; 2, that Ss were university students; and 3, that Ss were adults.

[b] N_E is the sample size for the experimental group; N_C is the sample size for the control group.

[c] Effect size was set to 0.00 because needed statistics were not reported in the paper.

d = Cohen's d.

CI = confidence interval.

The table was adapted from Deci et al. (1999a).

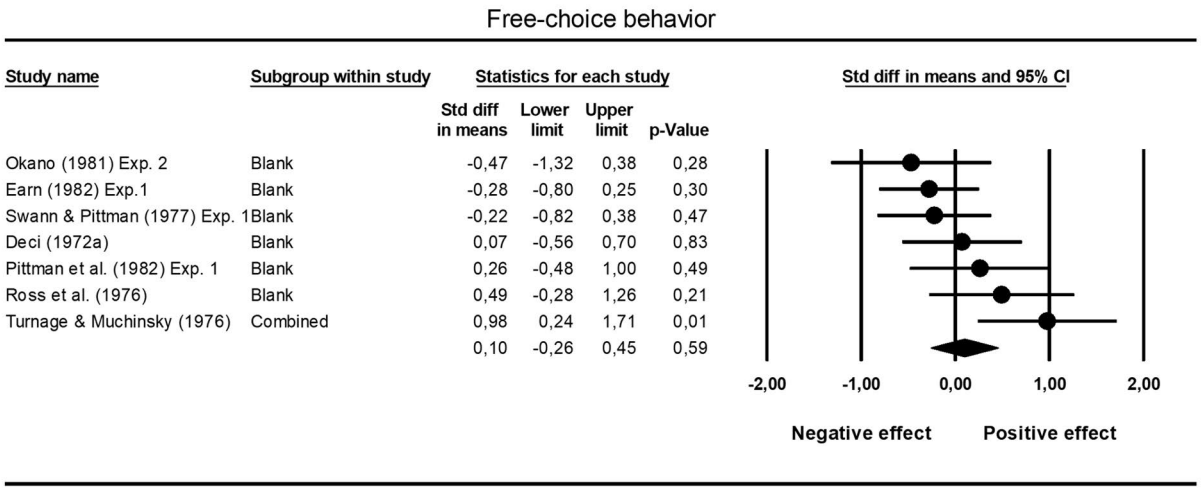

Figure 8 The forest plot for the effects of task-noncontingent rewards on free-choice behavior.

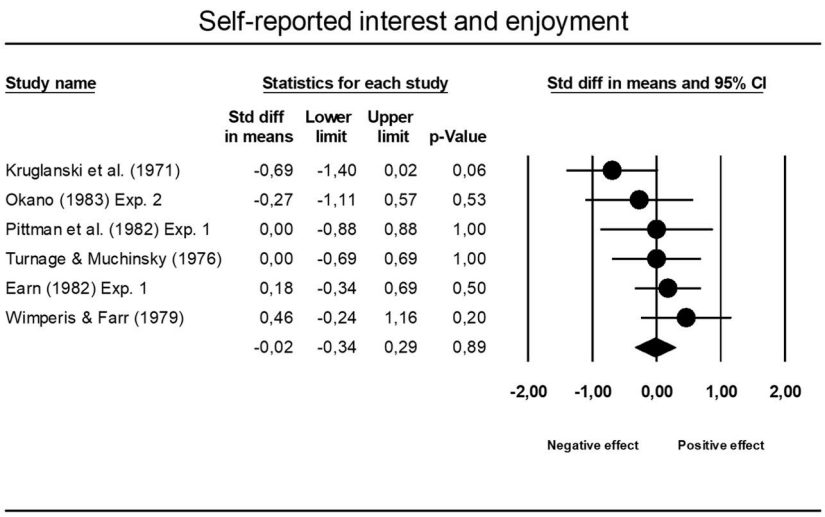

Figure 9 The forest plot for the effects of task-noncontingent rewards on self-reported interest and enjoyment.

Overall, the results of this meta-analysis show that task-noncontingent rewards do not affect intrinsic motivation. The results are similar to previous meta-analytical studies, although minor differences exist in the composite effect sizes. For example, Deci et al. (1999a) demonstrated that task-noncontingent rewards had nonsignificant effects on free-choice behavior (d = –0.14) and self-reported interest (d = 0.21). Likewise, Cameron et al. (2001) did not find statistically significant effects for the behavioral measure of intrinsic motivation (d = –0.10) or self-reported interest (d = 0.17). Also, Tang and Hall's (1995) results concur with these findings as their overall measure of intrinsic motivation showed a nonsignificant effect (d = 0.12). However, it must be noted that Tang and Hall (1995) reported a significant enhancement of self-reported interest by task-noncontingent rewards for university students. Based on the results of the current meta-analysis and previous meta-analytical studies, task-noncontingent rewards can be concluded as not affecting intrinsic motivation.

Assessment of publication bias

Neither the assessment of funnel plots nor the results of the trim-and-fill or fail-safe N procedures indicated that publication bias would be an issue. As shown in Table 7, neither the trim-and-fill nor the fail-safe N analyses indicated any missing studies for either dependent measure of intrinsic motivation. Table 7 summarizes the results. Figures 28 and 29 display the funnel plots (see Appendix 4).

Table 7 Summary of the results on the effects of task-contingent rewards on intrinsic motivation and assessment of the potential impact of publication bias.

Task-noncontingent rewards	*k*	Effect size *(d)*	95% CI	Fail-safe N	Number of imputed studies	Adjusted effect size (trim-and-fill)	Adjusted 95% CI
Free-choice behavior							
All task-noncontingent rewards (hom.)	7	0.10	–0.26, 0.45	0	0	–	–
Self-reported interest							
All task-noncontingent rewards (hom.)	6	–0.02	–0.34, 0.29	0	0	–	–

Note.
k = number of studies
d = Cohen's d
CI = confidence interval
het = heterogeneous set of effects
hom = homogeneous set of effects
outliers excl. = outliers have been excluded from the analysis
– = no adjustment

5.1.7 Engagement-contingent rewards

Engagement-contingent rewards represent a class of rewards that are given to or offered to a person for engaging in an activity (Ryan & Deci, 2017, p. 132). A defining characteristic of this reward contingency is that engagement-contingent rewards can be attained just by doing the activity. Thus, this reward type differs from completion-contingent rewards and performance-contingent rewards, which are offered for completing a task or performing a task well enough. (Deci et al., 1999a, p. 636.) A classic example of engagement-contingent rewards comes from Lepper et al.'s (1973) study where the reward group children were promised (and given) a symbolic good player award simply for drawing with magic marker pens. In a more recent study, Marinak and Gambrell (2008) rewarded children for reading books and providing recommendations on which books their school library should acquire. Carr et al. (2005) used an older population of subjects (university students) and offered them rewards for engaging in a puzzle task. Altogether, 52 studies used a free-choice measure of intrinsic motivation, while 32 studies used a measure of self-reported interest. All studies included in the analyses are presented in Table 8.

Free-choice intrinsic motivation. Altogether, 52 studies using a measure of free-choice behavior (N = 2507) examined the effect of engagement-contingent rewards on intrinsic motivation, showing that offering a reward for engaging in or doing a task significantly undermines free-choice intrinsic motivation, $d = –0.57$ (95% CI = –0.75, –0.39; 95% PI = –1.75, 0.61). However, the composite effect size was heterogeneous, $Q_w(51) = 246.87$, $p < 0.0001$, $I^2 = 79.34\%$. A subsequent moderator analysis was conducted using the population type (children vs. university students) as a moderator variable. The results showed that the composite effects of engagement-contingent reward on children's ($d = –0.59$, 95% CI = –0.80, –0.38, k = 40 studies) and university students' ($d = –0.50$, 95% CI = –0.88, –0.13, k = 12 studies)[39] free-choice intrinsic motivation were similar, $Q_b(1) = 0.16$, $p = 0.69$[40].

[39] These composite effects differ slightly from those that will be presented shortly. When performing the subgroup analysis, the between-studies variance was assumed to be the same for both subgroups. This is the reason for the slightly differing composite effect sizes (Borenstein et al., 2009, pp. 162–163).

[40] Another, more fine-grained analysis of the age effect was conducted because the composite effect size was heterogeneous. Studies using children as subjects were further classified into four different categories: 1) kindergartners/nursery school-aged children or younger, 2) elementary school-aged children, 3) high school-aged children, and 4) mixed-age children. The mixed-age group consisted of studies in which the sample contained children from categories 1 and 2. One study (Chung, 1995) had to be excluded from the analysis because it could not be classified. Studies using university students were also included in the moderator analysis. The goal of this post hoc moderator analysis was to explore whether the observed heterogeneity could be explained by a more fine-grained analysis of the age effect. The analysis showed that

Figure 10 depicts a forest plot of the studies in the engagement-contingent reward meta-analysis.

The next step was to explore the individual effect sizes in search of potential outliers. Initially, ten studies were excluded as outliers[41] (Boggiano et al., 1982; Brennan & Glover, 1980; Carr et al., 1996, 2005; Danner & Lonky, 1981, Exp. 2; Loveland & Olley, 1979; Morgan, 1983, Exp. 1; Pittman et al., 1982, Exp. 1; Swann & Pittman, 1977, Exp. 2; Tripathi & Agarwal, 1985). However, this action did not result in a homogeneous set of effects, $Q_w(41) = 60.10$, $p = 0.030$, $I^2 = 31.78\%$ ($d = –0.45$, 95% CI = –0.57, –0.34; 95% PI = –0.89, –0.02). Therefore, two additional studies (Fabes et al., 1988; Okano, 1981, Exp. 2) were removed to achieve a homogeneity of effects, $Q_w(39) = 52.78$, $p = 0.07$, $I^2 = 26.10\%$. Based on the composite effect size, it can be concluded that engagement-contingent rewards significantly undermine free-choice behavior ($d = –0.42$, 95% CI = –0.53, –0.31). The 95% prediction interval is from –0.80 to –0.05, meaning the true effect size in 95% of all comparable populations falls in this interval.

Although the difference in the composite effect sizes between children (vs. controls) and university students (vs. controls) was not statistically significant, it was still decided to carry out further analyses separately for children and university students to maintain comparability with Deci et al.'s (1999a) meta-analysis.

The analysis of 12 studies using university students showed that engagement-contingent rewards did not lead to a statistically significant decrease in free-choice intrinsic motivation, $d = –0.53$ (95% CI = –1.08, 0.03; 95% PI = –2.70, 1.65). A test for heterogeneity revealed that this set of studies was not homogeneous, $Q_w(11) = 199.88$, $p < 0.0001$, $I^2 = 90.82\%$. Therefore, three outliers were excluded from the analysis (Brennan & Glover, 1980; Carr et al., 1996, 2005), resulting in a homogeneous set of studies, $Q_w(8) = 10.61$, $p = 0.12$, $I^2 = 24.63\%$. The remaining studies comprising nine effect sizes show that, on average, engagement-contingent rewards have a significant negative effect on university students' free-choice intrinsic motivation, $d = –0.24$ (95% CI = –0.46, –0.03; 95% PI = –0.72, 0.24). Inspection of the 95% prediction interval denotes that the true effect is somewhat

the age group did not explain observed heterogeneity, $Q_b(3) = 0.74$, $p = 0.86$. The unexplained heterogeneity suggests that an unknown factor moderates the effects of engagement-contingent rewards on free-choice behavior. It is recommended that future research analyze potential theoretical differences among this set of studies to identify the unknown cause of heterogeneity.

41 A study was deemed a clear outlier if the study's 95% CI did not overlap with the composite effect's 95% CI. This was the case for six studies (Boggiano et al., 1982; Brennan & Glover, 1980; Carr et al., 1996, 2005; Morgan, 1983; Tripathi & Agarwal, 1985). The remaining four studies were classified as outliers based on the extreme effect sizes.

dispersed. In many cases, giving engagement-contingent rewards will have a quite strong deleterious effect on university students' free-choice persistence. However, in a limited number of comparable populations, the effect will be positive, albeit small.

For the 40 studies using children as subjects, the negative effects of engagement-contingent rewards on children's free-choice behavior are evident. The composite effect size (d = –0.58, 95% CI = –0.75, –0.40, k = 40) indicate that engagement-contingent rewards have a quite significant negative impact on children's free-choice behavior, although this set of studies turned out to be heterogeneous, $Q_w(39)$ = 125.97, p < 0.0001, I^2 = 69.04%. In trying to obtain homogeneity, seven outliers[42] were removed from the analysis (Boggiano et al., 1982; Danner & Lonky, 1981, Exp. 2; Fabes et al., 1988; Loveland & Olley, 1979; Morgan, 1983, Exp. 1; Pittman et al., 1982, Exp. 1; Swann & Pittman, 1977, Exp. 2). The remaining set of 33 effect sizes yielded a statistically significant negative composite effect size of d = –0.48 (95% CI = –0.61, –0.35; 95% PI = –0.92, –0.04), showing that engagement-contingent rewards have a moderate negative effect on children's free-choice intrinsic motivation. Inspection of the prediction interval shows that the effect varies to some extent but is negative in almost all comparable populations. However, even the removal of the potential outliers did not produce a homogeneous set of effect sizes, $Q_w(32)$ = 46.44, p = 0.048, I^2 = 31.10%. This finding suggests that future meta-analytical studies might benefit from examining the effects of possible moderator variables that might explain observed heterogeneity[43].

Self-reported interest and enjoyment. Altogether, 32 experiments (N = 1601) included a self-report measure of interest and enjoyment. These experiments show that engagement-contingent rewards significantly deteriorate self-reported interest and enjoyment, d = –0.16 (95% CI = –0.28, –0.03) but these effect sizes were not homogeneous, $Q_w(31)$ = 45.98, p = 0.04, I^2 = 32.57%. A test for heterogeneity showed a statistically significant difference between the composite effect sizes of different age groups, $Q_b(1)$ = 7.30, p = 0.01.

For 13 experiments using university students as subjects, the results show a nonsignificant effect of engagement-contingent rewards on self-reported interest, d = 0.03 (95% CI = –0.15, 0.18; 95% PI = –0.15, 0.20). Analyzing heterogeneity

[42] Three studies (Boggiano et al., 1982; Morgan, 1983 Exp. 1; Pittman et al., 1982 Exp. 1) were identified as outliers because the 95% confidence interval of the composite effect did not overlap with the 95% confidence intervals of the aforementioned studies. The remaining four studies were excluded, showing atypically strong positive or negative effect sizes.

[43] If a study by Okano (1982, Exp. 2) is removed, then the set of effects becomes homogeneous, $Q_w(31)$ = 43.75, p = 0.064, I^2 = 29.15%, but just barely. In this case, the composite effect size is d = –0.46, (95% CI = –0.59, –0.34).

revealed that this set of studies was homogeneous, $Q_w(12) = 9.46$, p = 0.66, I^2 = 0.00%. Conversely, the analysis shows that for 19 experiments with children, the effect of engagement-contingent rewards on self-reported interest is negative and statistically significant, $d = –0.29$ (95% CI = –0.45, –0.12; 95% PI = –0.75, 0.18). Additionally, the results show that these effects were homogeneous, $Q_w(18) = 27.06$, p = 0.08, I^2 = 33.49%. Figure 11 depicts a forest plot of the studies analyzing the effects of engagement-contingent rewards on self-reported interest and enjoyment.

Table 8 Effects of engagement-contingent rewards on intrinsic motivation.

Effects of engagement-contingent rewards on intrinsic motivation

Study name	Sample[a]	N_E /N_C[b]	Free-choice behavior *(d)*	Lower 95% CI	Upper 95% CI	Self-reported interest *(d)*	Lower 95% CI	Upper 95% CI
Amabile et al. (1986) Exp. 1	1	57/58	0.00[c]	–0.37	0.37	0.00[c]	–0.37	0.37
Amabile et al. (1986) Exp. 3	2	30/30	–	–	–	0.00[c]	–0.51	0.51
Anderson, R. et al. (1976)	1	36/37	–0.54	–1.01	–0.07	–	–	–
Arnold (1976)	2	17/36	–	–	–	0.00[c]	–0.58	0.58
Arnold (1985)	2	13/16	–	–	–	0.03	–0.74	0.67
Boggiano et al. (1985)	1	13/13	–0.67	–1.46	0.12	–	–	–
Boggiano & Ruble (1979)	1	20/20	–0.78	–1.55	–0.002	–	–	–
Boggiano et al. (1982)	1	81/85	0.27	–0.03	0.57	–	–	–
Brennan & Glover (1980)	2	20/19	1.12	0.46	1.77	–	–	–
Carr et al. (1996)	2	46/24	–1.46	–2.00	–0.92	–	–	–
Carr et al. (2005) Exp. 2	2	72/12	–4.19	–5.07	–3.31	–	–	–
Chung (1995)	1	5/5	–1.15	–2.49	0.19	–	–	–
Danner & Lonky (1982) Exp. 2	1	30/30	–1.29	–1.84	–0.73	–1.24	–1.80	–0.69
DeLoach et al. (1983)	1	26/26	0.00[c]	–0.54	–0.54	–	–	–
Fabes et al. (1988)	1	14/14	–1.29	–2.10	–0.48	–0.71	–1.48	0.05
Fabes et al. (1989)	1	15/14	–0.77	–1.52	–0.01	–	–	–
Fabes et al. (1986)	1	24/24	0.05	–0.51	0.62	–0.15	–0.71	0.42
Greene & Lepper (1974)	1	15/14	–0.75	–1.51	–0.001	–	–	–
Hamner & Foster (1975)	2	15/15	–	–	–	–0.15	–0.87	0.57
Harackiewicz (1979)	1	29/29	–	–	–	–0.55	–1.07	–0.04
Hennessey (1989) Exp. 1	1	24/13	0.00[c]	–0.69	0.69	0.00[c]	–0.67	0.67
Hitt et al. (1992)	2	30/15	–0.68	–1.31	–0.04	–0.49	–1.12	0.14

Karniol & Ross (1977)	1	17/20	–0.12	–0.75	0.50	–	–	–
Lepper et al. (1973)	1	18/15	–0.72	–1.42	–0.01	–	–	–
Lepper et al. (1982) Exp. 3	1	32/32	–0.51	–1.01	–0.01	–	–	–
Loveland & Olley (1979)	1	6/6	–1.29	–2.54	–0.05	–	–	–
Margolis & Mynatt (1986)	1	19/10	–0.16	–0.89	0.57	–	–	–
Marinak & Gambrell (2008)	1	60/15	–0.83	–1.40	–0.25	–	–	–
Morgan (1981) Exp. 1	1	27/27	–0.98	–1.53	–0.43	–0.14	–0.66	–0.38
Morgan (1981) Exp. 2	1	20/20	–0.74	–1.38	–0.10	0.03	–0.59	0.65
Morgan (1983) Exp. 1	1	40/40[d]	–1.94	–2.47	–1.42			
		20/20[d]				–0.56	–1.17	0.05
Morgan (1983) Exp. 2	1	20/20	–0.64	–1.28	–0.005	0.00[c]	–0.62	0.62
Mynatt et al. (1978)	1	5/5	–0.12	–1.36	1.12	–	–	–
Newman & Layton (1984)	1	21/10	–0.37	–1.13	0.39	–	–	–
Ogilvie & Prior (1982)	1	26/26	–0.08	–0.62	0.46	–	–	–
Okano (1981) Exp. 1	1	15/15	–0.96	–1.72	–0.20	–0.44	–1.16	0.28
Okano (1981) Exp. 2	1	10/11	–1.22	–2.15	–0.29	0.00[c]	–0.86	0.86
Perry et al. (1977)	1	16/16	–1.14	–1.89	–0.39	–0.68	–1.39	0.04
Pittman et al. (1982) Exp. 1	1	10/10	0.17	–0.32	0.65	0.00[c]	–0.88	0.88
Pittman et al. (1982) Exp. 2	1	27/27	–0.16	–0.68	0.36	–	–	–
Pretty & Seligman (1984) Exp. 1	2	30/30	–0.78	–1.30	–0.27	–0.06	–0.55	0.44
Pretty & Seligman (1984) Exp. 2	2	30/30	–0.12	–0.62	0.37	–0.13	–0.62	0.37
Reiss & Sushinsky (1975) Exp. 1	1	16/16	–0.84	–1.54	–0.15			
Ross (1975) Exp. 1	1	40/20	0.01	–0.44	0.46	–0.44	–0.89	0.004
Ross (1975) Exp. 2	1	52/14	–0.64	–1.23	–0.06	0.00[c]	–0.59	0.59

Ross et al. (1976)	1	12/12	–0.71	–1.49	0.07	–	–	–
Ryan (1983)	2	16/16	–0.36	–1.06	0.34	0.00[c]	–0.69	0.69
Sarafino (1984)	1	85/15	–0.42	–0.72	–0.12	0.00[c]	–0.55	0.55
Swann & Pittman (1977) Exp. 1	1	20/20	–0.78	–1.40	–0.16	–	–	–
Swann & Pittman (1977) Exp. 2	1	26/26	–1.22	–1.80	–0.65	–	–	–
Thill et al. (1998)	1	44/44	–	–	–	–0.63	–1.06	–0.20
Thompson et al. (1993)	2	34/33	–0.02	–0.51	0.48	–0.02	–051	0.48
Tripathi & Agarwal (1985)	2	20/20	0.29	–0.33	0.91	0.29	–0.33	0.91
Tripathi & Agarwal (1988)	2	20/10	0.00[c]	–0.76	0.76	0.00[c]	–0.76	0.76
Warneken & Tomasello (2008)	1	12/12	–1.15	–2.02	–0.29	–	–	–
Weiner & Mander (1978)	2	30/30	–0.32	–0.82	0.18	–0.32	–0.82	0.18
Wiechman & Gurland (2009)	2	31/30	–0.14	–0.64	0.36	0.18	–0.32	0.68
Williams (1980)	1	24/12	–0.23	–0.81	0.36	0.00[c]	–0.57	0.57

Note.

[a] Number 1 indicates that the subjects (Ss) were children; 2, that the Ss were university students; and 3, that the Ss were adults.

[b] N_E is the sample size for the experimental group; N_C is the sample size for the control group.

[c] The effect size was set to 0.00 because needed statistics were not reported in the paper.

[d] The sample sizes differed in analyses of free-choice behavior and self-reported interest.

d = Cohen's d

CI = confidence interval

The table was adapted from Deci et al. (1999a).

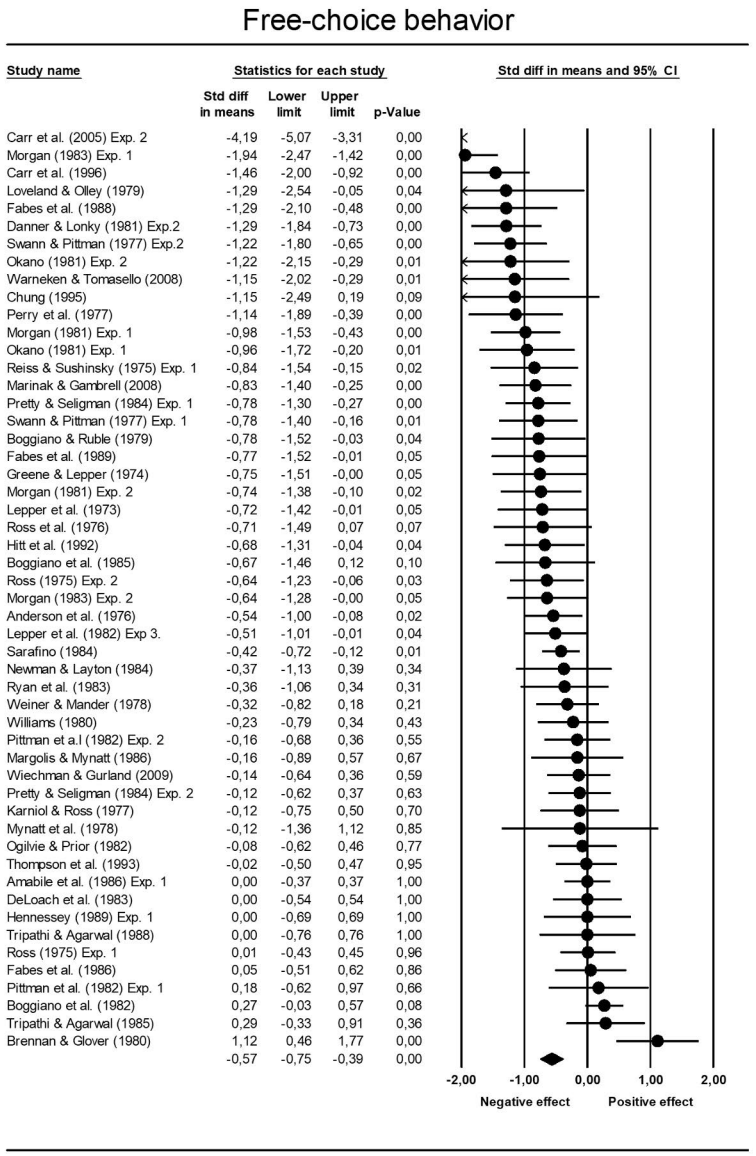

Figure 10 The forest plot for the effects of engagement-contingent rewards on free-choice behavior.

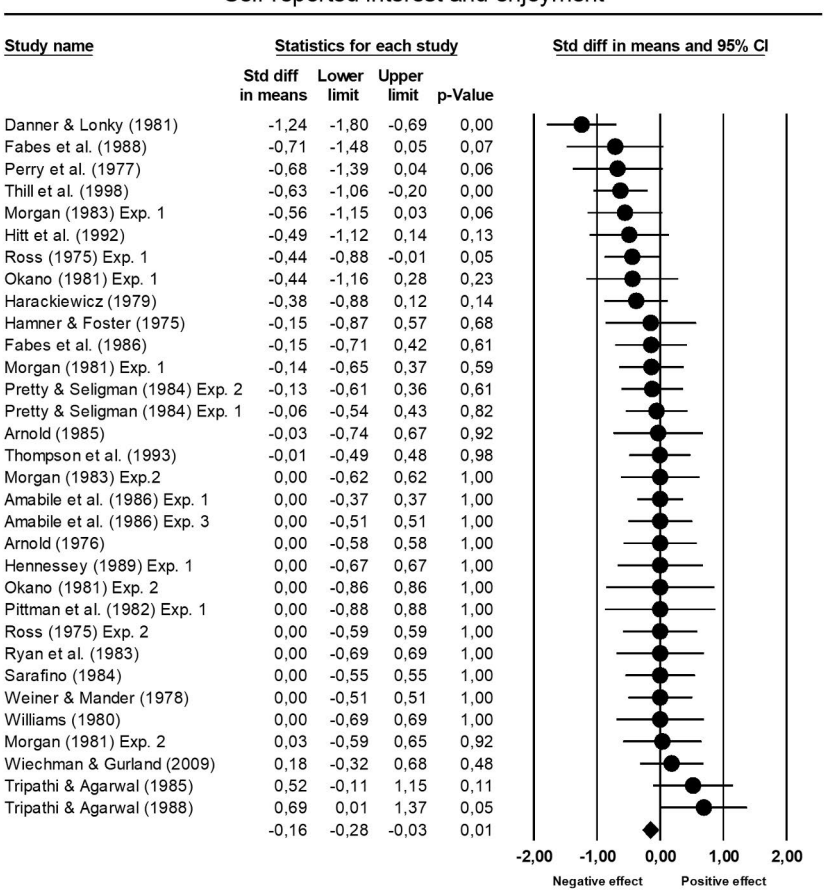

Figure 11 The forest plot for the effects of engagement-contingent rewards on self-reported interest and enjoyment.

Overall, the results suggest that after terminating the reward contingency, engagement-contingent rewards do undermine intrinsically motivated behavior (d = –0.42) when compared with no-reward controls. Additionally, this reward contingency is detrimental to university students' (d = –0.24) and children's (d = –0.48) free-choice intrinsic motivation alike. The results also demonstrate that this reward contingency damages self-reported interest (d = –0.16), albeit the effect is moderated by age. Engagement-contingent rewards undermine children's self-reported interest in and enjoyment of an activity (d = –0.29) but do not produce similar negative effects for university students (d = 0.03). Comparing the current

results with previous meta-analytical findings show that the results are more or less aligned. For example, Deci et al. (1999a) reported a statistically significant undermining of free-choice behavior by engagement-contingent reward (d = –0.40) and that the effect was stronger for children (d = –0.43) than for university students (d = –0.21). Cameron et al. (2001) reported a statistically significant negative mean effect size of –0.30 for all studies. Regarding self-reported interest, Deci et al. (1999a) found that engagement-contingent rewards significantly undermine self-reported interest/enjoyment (d = –0.15) as did Cameron et al. (2001) (d = –0.13). Unlike these two meta-analyses, which reported homogeneous composite effect sizes for self-reported interest, the present results suggest that the effect of engagement-contingent rewards on self-reported interest depends on one's age.

Assessment of publication bias

Examining publication bias was performed by visually examining the funnel plots and using Rosenthal's (1979) fail-safe N and Duval and Tweedie's (2000) trim-and-fill methods (see Borenstein et al., 2009). All engagement-contingent reward studies were included in these analyses.

A visual inspection of the funnel plot displaying all *free-choice intrinsic motivation* studies suggests that some studies may be missing from the mean effect's left side. The fail-safe N test indicates that over 2000 missing studies with an effect size of 0.00 would be needed to make the effect size nonsignificant. The trim-and-fill method suggests that no studies are missing, providing evidence for the absence of publication bias. Figure 30 (Appendix 4) displays the funnel plot for free-choice behavior.

Additional analyses were performed for the set of studies from which outliers were excluded. The trim-and-fill analysis suggests that multiple studies are missing from the right side of the mean effect. Although the corrected mean effect size is smaller (d = –0.29), it is still statistically significant. Likewise, separate analyses were performed for university students and children, with all studies included in the analyses and also after the outliers were removed from the analyses. The results of these analyses are presented in Table 9.

Regarding *self-reported interest*, neither the trim-and-fill method nor the fail-safe N indicated that publication bias would be a serious issue. However, it is noteworthy that the number of missing studies needed to make the composite effect nonsignificant is significantly lower than in the analysis of free-choice studies. Statistics of all analyses and a summary of the results are presented in Table 9. Figure 31 (Appendix 4) displays the funnel plot for self-reported interest. Overall, the results of the performed publication bias analyses suggest that bias may be an issue for the free-choice behavior studies but that the magnitude of the bias is quite modest.

Table 9 Summary of the results on the effects of engagement-contingent rewards on intrinsic motivation and assessment of the potential impact of publication bias.

Engagement-contingent rewards	*k*	Effect size *(d)*	95% CI	Fail-safe N	Number of imputed studies	Adjusted effect size (trim-and-fill)	Adjusted 95% CI
Free-choice behavior							
All engagement-contingent reward studies (het.)	52	–0.57	–0.75, –0.39	2022	0	–	–
All studies (outliers excl., hom.)	40	–0.42	–0.53, –0.31	820	11	–0.29	–0.41, –0.17
Children, all studies (het.)	40	–0.57	–0.75, –0.40	1247	13	–0.31	–0.49, –0.13
Children (outliers excl., het.)	33	–0.48	–0.61, –0.35	660	11	–0.32	–0.45, –0.18
University students, all studies (het.)	12	–0.53	–1.08, 0.03	80	4	–0.97	–1.55, –0.39
University students (outliers excl., hom.)	9	–0.24	–0.46, –0.03	6	1	–0.30	–0.53, –0.07
Self-reported interest							
All engagement-contingent reward studies (het.)	32	–0.16	–0.28, –0.03	43	3	–0.22	–0.35, –0.08
Children, all studies (hom.)	19	–0.29	–0.45, –0.12	69	2	–0.31	–0.47, –0.16
University students, all studies (hom.)	13	0.03	–0.15, 0.18	0	2	0.07	–0.08, 0.22

Note.
k = number of studies
d = Cohen's d
CI = confidence interval
het. = heterogeneous set of effects
hom. = homogeneous set of effects
outliers excl. = outliers have been excluded from the analysis
— = no adjustment

5.1.8 Completion-contingent rewards

Rewards given for completing a certain task represent the class of completion-contingent rewards. This reward contingency type differs from the previously discussed engagement-contingent rewards, which are given for engaging in an activity without an explicit requirement of completing the given task (Deci et al., 1999a, p. 628). In contrast, completion-contingent rewards are offered, for example, for each produced unit or completed task. In the context of this meta-analysis, this means that experimental studies using this reward contingency offered completion-contingent rewards typically for each completed puzzle (see, e.g., Deci, 1971; Hagger & Chatzisarantis, 2011). All studies included in the analyses are presented in Table 10

Free-choice intrinsic motivation. Twenty-three studies (N = 1090) measured intrinsic motivation using the free-choice behavior indicator of intrinsic motivation. The results show that, on average, completion-contingent rewards undermine the behavioral manifestation of intrinsic motivation (i.e., free-choice behavior), $d = –0.36$ (95% CI = –0.59, –0.14). The 95% prediction interval ranges from –1.31 to 0.58. However, this set of studies was not homogeneous, $Q_w(22) = 68.61$, $p < 0.0001$, $I^2 = 67.93\%$. A moderator analysis was performed using the age group of subjects as a moderator variable to examine a potential source of this heterogeneity. This comparison was not statistically significant, indicating that age was not the source of heterogeneity in effect sizes, $Q_b(1) = 1.87$, $p = 0.17$. Figure 12 depicts a forest plot of the studies in the completion-contingent reward analysis of free-choice behavior.

Next, three possible outliers were removed (Deci, 1972b; Pierce et al., 2003; Turnage & Muchinsky, 1976). These studies were identified as outliers because the lower bound of the confidence intervals of these studies did not overlap with the 95% confidence interval of the composite effect size (Lipsey & Wilson, 2001, pp. 107–108). However, the set of studies remained heterogeneous, so additional outlying studies were searched for, $Q_w(19) = 34.55$, $p = 0.02$, $I^2 = 45.01\%$. Based on this search, it was decided to exclude two additional studies (Carton & Nowicki, 1998, Exp. 2; Weiner, 1980).

After excluding these two studies, the composite effect size for the remaining 18 studies became homogeneous, $Q_w(17) = 26.17$, $p = 0.071$, $I^2 = 35.03\%$. The composite effect size for these 18 studies was $d = –0.48$ (95% CI = –0.67, –0.30; 95% PI = –1.01, 0.04), indicating that, on average, completion-contingent rewards have a significant and moderately negative effect on free-choice behavior after the reward contingency is no longer in place.

Self-reported interest and enjoyment. Altogether, 20 studies (N = 931) examined the effects of completion-contingent rewards on self-reported interest. Of these studies, 18 experiments used university students as experimental subjects, while only one used children, and another used adults. Analyzing this set of studies showed a

nonsignificant composite effect on self-reported interest (d = 0.01, 95% CI = –0.19, 0.22), but this overall mean effect size was heterogeneous, $Q_w(19) = 44.02$, p = 0.001, I^2 = 58.83%. Next, whether the subjects' age group operated as a moderator variable was examined. However, this analysis resulted in a homogeneous set of effects, indicating that age was not responsible for the heterogeneity of effect sizes, $Q_b(2)$ = 1.23, p = 0.54. Therefore, three outliers (Carton & Nowicki, 1998, Exp. 2; Luyten & Lens, 1981; Wimperis & Farr, 1979) were removed, after which the set of studies became homogeneous, $Q_w(16) = 18.10$, p = 0.32, I^2 = 11.60%. For the remaining 17 studies, the mean effect size showed no effect of completion-contingent rewards on intrinsic interest (d = –0.04, 95% CI = –0.19, 0.101)[44]. The 95% prediction interval ranges from –0.32 to 0.23. Figure 13 depicts a forest plot of the studies examining the effects of completion-contingent reward on self-reported interest.

[44] For 18 university student studies, the composite effect size for completion-contingent rewards was d = –0.024 (95% CI = –0.243, 0.195), $Q_w(17) = 41.45$, p = 0.001, I^2 = 58.99%. After the outliers (Carton & Nowicki, 1998, Exp. 2; Luyten & Lens, 1981; Wimperis & Farr, 1979) were removed, the set of remaining 15 studies became homogeneous, $Q_w(14) = 14.63$, p = 0.404, I^2 = 4.28%. The mean effect size for these 15 studies was d = –0.08 (95% CI = –0.230, 0.007; 95% PI = –0.63, 0.46).

Table 10 Effects of completion-contingent rewards on intrinsic motivation.

Effects of completion-contingent rewards on intrinsic motivation

Study name	Sample	N_E / N_C	Free-choice behavior *(d)*	Lower 95% CI	Upper 95% CI	Self-reported interest *(d)*	Lower 95% CI	Upper 95% CI
Albrecht et al. (2014)	3	22/19	–	–	–	0.31	–0.28	0.91
Anghelcev (2015)	2	32/32	–	–	–	–0.54	–1.04	–0.04
Arkes (1979)	2	32/32	–0.16	–0.64	0.32	0.04	–0.45	0.52
Arnold (1985)	2	13/16	–	–	–	–0.05	–0.75	0.65
Boggiano et al. (1985)	1	13/13	–0.89	–1.70	–0.09	–	–	–
Brockner & Vasta (1981)	2	26/26	–0.37	–0.91	0.18	–0.58	–1.14	–0.02
Calder & Staw (1975)	2	10/10	–	–	–	–0.42	–1.25	0.41
Cameron et al. (2004)	2	36/36	–0.01	–0.47	0.44	0.30	–0.15	0.76
Carton & Nowicki (1998) Exp. 1	2	22/22	–1.00	–1.63	–0.37	–	–	–
Carton & Nowicki (1998) Exp. 2	2	20/29	–1.07	–1.68	–0.46	0.88	0.25	1.50
Deci (1971) Exp. 1	2	12/12	–0.54	–1.36	0.27	0.00[c]	–0.80	0.80
Deci (1972b)	2	64/32	0.33	–0.09	0.75	–	–	–
Eisenstein (1985)	1	18/10	–0.50	–1.28	0.28	–	–	–
Fabes (1987) Exp. 1	1	18/19	–0.79	–1.46	–0.12	–	–	–
Fabes (1987) Exp. 2	1	14/14	–0.42	–1.17	0.32	–	–	–
Feehan & Enzle (1991) Exp. 1	2	24/12	–0.97	–1.67	–0.27	–	–	–
Griffith et al. (1984)	1	48/48	0.00[c]	–0.40	0.40	–	–	–
Hagger & Chatzisarantis (2011)	2	40/40	–0.05	–0.49	–0.38	–	–	–
Hamner & Foster (1975)	2	20/15	–	–	–	–0.26	–0.93	0.41

Kruglanski et al. (1975) Exp. 1	1	24/24	–	–	–	0.43	–0.26	1.12
Luyten & Lens (1981)	2	10/10	–1.30	–1.96	–0.09	–1.28	2.24	–0.31
McGraw & McCullers (1979)	2	20/20	–	–	–	–0.04	–0.66	–0.58
McLoyd (1979)	1	18/9	–1.04	–1.74	–0.34	–	–	–
Pierce et al. (2003)	2	30/30	0.63	0.11	1.15	–0.43	–0.94	0.09
Porac & Meindl (1982)	2	20/20	–0.78	–1.42	–0.14	–	–	–
Shapira (1976)	2	20/40	–	–	–	–0.03	–0.56	0.51
Sorensen & Maehr (1976)	1	20/20	–0.54	–1.15	0.07	–	–	–
Staw et al. (1980)	2	47/46	–	–	–	0.17	–0.25	0.59
Turnage & Muchinsky (1976)	2	16/16	0.88	0.15	1.61	0.00[c]	–0.69	0.69
Vasta & Stirpe (1979)	1	4/5	–1.02	–2.41	0.38	–	–	–
Weiner (1980)	2	24/24	0.19	–0.41	0.79	0.00[c]	–0.57	0.57
Wicker et al. (1990)	2	29/29	–0.46	–0.98	0.06	0.18	–0.34	0.79
Wimperis & Farr (1979)	2	16/16	–	–	–	1.32	0.56	2.08

Note.

[a] Number 1 indicates that the subjects (Ss) were children; 2, that the Ss were university students; and 3, that the Ss were adults.

[b] N_E is the sample size for the experimental group; N_C is the sample size for the control group.

[c] The effect size was set to 0.00 because needed statistics were not reported in the paper.

[d] The sample sizes differed in analyses of free-choice behavior and self-reported interest.

d = Cohen's d

CI = confidence interval

The table was adapted from Deci et al. (1999a).

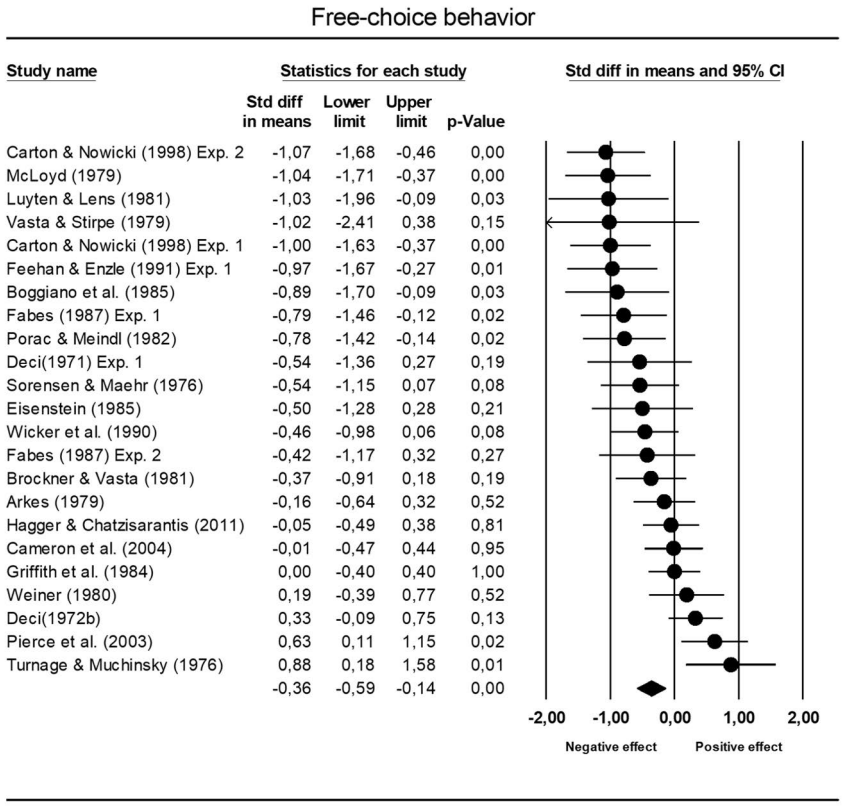

Figure 12 The forest plot for the effects of completion-contingent rewards on free-choice behavior.

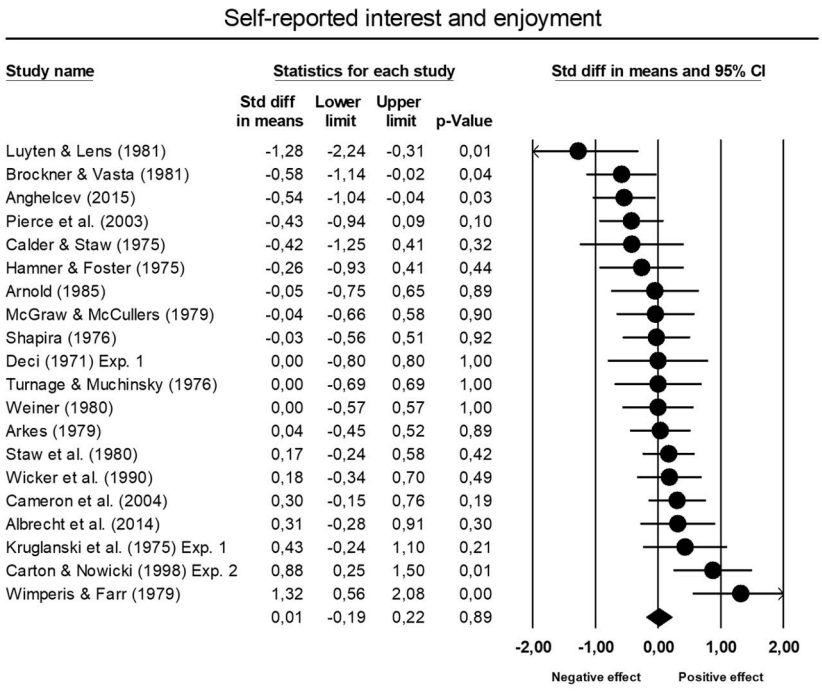

Figure 13 The forest plot for the effects of completion-contingent rewards on self-reported interest and enjoyment.

Overall, the results show that completion-contingent rewards significantly undermine free-choice persistence, and the magnitude of this effect is moderate (d = –0.48) while having no effect on self-reported interest (d = –0.04). Comparing these findings to previous meta-analytical studies reveals that the present results for free-choice persistence are in line with those reported by Deci et al. (1999a) (d = –0.44) while being substantially larger than what Cameron et al. (2001) reported for rewards given either for each unit solved (d = –0.16) or completing a task (d = –0.24). While Deci et al. (1999a) found that the effect was statistically significant, Cameron et al. (2001) found a statistically significant negative effect only for rewards given for each unit a person managed to solve, while the composite effect for rewards offered for task completion was statistically nonsignificant. Finally, Eisenberger and Cameron (1996) reported a statistically nonsignificant mean effect of d = –0.12. Regarding self-reported interest, Deci et al. (1999a) reported a statistically significant negative effect (d = –0.17), while Eisenberger and Cameron (1996) reported a statistically

nonsignificant composite effect size (d = –0.05), and Cameron et al. (2001) reported a significant enhancement effect (d = 0.15).

In conclusion, the present meta-analytical results suggest that the effect of completion-contingent rewards on free-choice intrinsic motivation is a bit stronger than previously reported. The present finding for the self-reported interest measure is in the middle compared to the pooled effect sizes reported in previous meta-analytical studies.

Assessment of publication bias

Examining possible publication bias was performed by visually examining the funnel plots and using Rosenthal's (1979) fail-safe N and Duval and Tweedie's (2000) trim-and-fill method (Borenstein et al., 2009). The results are presented in Table 11. The funnel plots for free-choice behavior (Figure 32) and self-reported interest (Figure 33) are presented in Appendix 4.

For *free-choice behavior,* the trim-and-fill methods suggest a small number of studies (4) may be missing from the right side of the mean effect. When these potentially missing studies are imputed, the adjusted composite effect becomes somewhat smaller but remains statistically significant (d = –0.26). Rosenthal's fail-safe N suggests that 142 missing studies with an average effect size of 0.00 should be included in the analysis to make the composite effect nonsignificant. Based on these findings, it seems publication bias is not a major concern.

Regarding the *self-report measure of intrinsic motivation* when all studies are included in the analysis, the trim-and-fill method suggests some studies might be missing from the right side of the mean effect. Conversely, when the analysis is performed on the homogeneous set of effects, the trim-and-fill method suggests that two studies might be missing from the composite effect's left side. In both cases, the composite effect remains statistically nonsignificant. The results are presented in Table 11.

Table 11 Summary of the results on the effects of completion-contingent rewards on intrinsic motivation and assessment of the potential impact of publication bias.

Completion-contingent rewards	*k*	Effect size *(d)*	95% CI	Fail-safe N	Number of imputed studies	Adjusted effect size (trim-and-fill)	Adjusted 95% CI
Free-choice behavior							
All comp-cont. rewards (het.)	23	–0.36	–0.59, –0.14	142	4	–0.26	–0.47, –0.04
Comp-cont. rewards (outliers excl., hom.)	18	–0.48	–0.67, –0.30	195	8	–0.25	–0.45, –0.04
Self-reported interest							
All comp-cont. rewards (het.)	20	0.01	–0.19, 0.22	0	5	0.20	–0.02, 0.43
All comp-cont. rewards (hom.)	17	–0.04	–0.19, 0.11	0	2	–0.08	–0.23, 0.06
University students (het.)	18	–0.024	–0.24, 0.19	0	6	0.213	–0.24, 0.45
University students (hom.)	15	–0.082	–0.23, 0.07	0	0	–	–

Note.
k = number of studies
d = Cohen's *d*
CI = confidence interval
het = heterogeneous set of effects
hom. = homogeneous set of effects
outliers excl. = outliers have been excluded from the analysis
– = no adjustment

5.1.9 Performance-contingent rewards

Performance-contingent rewards (PCRs) represent a class of rewards that are given for exceeding or meeting a certain performance standard (Deci et al., 1999a). As Ryan, Mims, and Koestner (1983, p. 737) elaborate, this reward contingency focuses on one's level of performance relative to some set criterion or standard. Consequently, performance-contingent rewards are only given if a person performs well on a specified task. This can happen by exceeding an ex-ante set performance standard or surpassing some standard or criterion. This can mean reward attainment depends on exceeding the performance levels of others or surpassing an absolute performance standard (Cameron et al., 2001; Deci et al., 1999a).

As pointed out by Deci, Koestner, and Ryan (1999a, pp. 636–637) and discussed in the method chapter of this doctoral thesis, studies examining the effects of performance-contingent rewards vary to some extent regarding the utilized reward amount (maximum rewards vs. less-than maximum rewards) and feedback received by control group members (equivalent feedback vs. no feedback). Therefore, it is necessary to examine both the overall effect of performance-contingent rewards and those of specific reward group–control group combinations. Hence, the categorization of PCR studies and a subsequent analysis framework draws extensively on Deci et al.'s (1999a) framework. Before proceeding to the statistical analyses, a conceptual differentiation of the above-mentioned PCR and control group characteristics will be presented.

First, in some studies (e.g., Cameron et al., 2005; Houlfort et al., 2002), all participants assigned to performance-contingent reward conditions received maximum rewards. Because the attainment of maximum rewards is contingent on excellent performance, this type of reward essentially indicates positive competence information (Deci et al., 1999a). In contrast, some reward group participants received less-than maximum rewards in some studies (e.g., Luyten & Lens, 1981; Parker et al., 2017; Rosenfield et al., 1980). These situations where a participant receives less-than maximum performance-contingent rewards can signal to the recipient of the reward that their performance is less-than-optimal. Thus, less-than maximum performance-contingent rewards may convey negative competence information. (Deci et al., 1999a.) [45]

[45] Closely tied with the preceding discussion is a situation in which some reward group subjects fail to attain any rewards. In a few studies, some reward group subjects' performance did not qualify for attaining expected rewards, which may be considered an even stronger signal of incompetence than receiving less-than maximum rewards (see Ryan & Deci, 2017, p. 130). This situation occurred, for example, in Vansteenkiste and Deci's (2003) study in which some competition-contingent reward group participants were totally left without a reward because they lost the competition (see

Second, as pointed out by Deci et al. (1999a, pp. 636–637), the appropriate no-reward control group is also a significant issue when examining the effects of PCRs. As the above discussion highlights, performance-contingent rewards can convey either implicit or explicit positive feedback (i.e., competence information) or negative feedback (see Rosenfield et al., 1980). According to Deci et al. (1999a), this issue should be taken into account when choosing the "correct" no-reward control group (for further discussion, see Deci et al., 1999b; Eisenberger, Pierce, et al., 1999; Harackiewicz et al., 1984, 1987; Harackiewicz & Sansone, 2000). As the obtainment of a (maximum) performance-contingent reward signals to a person that he or she has performed well, the participants in a no-reward control group should be given the same positive performance feedback to isolate the rewards' effects from the feedback effect (Deci et al., 1999a; Ryan & Deci, 2017, p. 133).

For example, Houlfort et al. (2002) gave positive feedback to the performance-contingent reward and control groups, while in Fabes' (1987, Exp. 1) study, only the reward group subjects received positive feedback (in the form of reward attainment) while the control group subjects did not receive equivalent competence-enhancing feedback. Conversely, in some cases (Karniol & Ross, 1977; Rosenfield et al., 1980), the control group members received negative feedback that was equivalent to the negative feedback the reward group members received. However, in most cases, no-reward control group subjects did not receive equivalent positive (or negative) feedback conveyed by reward attainment.

Finally, in some studies (e.g., Cameron et al., 2005; Eisenberger & Aselage, 2009; Harackiewicz et al., 1984, 1987; Parker et al., 2017), some or all control group subjects were exposed to explicit or implicit evaluative pressures. For example, in a study by Parker et al. (2017), the control group subjects were informed that their performance on the experimental task would be evaluated. Another example comes from Eisenberger and Aselge's (2009, p. 109) study in which the control group participants were told that their creative performance would be compared and judged against past experimental participants who had participated in the study.

As acknowledged by many scholars (Deci et al., 1999a, 1999b; Eisenberger, Pierce, et al., 1999; Harackiewicz & Sansone, 2000), this issue bears theoretical importance and relates to the question of the appropriate control condition, not least because evaluation has been shown to undermine intrinsic motivation on its own (see Harackiewicz et al., 1984). Deci et al. (1999a, 1999b) have suggested that PCRs' effects should be compared with no-reward controls not subjected to performance

also Burroughs et al., 2011; Pritchard et al., 1977; H. S. Wehe et al., 2015). Although these studies represent an interesting and ecologically relevant situation, they were included only in a supplementary analysis because reward nonattainment may operate as a confounding variable.

standards or evaluative pressures. However, some disagree. For example, Eisenberger and his colleagues (1999, p. 680) suggest that when studying PCR's effects on intrinsic motivation, the control group should be subjected to performance standards and evaluation to differentiate the effect of performance evaluation from that of a promised performance-contingent reward. However, as the no-reward/no-evaluation control group has been the norm (Deci et al., 1999b, p. 697), it was chosen to follow Deci et al.'s (1999a) logic by including only no-reward/no-evaluation control groups whenever possible. In some cases, this was not possible, and the effect of PCRs was compared with no-reward control groups subjected to performance evaluation.

As the above discussion underlines, examining the main effect of performance-contingent rewards on intrinsic motivation and the specific combinations of different performance-contingent reward categories (maximum rewards / less-than maximum rewards) and control groups (no feedback / positive feedback / negative feedback) is necessary. Aligning with the procedure Deci et al. (1999a) used in their meta-analytical review, the analysis will proceed with the following steps. First, analyses of the overall effect of performance-contingent rewards on intrinsic motivation will be presented. After that, analyses on the specific performance-contingent reward–control group combinations will be performed: 1) maximum rewards group vs. no-feedback control groups, 2) less-than maximum rewards groups vs. no-feedback control groups, 3) maximum rewards groups vs. positive feedback control groups, and 4) less-than maximum rewards group vs. negative feedback control group. Separate meta-analyses are performed for free-choice behavior and self-reported interest. Altogether, 29 studies used a free-choice measure of intrinsic motivation, while 28 studies used a measure of self-reported interest. All studies included in the analyses are presented in Table 12. Finally, a supplementary analysis comparing no-reward control groups to reward groups in which some subjects failed to attain rewards will be conducted.

Free-choice intrinsic motivation. The overall analysis was performed using all 29 performance-contingent reward studies (N = 1867) (see Table 12 and Figure 14), yielding 32 effect sizes. In some cases, a study reported two effect sizes. In such cases, an average effect size was calculated and entered into the main analysis[46]. The

[46] In a few cases (Karniol & Ross, 1977; Ryan et al., 1983; Vansteenkiste & Deci, 2003), a study reported more than one comparison but used only one control group. In this type of situation, an average effect size was calculated for the particular study and used in the main analysis. Two effect sizes were also extracted from Rosenfield et al.'s (1980) study. Because Rosenfield et al. (1980) used two different control group types (positive feedback and negative feedback control groups), these were treated as individual studies. However, if the effects are averaged and the mean effects are included in the analysis, the results show no difference.

analysis of these 29 studies yielded an overall effect size of –0.23 (95% CI = –0.43, –0.04; 95% PI = –1.15, 0.69). This result highlights that, on average, free-choice intrinsic motivation is undermined by performance-contingent rewards and that this effect is statistically significant. Unsurprisingly, this set of effect sizes was heterogeneous [$Q_w(28) = 103.14$, $p < 0.001$, $I^2 = 72.85\%$], indicating that further analyses should be carried out. Figure 14 depicts a forest plot of all studies in the performance-contingent rewards analysis of free-choice.

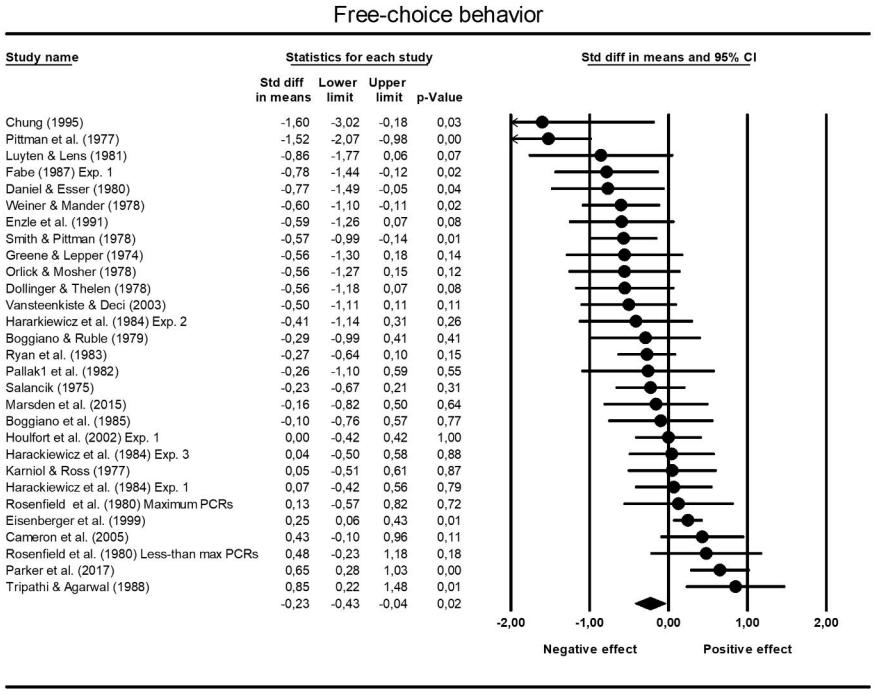

Figure 14 The forest plot for the effects of performance-contingent rewards on free-choice behavior.

In the first step, it was examined whether the age group (children, university students, adults) was responsible for the observed heterogeneity of the effect sizes. The results showed this was not the case as the test for heterogeneity was not statistically significant, $Q_b(2) = 1.57$, $p = 0.46$. The results remained unchanged regardless of whether the only study with adult subjects (Marsden et al., 2015) was excluded from the analysis [$Q_b(1) = 1.55$, $p = 0.21$] or whether it was subsumed into the category of university students, $Q_b(1) = 1.60$, $p = 0.21$. Thus, the effects of

performance-contingent rewards on children's, university students', and adults' free-choice behavior were not significantly different.

Next, whether the PCR–control group combination variable operated as a moderator[47] was examined. Somewhat unexpectedly, the analysis showed that effect sizes were homogeneous, $Q_b(3) = 7.28$ p = 0.064. Thus, the next step was to search for possible outliers. Six studies were excluded from the overall analysis (Chung, 1995; Eisenberger, Rhoades, et al., 1999; Fabes, 1987; Parker et al., 2017; Pittman et al., 1977; Tripathi & Agarwal, 1988)[48] after which the set of effects became homogeneous, $Q_w(22) = 28.06$, p = 0.17, $I^2 = 21.60\%$. The mean effect for the remaining 23 studies shows that, on average, performance-contingent rewards undermine free-choice behavior, $d = –0.24$ (95% CI = –0.38, –0.10). The 95% prediction interval is –0.59 to 0.12, meaning that for most comparable populations, the effect is negative.

Although removing outliers resulted in a homogeneous set of studies, further analyses were conducted analyzing the effects of specific performance-contingent reward–control group combinations separately. This was deemed necessary because this variable has been shown to moderate the performance-contingent rewards–intrinsic motivation cause-effect relationship (Deci et al., 1999a). This decision was made to make the results of this meta-analysis more comparable with the analysis framework of Deci et al.'s (1999a) meta-analysis. These moderator analyses were conducted using all PCR studies.

The first comparison was made between the maximum performance-contingent reward groups and the control groups, which did not receive any positive performance feedback. This analysis consisted of 13 studies and 13 effect sizes. Compared to the no-feedback control group, the results showed a nonsignificant undermining of free-choice intrinsic motivation by maximum performance-contingent rewards, $d = –0.18$ (95% CI = –0.48, 0.11; 95% PI = –1.10, 0.74). However, this set of studies showed signs of heterogeneity, $Q_w(12) = 26.04$, p = 0.011, $I^2 = 53.93\%$. Therefore, a forest plot and confidence intervals of each study were examined to identify possible outliers. A study by Tripathi and Agarwal (1988) was excluded because the confidence interval of their study did not overlap with that of the composite effect. The remaining set of 12 effects was homogeneous, $Q_w(11) = 16.68$, p = 0.12, $I^2 = 34.06\%$. The mean effect size for these 12 studies was statistically significant, $d = –0.26$ (95% CI = –0.51, –0.002; 95% PI = –0.91, 0.39).

47 All 32 effect sizes were treated as independent studies.

48 An examination of studies classified as outliers did not indicate any substantial difference between these studies and other studies. However, the need to exclude many studies to achieve homogeneity of effects suggests that unidentified factor moderates the effects.

This finding demonstrates that, on average, maximum performance-contingent rewards undermined free-choice persistence when compared to those control group participants who did not receive equivalent positive feedback conveyed by attaining PCRs.

The second comparison focused on examining the effects of receiving less-than maximum rewards on free-choice intrinsic motivation. The comparison group for this type of PCR was the no-feedback control group. Unlike maximum performance-contingent rewards, which convey positive information about one's competence, less-than maximum performance-contingent rewards are argued to signal suboptimal performance (Deci et al., 1999a, p. 644). For eight studies examining the effects of less-than maximum PCRs, the mean effect was negative and statistically significant, $d = –0.65$ (95% CI = –1.19, –0.10). However, an analysis of heterogeneity showed that these effects were heterogeneous, $Q_w(7) = 52.92$, $p < 0.0001$, $I^2 = 86.77\%$. Parker et al.'s (2017) study was excluded as an outlier. The mean effect for the remaining seven studies remained statistically significant, and the homogeneity of effects was also achieved, $Q_w(6) = 9.64$, $p = 0.14$, $I^2 = 37.74\%$. This result shows that less-than maximum rewards have a statistically significant negative effect on free-choice intrinsic motivation, $d = –0.84$ (95% CI = –1.13, –0.54; 95% PI = –1.56, –0.11). Based on Cohen's classification (1988), the magnitude of this effect is large; based on this evidence, it seems that receiving a less-than maximum possible reward has a strong detrimental effect on free-choice intrinsic motivation.

The third category of performance-contingent reward studies compared a situation in which reward and no-reward control groups received comparable positive performance feedback. For example, Houlfort et al. (2002, p. 285) told all subjects that they had reached "an excellent level of performance." For the reward group, positive performance information was further emphasized by stating, "You earned $5" (Houlfort et al., 2002, p. 286). Likewise, Eisenberger et al. (1999b, p. 1029) informed the subjects that they had "achieved an excellent level of performance." According to Ryan and Deci (2000c, p. 27), this type of comparison enables one to differentiate the effect of a reward from the effect of positive feedback that attaining the reward conveys.

Nine experiments were included in this analysis. The results showed that when comparing performance-contingent reward groups to positive feedback control groups, there is no effect, $d = –0.02$ (95% CI = –0.21, 0.16). This set of studies was homogeneous [$Q_w(8) = 11.669$, $p = 0.167$, $I^2 = 31.44\%$], and the 95% prediction interval ranged from –0.45 to 0.41. This finding was somewhat unexpected as Deci et al. (1999a) reported a statistically significant undermining of free-choice behavior by this reward–control group combination ($d = –0.20$). Possible reasons for this finding are discussed in Chapter 6.

The fourth and last category compared the effect of receiving a reward that signaled poor task performance to a control group that received negative performance feedback. However, this category of performance-contingent rewards contained only two studies by Rosenfield et al. (1980) and Karniol and Ross (1977). For these two studies, the effect on free-choice behavior (d = 0.38, 95% CI = –0.17, 0.93) was positive but nonsignificant. This finding should be interpreted with caution because only two studies were included in the analysis (Borenstein et al., 2009, pp. 363–364).

As well as the specific subcategories of performance-contingent rewards mentioned, another supplementary analysis was conducted on the effects of (partial) reward nonattainment. As the preceding results clearly show, when at least some reward group subjects receive a less-than maximum reward (while others receive the maximum reward), such tends to have a very negative effect on free-choice intrinsic motivation compared to no-reward controls. The aim of this supplementary analysis was to broaden this finding and our understanding of the PCR effects by analyzing studies in which some or all reward group participants were left without performance-contingent rewards. Three studies—not included in the foregoing primary analyses—were identified: Pritchard et al. (1977), Vansteenkiste and Deci (2003), and Wehe et al. (2015) (for details, see Table 12).

For example, in a study by Pritchard et al. (1977), university students were asked to solve chess problems. For the three reward groups included, Pritchard et al. (1977) promised a $5 reward for whoever could solve the greatest number of chess-related problems in their group, meaning only one subject in each group could attain the promised reward. The results of Pritchard et al.'s (1977) study demonstrated that the promised reward significantly undermined free-choice persistence (d = –0.96; 95% CI = –1.76, –0.16). Likewise, Vansteenkiste and Deci (2003) showed that nonattainment of a $3 performance-contingent reward had a strong negative effect on free-choice behavior, d = –0.80 (95% CI = –1.52, –0.08). Finally, the results of a recent study by Wehe et al. (2015) showed that when some reward group subjects did not perform well enough to attain the reward (a chance to be included in a drawing for a $10 gift card), this significantly undermined the free-choice intrinsic motivation of the reward group compared to the no-reward control group (d = –0.57, 95% CI = –0.94, –0.20). The overall composite effect for these three studies showed a significant undermining of free-choice intrinsic motivation, d = –0.66 (95% CI = –0.97, –0.36). This set of effects was homogeneous, $Q_w(2) = 0.90$, p = 0.63, I^2 = 0.00%. Therefore, it can be concluded that performance-contingent reward nonattainment (partial or complete) has a very deleterious effect on free-choice intrinsic motivation compared to no-reward/no-feedback control groups. However, as only three studies were included in the analysis, this finding should be interpreted with caution.

Self-reported interest and enjoyment. Twenty-eight experimental studies examined how performance-contingent rewards affect intrinsic interest. These studies yielded 30 effect size estimates (N = 2553). Table 12 provides a list of all studies included in the analyses of self-reported interest and the details of each study. Figure 15 depicts a forest plot of all studies in the performance-contingent rewards analysis of self-reported interest and enjoyment. The results show that performance-contingent rewards do not affect self-reported interest, d = 0.04 (95% CI = –0.09, 0.17). Additionally, this set of effects turned out to be heterogeneous, $Q_w(27)$ = 62.27, p = 0.0001, I^2 = 56.64%. A moderator analysis using the age group as a moderator variable was conducted to assess the potential source of heterogeneity. However, a test for heterogeneity did not produce a statistically significant result, meaning age was not responsible for the variability of observed effect sizes. The results did not change whether the single study using adult subjects were included as a separate age group [$Q_b(2)$ =1.45, p = 0.48], excluded from the analysis [$Q_b(1)$ = 1.44, p = 0.23], or subsumed into the category of university students, $Q_b(1)$ = 1.40, p = 0.24.

The next step was to examine to what degree a particular type of performance-contingent reward (maximum reward vs. less-than maximum reward) and control group (no feedback, positive feedback, negative feedback) combination might be responsible for the variability of effect sizes. This comparison turned out to be nonsignificant, $Q_b(3)$ = 4.34, p = 0.23. Next, a search for possible outliers was conducted. Four studies (Eisenberger & Aselage, 2009; Harackiewicz, 1979[49]; Kruglanski et al., 1975, Exp. 2; Tripathi & Agarwal, 1988) were identified as outliers based on examining the 95% confidence intervals of each study and the confidence interval of the mean effect. After these outliers were removed, a test for heterogeneity showed that the remaining set of 24 studies was homogeneous, $Q_w(23)$ = 21.56, p = 0.55, I^2 = 0.00%. For these 24 studies, the results showed that performance-contingent rewards have a significant positive effect on self-reported interest/enjoyment, d = 0.11 (95% CI = 0.02, 0.20). The 95% prediction interval shows that the dispersion of the effects is quite limited, ranging from 0.01 to 0.20. Overall, the results show that when all performance-contingent reward category studies are included in the analysis, the mean effect of PCRs on self-reported interest and enjoyment is positive when compared to no-reward control groups. However, the magnitude of the mean effect is relatively small. Also noteworthy is that for 8 out of the 24 studies included in the analysis, an effect size of d = 0.00 had to be used due to missing statistical information.

[49] The effect size based on a comparison between a maximum performance-contingent reward group and a positive feedback control group was excluded.

As in free-choice behavior analyses, further analyses were conducted to examine the moderating effect of different PCRs—control group combinations on self-reported interest. This was done even though the performed test for heterogeneity showed that the type of given performance-contingent reward and utilized control group did not moderate the effects. It was decided to conduct these subgroup analyses to keep the analysis comparable to the one on free-choice intrinsic motivation.

The first comparison was made between the reward groups who received maximum performance-contingent rewards and the no-reward controls who did not receive any performance feedback. Seven experiments utilized this type of comparison. The analysis showed that maximum performance-contingent rewards significantly enhanced self-reported intrinsic interest and enjoyment compared to the no-reward control group subjects who did not receive performance feedback, d = 0.23 (95% CI = 0.01, 0.46)[50]. These seven studies were homogeneous, $Q_w(6) = 8.96$, p = 0.18, $I^2 = 33.03\%$. On average, maximum performance-contingent rewards have a small and statistically significant positive effect on self-expressed interest when the reward effect is compared with control group subjects not given equivalent positive feedback. An inspection of the 95% prediction interval shows that the effect varies from –0.28 to 0.75 in comparable populations. This means that while the effect can be somewhat negative for some populations, it can have a substantial positive effect on interest and enjoyment in others.

The second comparison examined the effect of less-than maximum rewards compared to no-feedback controls. Based on seven studies, the results showed a nonsignificant undermining of intrinsic motivation, d = –0.12 (95% CI = –0.33, 0.10). These effects were homogeneous, $Q_w(6) = 3.81$, p = 0.70, $I^2 = 0.00\%$. The 95% prediction interval ranges from –0.40 to 0.17, indicating that for some populations, less-than maximum performance-contingent rewards have a quite significant negative effect on self-reported intrinsic interest and enjoyment, but the effect is positive for others.

The third comparison was made between performance-contingent reward groups (maximum rewards) and positive feedback control groups. Altogether, 14 experiments used this type of experimental manipulation. For these 14 studies, the

[50] Unlike Deci et al. (1999a), who included Taub et al.'s (1975) study in this analysis, I decided to exclude it because the study did not clearly indicate whether all reward group members received maximum rewards. However, reanalyzing the data with Taub et al.'s (1975) study included in the analysis yielded a nonsignificant positive composite effect size (d = 0.181, 95% CI = –0.023, 0.385), which was homogeneous, $Q_w(7) = 12.70$, p = 0.08. This finding suggests that some uncertainty remains about the true effect of maximum performance-contingent rewards on self-reported interest when compared with no-feedback controls.

composite effect size for self-reported interest showed a nonsignificant effect (d = –0.02, 95% CI = –0.23, 0.20). This set of effects was heterogeneous; thus, possible outliers were searched for, $Q_w(13) = 38.82$, p = 0.0002, $I^2 = 66.51\%$. Harackiewicz's (1979) study was excluded from the analysis based on the examination of the confidence intervals. For the remaining 13 studies, homogeneity was achieved [$Q_w(12) = 17.46$, p = 0.13, $I^2 = 31.26\%$], and the analysis yielded a nonsignificant overall effect size (d = 0.11, 95% CI = –0.04, 0.26). This indicates that performance-contingent rewards do not affect self-reported intrinsic interest compared with positive feedback control groups, which receive equivalent positive feedback. The 95% prediction interval indicates that the true effect size in 95% of all comparable populations falls between –0.26 and 0.47.

The fourth and last comparison was made between the performance-contingent reward groups that received less-than maximum rewards and the control groups that received negative feedback. Only a study by Rosenfield et al. (1980) used this experimental design[51], yielding a nonsignificant positive effect of d = 0.50 (95% CI = –0.24, 1.23). Because only one study used this comparison, more studies are needed to make any generalizable inferences.

[51] In Rosenfield et al.'s (1980) study, some reward group subjects received a small reward ($1.75) which conveyed information that they had performed worse than 85% of their peers. They were explicitly informed that their task performance belonged to the bottom 15%. Likewise, a control group received identical negative feedback on their task performance but did not receive any rewards. Compared to the control group, which received negative feedback, the small performance-contingent reward given for poor performance led to higher free-choice persistence and self-reported interest, albeit neither effect was statistically significant.

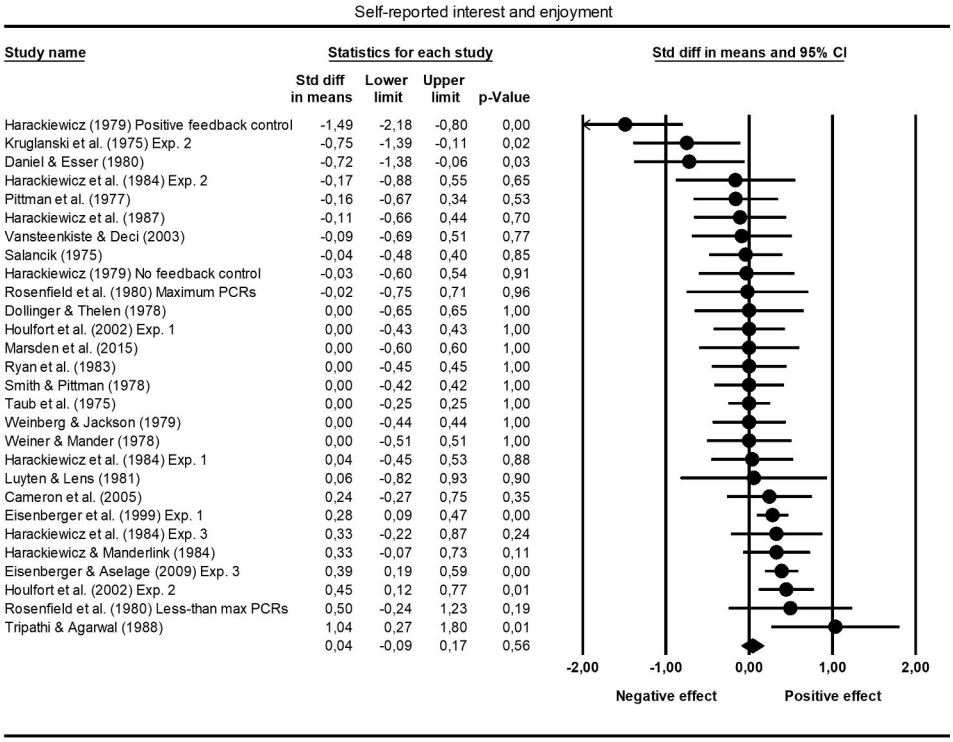

Figure 15 The forest plot for the effects of performance-contingent rewards on self-reported interest and enjoyment.

As in the free-choice analysis, a supplementary analysis was performed to examine the effects of not receiving an expected performance-contingent reward. In this performance-contingent reward category, some (or all) reward group participants were left without expected performance-contingent rewards because they did not meet set performance standards. These reward groups were compared with no-feedback control groups. Three studies (Burroughs et al., 2011, Exp. 3; Pritchard et al., 1977; Vansteenkiste & Deci, 2003) examined this issue (see Table 12). For these three studies, the overall effect was nonsignificant (d = –0.24; 95% CI = –1.19, 0.71), and the set of effects showed signs of heterogeneity, $Q_w(2)$ = 14.12, p = 0.001, I^2 = 85.94%. An inspection of the individual effect sizes showed no obvious outliers as each study's 95% confidence interval overlapped with the 95% confidence interval of the composite effect.

A closer inspection of these studies showed that although each study used university students as subjects, some major differences were evident, especially between studies by Vansteenkiste and Deci (2003) and Burroughs et al. (2011). These differences are addressed next. For the reward group subjects, Vasteenkiste and Deci (2003) emphasized that the goal of the experimental puzzle task was to perform better than the other participant. Vansteenkiste and Deci (2003, 286) emphasized this by stating that *"[t]o win the game you will need to solve the puzzles more quickly than your opponent.*" In reality, the alleged opponent in the next room was fictitious. The interpersonal context of Vansteenkiste and Deci's (2003) study seems to have been quite controlling and pressuring, which, according to CET (Deci et al., 1999a), tends to enhance the controlling aspect of rewards. By contrast, the interpersonal context in Burroughs et al.'s (2011) study seems to have been quite noncontrolling, which may partially explain these divergent results. Experiments assessing the effect of competition on intrinsic motivation provide some support for this suggestion. Research shows that competition in a pressuring environment (vs. a non-pressuring environment) undermines intrinsic motivation (Reeve & Deci, 1996; see also Deci et al., 1981).

While the reward group participants in Vansteenkiste and Deci's (2003) study thought they had to outperform a single opponent to receive the promised reward, in Burroughs et al.'s (2011) study, the reward group participants were told that the top three performers would be rewarded[52]. Although Burroughs et al. (2011) did not explicitly state in their paper whether the reward group participants were aware of how many other persons were competing for the rewards, this ambiguity between

[52] The competitive situation in Vansteenkiste and Deci's (2003) experiment seems to correspond to what Swab and Johnson (2019, p. 149) call a zero-sum competitive situation. In a zero-sum competition, only the winner will be rewarded, meaning the competitive pressure is heightened (Swab & Johnson, 2019).

performance and the expected reward may have reduced the controlling aspect of promised rewards and weakened the performance-reward expectancy linkage.

Moreover, another major difference between these two studies is that Burroughs et al. (2011) examined whether creativity training would suppress or even reverse the possible negative effects of rewards. Some early experimental studies have shown that focusing more on the intrinsic qualities of a task can protect intrinsic motivation (e.g., Fazio, 1981; Pittman et al., 1977; Porac & Meindl, 1982) and creativity (Hennessey et al., 1989). The effect of promised reward varied substantially in Burroughs et al.'s (2011) study depending on whether the reward and control group participants had received creativity training (d = 1.27) or not (d = –0.03).

If Burroughs et al.'s (2011) study is excluded from the analysis, the results become homogeneous [$Q_w(1) = 0.05$, p = 0.83, $I^2 = 0.00\%$] and show a significant undermining of self-reported interest by nonattainment of expected performance-contingent rewards (d = –0.70, 95% CI = –1.23, –0.17). Overall, the results seem to indicate that reward nonattainment can diminish interest in an activity. However, because only three studies examined this issue, further research is needed to clarify this issue.

Table 12 Effects of performance-contingent rewards on intrinsic motivation.

Effects of performance-contingent rewards on intrinsic motivation									
Study name	Sample[a]	N_E/N_C[b]	Free-choice behavior *(d)*	Lower 95% CI	Upper 95% CI	Self-reported interest *(d)*	Lower 95% CI	Upper 95% CI	Type[d]
Boggiano & Ruble (1979)	1	20/20	–0.29	–1.01	0.43	–	–	–	1
Boggiano et al. (1985)	1	26/13	–0.10	–0.76	0.57	–	–	–	1
Cameron et al. (2005)	2	28/28	0.43	–0.10	0.96	0.24	–0.28	0.76	1
Chung (1995)	1	5/5	–1.60	–3.02	–0.18	–	–	–	1
Daniel & Esser (1980)	2	16/16	–0.77	–1.49	–0.05	–0.72	–1.41	–0.03	2
Dollinger & Thelen (1978)	1	36/12	–0.56	–1.20	0.09	0.00[c]	–0.65	0.65	2
Eisenberger et al. (1999) Exp. 1	2	218/217	0.25	0.06	0.43	0.28	0.09	0.47	3
Eisenberger & Aselage (2009) Exp. 3	2	202/203	–	–	–	0.39	0.19	0.59	1
Enzle et al. (1991)	2	40/10	–0.59	–1.28	0.09	–	–	–	1
Fabes (1987) Exp. 1	1	19/19	–0.78	–1.44	–0.12	–	–	–	1
Greene & Lepper (1974)	1	15/14	–0.56	–1.30	0.18	–	–	–	1
Harackiewicz (1979)	1	29/14	–	–	–	–1.49	–2.18	–0,80	3
Harackiewicz (1979)	1	32/17	–	–	–	–0.03	–0.60	0.54	1
Harackiewicz & Manderlink (1984)	1	47/47	–	–	–	0.33	–0.07	0.73	3
Harackiewicz et al. (1984) Exp. 1	2	32/32	0.07	–0.42	0.56	0.04	–0.45	0.53	3
Harackiewicz et al. (1984) Exp. 2	2	15/15	–0.41	–1.14	0.31	–0.17	–0.88	0.55	3
Harackiewicz et al. (1984) Exp. 3	2	26/26	0.04	–0.50	0.28	0.33	–0.22	0.87	3

Harackiewicz et al. (1987)	1	24/27	–	–	–	–0.11	–0.66	–0.44	3
Houlfort et al. (2002) Exp. 1	2	43/42	0.00d	–0.43	0.43	0.00[c]	–0.43	0.43	3
Houlfort et al. (2002) Exp. 2	1	73/72	–	–	–	0.45	0.12	0.77	3
Karniol & Ross (1977)	1	10/10	0.26	–0.62	1.14	–	–	–	4
Karniol & Ross (1977)	1	10/10	–0.16	–1.04	0.72	–	–	–	1
Kruglanski et al. (1975) Exp. 2	1	20/20	–	–	–	–0.75	–1.39	–0.11	3
Luyten & Lens (1981)	2	10/10	–0.86	–1.77	0.06	0.06	–0.82	0.93	2
Marsden et al. (2015)	3	21/22	–0.16	–0.82	0.50	0.00[c]	–0.60	0.60	3
Orlick & Mosher (1978)	1	14/12	–0.56	–1.30	0.19	–	–	–	1
Pallak et al. (1982)	1	15/12	–0.26	–1.10	0.59	–	–	–	1
Parker et al. (2017)	2	61/62	0.65	0.28	1.03	–	–	–	2
Pittman et al. (1977)	2	60/20	–1.52	–2.07	–0.97	–0.16	–0.67	0.34	2
Rosenfield et al. (1980)	2	15/14	0.13	–0.60	0.86	–0.02	–0.75	0.71	3
Rosenfield et al. (1980)	2	15/14	0.48	–0.26	1.22	0.50	–0.24	1.23	4
Ryan et al. (1983)	2	32/16	0.06	–0.54	0.66	0.00[c]	–0.60	0.60	1
Ryan et al. (1983)	2	32/32	–0.45	–0.95	0.04	0.00[c]	–0.49	0.49	3
Salancik (1975)	2	38/39	–0.23	–0.67	0.21	–0.04	–0.48	0.40	3
Smith & Pittman (1978)	2	66/33	–0.57	–0.99	–0.14	0.00[c]	–0.42	0.42	2
Tripathi & Agarwal (1988)	2	20/10	0.85	0.19	1.51	1.04	0.27	1.80	1
Vansteenkiste & Deci (2003)	2	16/16	0.09	–0.60	0.78	0.03	–0.66	0.73	1
Vansteenkiste & Deci (2003)	2	16/16	–1.14	–1.88	–0.39	–0.18	–0.88	0.51	2
Weinberg & Jackson (1979)	2	40/40	–	–	–	0.00[c]	–0.44	0.44	1
Weiner & Mander (1978)	2	30/30	–0.60	–1.11	–0.10	0.00[c]	–0.51	0.51	2
Studies included in the supplementary analyses of PCR nonattainment									
Burroughs et al. (2011) Exp. 3	2	53/55	–	–	–	0.55	0.17	0.94	–

Pritchard et al. (1977)	2	17/11	–0.96	–1.76	–0.16	–0.76	–1.55	0.02	–
Vansteenkiste & Deci (2003) Conditon 3	2	16/16	–0.80	–1.15	–0.08	–0.65	–1.36	0.06	–
Wehe et al. (2015)	2		–0.57	–0.94	–0.20	–	–	–	–

Note.

[a] Number 1 indicates that the subjects (Ss) were children; 2, that Ss were university students; and 3, that Ss were adults.

[b] N_E is the sample size for the experimental group; N_C is the sample size for the control group.

[c] Effect size was set to 0.00 because needed statistics were not reported in the paper.

[d] Type is used to indicate what kind of performance-contingent reward (maximum, less-than maximum) was given to reward group participants and what kind of control group was used. 1 = maximum reward / no-feedback control group, 2) less-than maximum reward / no-feedback control group, 3 = maximum reward / positive feedback control group, 4 = less-than maximum reward / negative feedback control group.

d = Cohen's d

CI = confidence interval

The table was adapted from Deci et al. (1999a).

To summarize the findings, performance-contingent rewards reliably undermine the behavioral manifestation of intrinsic motivation (i.e., free-choice behavior). Based on the analyses, it was found that this undermining of the behavioral form of intrinsic motivation by performance-contingent rewards was evident at the aggregate level (i.e., when all studies were included) and in two cases of subgroup analyses: 1) maximum rewards vs. no-feedback controls and 2) less-than maximum rewards vs. no-feedback controls. The behavioral form of intrinsic motivation was also undermined when some or all the reward group subjects could not attain the reward compared to the no-reward controls. For self-reported interest and enjoyment, the results showed a small enhancement effect of interest by performance-contingent rewards at the global level of analysis. Furthermore, the subgroup analyses demonstrated that performance-contingent rewards led to higher self-reported interest only when the effect of maximum rewards was contrasted with no feedback control groups.

Comparing the current results with those Deci et al. (1999a) reported indicates the results are quite similar. For example, for free-choice behavior, Deci et al. (1999a) reported the significant undermining of free-choice intrinsic motivation by all performance-contingent rewards (d = –0.28). In subgroups analyses, Deci et al. (1999a) found an undermining of free-choice intrinsic motivation when maximum rewards were compared with no feedback controls (d = –0.15), when less-than maximum rewards were compared with no feedback controls (d = –0.88), and when performance-contingent reward groups with positive performance feedback were compared with controls who received positive feedback (d = –0.20). The results of the present meta-analysis replicated Deci et al.'s (1999a) findings for the first three comparisons. However, for the last comparison between performance-contingent reward groups and control groups that received positive feedback, the present results showed a nonsignificant effect (d = –0.02). The overall results are also in line with Tang and Hall's (1995) finding that performance-contingent rewards significantly undermine free-choice persistence (d = –0.398).

Concerning the findings by Cameron et al. (2001), Eisenberger, Pierce, et al. (1999) and Eisenberger and Cameron (1996), comparing results is a bit more difficult as each study used a somewhat different classification of performance-contingent rewards. None of these meta-analyses used the same classification framework that was utilized in this doctoral thesis and in Deci et al.'s (1999a) meta-analysis. To begin with, Cameron et al. (2001) reported a significant undermining of free-choice persistence only when performance-contingent rewards were offered for doing well (d = –0.31), while no effect was found for performance-contingent rewards given for surpassing an absolute standard (d = 0.02). Cameron et al. (2001) also found a significant positive effect for PCRs given for performing better than others (d = 0.18). Eisenberger and Cameron (1996) reported a nonsignificant negative mean

effect of –0.13 for quality-dependent rewards, while Eisenberger, Pierce, et al. (1999) found no overall effect for all performance-contingent rewards (d = 0.03) but reported that explicitness of performance standard moderated this effect. The effect was negative (and significant) when the performance standard was vague (d = –0.29), positive (and significant) when it was explicit (d = 0.13), and the reward was given for performing better than others (d = 0.23).

Regarding the effect of performance-contingent rewards on self-reported interest/enjoyment, Deci et al. (1999a) reported a nonsignificant overall effect (d = –0.01), as did Tang and Hall (1995) (d = –0.197). In contrast, Cameron et al. (2001) reported significant positive effects for rewards given for performing better than others (d = 0.14) and for surpassing an absolute standard/score (d = 0.24), while they found no effect when performance-contingent rewards were offered for doing well (d = 0.04). Likewise, Eisenberger and Cameron (1996) and Eisenberger, Pierce, et al. (1999) found that performance-contingent rewards significantly enhance self-reported interest and enjoyment: the composite effects ranged between 0.16 and 0.26. When contrasted with the previous meta-analytical findings, the current meta-analytical results are more or less aligned with those.

Overall, the present meta-analysis indicates that performance-contingent rewards tend to harm free-choice intrinsic motivation while having a small positive effect on self-reported interest and enjoyment; however, this positive effect is evident only in a fairly limited situation. Found differences between the present meta-analysis and the previous ones seem to stem—at least partly—from different classification systems used to categorize different types of PCRs. Also, it seems reasonable to assume some of these observed differences are related to differences in the set of included studies. While the present meta-analysis included new studies, it excluded unpublished doctoral dissertations. This is a significant difference because Deci et al. (1999a), Eisenberger, Pierce, et al. (1999), and Cameron et al. (2001) included unpublished doctoral dissertations in their meta-analyses, which may have had some impact on the results.

Assessment of publication bias

Table 13 presents the impact of possible publication bias on the results and summarizes the results. Regarding the free-choice behavior measure of intrinsic motivation, the examination of the funnel plots and the results of fail-safe N and trim-and-fill procedures suggest that missing studies due to publication might be a problem in some cases. At the overall level of analysis (all PCR studies included), the trim-and-fill method suggests that six studies might be missing from the right side of the mean effect. If these studies are imputed, the adjusted composite effect size becomes smaller and nonsignificant (d = –0.07). When the homogeneous set of

all studies is assessed for publication bias, the number of missing studies is smaller than what it was in the previous analysis, and the adjusted composite effect size estimate remains statistically significant ($d = –0.17$). Table 13 presents the results of publication bias assessments for all PCR–control group combinations. The funnel plot for the effects of PCRs on free-choice behavior is presented in Figure 34 (see Appendix 4).

Concerning the effect of all performance-contingent rewards on self-reported interest and enjoyment, the trim-and-fill method suggests that nine studies might be missing from the right side of the mean effect. Including these studies in the analysis would change the summary effect size so the effect would become statistically significant and positive ($d = 0.19$) (see Table 13). For the homogeneous set of all PCR studies, the trim-and-fill method suggests some studies may be missing from the mean effect's right side. If these studies are imputed and included, the mean effect size changes slightly from 0.11 to 0.15. Figure 35 (see Appendix 4) presents the funnel plot for the effects of PCRs on self-reported interest and enjoyment.

Table 13 Summary of the results on the effects of performance-contingent rewards on intrinsic motivation and assessment of the potential impact of publication bias.

Performance-contingent rewards	*k*	Effect size *(d)*	95% CI	Fail-safe N	Number of imputed effects	Adjusted effect size (trim-and-fill)	Adjusted 95% CI
Free-choice intrinsic motivation							
All performance-contingent reward studies (het.)	29	–0.23	–0.43, –0.04	78	6	–0.07	–0.27, 0.13
All performance-contingent reward studies (outliers, exc., hom.)	24	–0.24	–0.38, –0.10	69	4	–0.17	–0.31, –0.02
Maximum rewards, no feedback control group (all studies, het.)	13	–0.18	–0.48, 0.11	0	4	0.04	–0.27, 0.34
Maximum rewards, no feedback control group (outliers exc., hom.)	12	–0.26	–0.51, –0.002	10	5	0.01	–0.28, 0.30
Less than maximum rewards, n feedback control group (all studies, het.)	8	–0.65	–1.19, –0.10	56	3	–0.35	–0.84, 0.15
Less than maximum rewards, n feedback control group (outliers exc., hom.)	7	–0.84	–1.13, –0.54	87	0	–	–
Maximum rewards, positive feedback control group (all studies, het.)	9	–0.02	–0.21, 0.16	0	5	0.18	–0.02, 0.38
Less-than maximum rewards, negative feedback control (all studies, hom.)	2	0.38	–0.17, 0.93	–	–	–	–
Partial reward nonattainment (all studies, hom.)	3	–0.66	–0.97, –0.36	12	2	–0.57	–0.83, –0.30

Self-reported interest and enjoyment							
All performance-contingent rewards (het.)	28	0.04	–0.09, 0.17	0	9	0.19	0.05, 0.33
All performance-contingent rewards (outliers exc., hom.)	24	0.11	0.02, 0.120	0	6	0.15	0.05, 0.24
Maximum rewards, no feedback control group (all studies, hom.)	7	0.23	0.01, 0.46	8	2	0.30	0.11, 0.50
Less-than maximum rewards, no feedback control group (all studies, hom.)	7	–0.12	–0.33, 0.10	0	1	–0.13	–0.34, 0.08
Maximum rewards, positive feedback control group (all studies, het.)	14	–0.02	–0.23, 0.20	0	4	–0.22	–0.48, 0.04
Maximum rewards, positive feedback control group (outliers excl., hom.)	13	0.11	–0.04, 0.26	0	6	0.24	0.08, 0.39
Less-than maximum rewards, negative feedback control group (all studies)	1	0.50	–0.24, 1.23	–	–	–	–
Partial reward nonattainment (all studies, het.)	3	–0.24	–1.19, 0.71	0	–	–	–
Partial reward nonattainment (outliers excl. hom.)	2	–0.70	–1.23, –0.17	–	–	–	–

Note.
k = number of studies
d = Cohen's *d*
CI = confidence interval
het = heterogeneous set of effects
hom = homogeneous set of effects
outliers excl. = outliers have been excluded from the analysis
– = no adjustments

5.2 Summary of the meta-analytical findings of experimental studies

Next, the results of the free-choice meta-analysis and self-report meta-analysis are summarized. Figures 16 and 17 present graphical summaries of the results. Figure 16 depicts the results for free-choice behavior, while Figure 17 depicts the results for self-reported interest. The presentation of summarized findings follows the same order in which the results were presented originally. The findings of free-choice behavior analyses will be summarized first, after which the same will be done for the self-report measure of intrinsic interest.

Regarding experimental laboratory studies with no-reward control groups, the current meta-analytical synthesis on the effects of rewards on free-choice intrinsic motivation mainly replicates Deci et al.'s (1999a) findings. At the highest level of analysis (all studies included), the results show that extrinsic rewards have a statistically significant negative effect on free-choice intrinsic motivation. A more fine-grained hierarchical analysis using reward contingency and reward type as moderator variables shows that extrinsic rewards damage free-choice behavior when given rewards are tangible, expected, and contingent on task engagement, task completion, or task performance. In contrast, task-noncontingent rewards, unexpectedly given rewards, and negative feedback do not affect free-choice behavior compared with control groups, while positive feedback enhances behaviorally measured intrinsic motivation, albeit this positive effect is evident only for university students. Especially notable is that, except for the previous four cases, the rewards most often used to actively motivate people consistently undermine free-choice persistence when the reward contingency is terminated.

As shown in Figure 16, the magnitudes of statistically significant negative composite effect sizes for free-choice behavior vary between –0.24 to –0.84. Both engagement-contingent rewards and completion-contingent rewards tend to have moderate negative effects on free-choice behavior (d = –0.42 and d = –0.48, respectively) (Cohen, 1988). In contrast, the effects of performance-contingent rewards vary somewhat more, as Figure 16 depicts. It is particularly notable that the strongest negative effect for the free-choice measure of intrinsic motivation was found for less-than maximum performance-contingent rewards (d = –0.84, 95% CI = –1.13, –0.54, k = 7 studies). In this category, some rewarded subjects received maximum rewards for good performance while others received smaller rewards because their performance level was not up to par. Because an effect size above 0.80 represents a large effect (Cohen, 1988), it seems that this particular reward contingency is especially detrimental to intrinsic motivation, as Deci et al. (1999a) noted in their meta-analysis.

A supplementary meta-analysis of three studies was conducted to examine the effect of a situation in which some performance-contingent reward group subjects

were left without a reward while some received the expected rewards. The results showed a statistically significant and quite strong undermining of free-choice behavior (d = –0.66) for this type of performance-contingent reward compared to no-reward control groups. As Deci and his colleagues (Deci et al., 1999b; Deci, Koestner, et al., 2001; Deci, Ryan, et al., 2001) have pointed out, these two performance contingencies (less-than maximum rewards or a failure to attain expected rewards) represent perhaps the most ecologically valid types of performance-contingent rewards. Not every employee or student will succeed in attaining expected rewards, or the received reward is smaller than the person might have expected.

All in all, the present meta-analytical findings provide strong evidence for the crowding out of free-choice intrinsic motivation, especially by expected tangible rewards for which a clear instrumental link exists between an activity and a promised reward. Indeed, when attaining a reward is explicitly linked to doing a task, finishing it, or performing well at it, it significantly undermines free-choice intrinsic motivation. It is also equally important to note that not all rewards cause the undermining of free-choice intrinsic motivation. Some rewards have nonsignificant effects (e.g., task-noncontingent rewards), while positive feedback can even enhance intrinsic motivation. Furthermore, the results suggest a need to consider age effects. Children seem more susceptible to the negative effects of expected rewards than university students, while positive feedback seems to have a stronger effect on university students' free-choice behavior than a younger population's intrinsic motivation. However, because studies using university students as study subjects have focused more on examining a less detrimental type of expected rewards (performance-contingent rewards), the finding concerning the interaction between age and expected rewards should be interpreted with some caution and studied further (see Borenstein, 2019, p. 203).

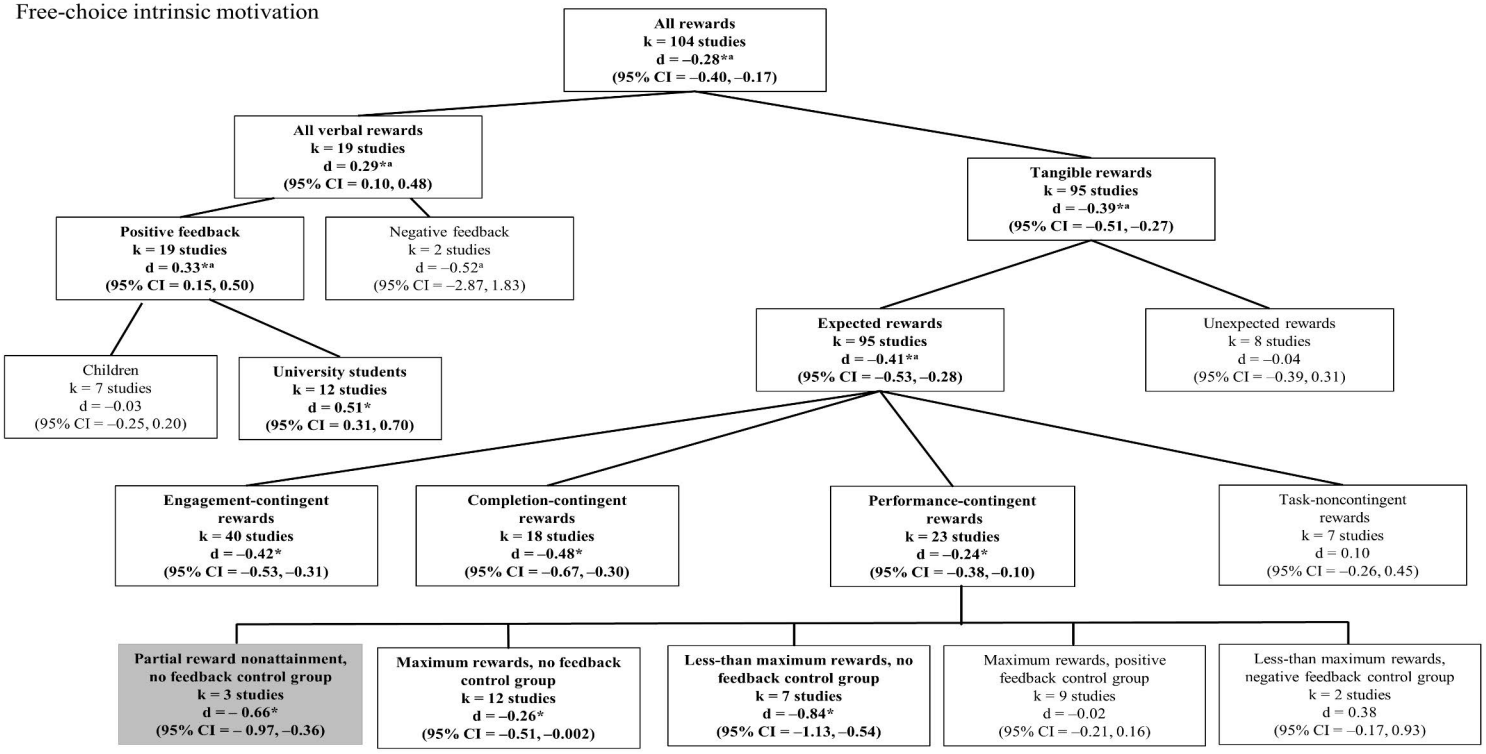

Figure 16 A summary of the composite effect sizes on the effects of extrinsic rewards on free-choice intrinsic motivation (reward groups vs. control groups). Reported composite effect sizes are standardized mean differences (Cohen's d). The 95% CI represents the confidence interval for each particular summary effect. Statistically significant composite effect sizes are highlighted with a superscript "*" and boldface text. The reward category "Partial reward nonattainment" was not included in the primary meta-analysis. If a composite effect is not homogeneous, a superscript "a" indicates this. The letter k denotes the number of studies included in the analysis (adapted from Deci et al., 1999a).

For *self-reported intrinsic interest and enjoyment*, the results show a somewhat different pattern of effects than what was found for the free-choice measure of intrinsic motivation. At the highest level of analysis, the mean effect of all rewards on self-reported interest was nonsignificant, $d = 0.04$, as Figure 17 shows. Regarding positive feedback, the meta-analysis showed a significant enhancement of self-reported interest ($d = 0.26$) while showing a nonsignificant mean effect for negative feedback ($d = –0.18$). Thus, these feedback effects on self-reported interest are quite consistent with the meta-analytical findings of free-choice behavior studies. The results showed nonsignificant negative effects for tangible, expected, unexpected, task-noncontingent, and completion-contingent rewards. The only statistically significant undermining of self-reported interest was found for the engagement-contingent rewards. However, a moderator analysis demonstrated that this type of reward undermines only children's self-reported interest/enjoyment ($d = –0.29$) while leaving university students' intrinsic interest unaffected ($d = 0.03$).

Finally, the only statistically significant positive enhancement effect for expected tangible rewards was found for performance-contingent rewards ($d = 0.11$). A more nuanced analysis showed that this statistically significant positive effect could be attributed to a comparison between maximum performance-contingent reward groups versus no-feedback controls ($d = 0.23$). Although less-than maximum performance-contingent rewards did not lead to a statistically significant undermining of self-reported interest ($d = –0.12$), the results seemingly suggest this type of reward may damage interest in a task. A supplementary analysis of studies in which some reward group participants did not attain expected and pursued performance-contingent rewards seem to provide further support for this suggestion as this type of reward contingency had a very negative effect on self-reported interest ($d = –0.70$). Figure 17 summarizes the findings.

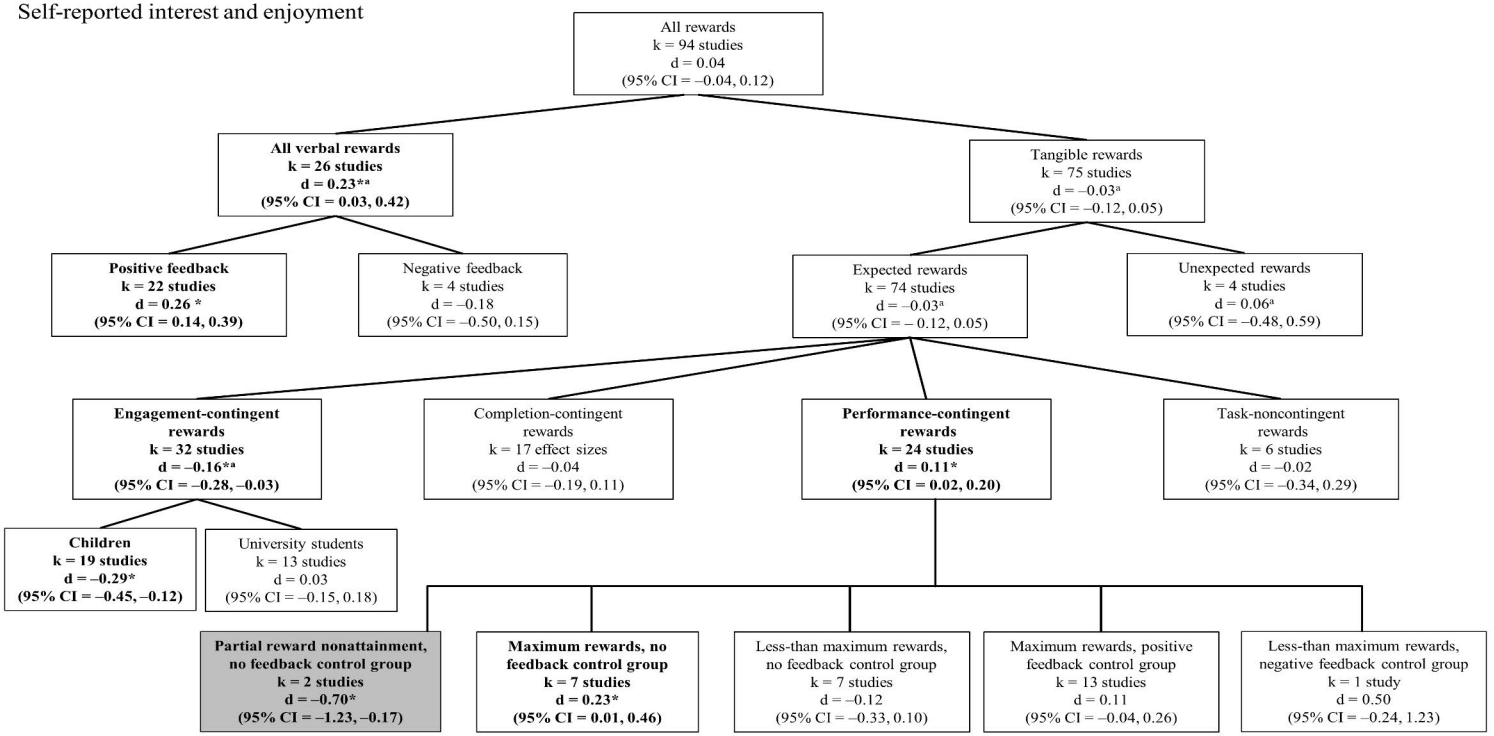

Figure 17 A summary of the composite effect sizes on the effects of extrinsic rewards on self-reported intrinsic motivation (reward groups vs. control groups). Reported composite effect sizes are standardized mean differences (Cohen's d). The 95% CI represents the confidence interval for each particular summary effect. Statistically significant composite effect sizes are highlighted with a superscript "*" and boldface text. The reward category "Partial reward nonattainment" was not included in the primary meta-analysis. If a composite effect is not homogeneous, a superscript "a" indicates this. The letter k denotes the number of studies included in the analysis (adapted from Deci et al., 1999a).

Overall, the meta-analytical results for free-choice intrinsic motivation and self-reported interest indicate that the attitudinal form of intrinsic motivation is somewhat less susceptible to the effects of extrinsic rewards than the behavioral form of intrinsic motivation (i.e., free-choice behavior), albeit the pattern of effects is similar in most cases. While the hierarchical meta-analysis of free-choice behavior showed significant undermining of intrinsic motivation by all rewards and almost all types of tangible reward contingencies (except for unexpected rewards and task-noncontingent rewards), the only statistically significant negative effects for self-reported interest were found for expected rewards and engagement-contingent rewards given to young subjects. Additionally, unlike the meta-analytical findings of free-choice behavior, performance-contingent rewards showed a statistically significant albeit small enhancement effect for self-reported interest compared to control groups who received no rewards. This stands in contrast to the findings of the free-choice analysis, which showed that performance-contingent rewards impair free-choice intrinsic motivation. The meta-analytical results for both dependent measures of intrinsic motivation are quite similar for positive feedback, negative feedback, task-noncontingent rewards, and unexpected rewards.

It is noteworthy that when examining the magnitudes of the composite effect sizes, extrinsic rewards have stronger effects on the free-choice behavior measure than the attitudinal measure of intrinsic motivation. An examination of the overall composite effect for all tangible rewards illustrates this quite well. While the effect is negative and statistically significant for free-choice behavior ($d = –0.39$), the effect is nonsignificant and almost nil for the self-reported interest measure ($d = –0.03$). Chapter 6 will discuss the reasons for this discrepancy.

In general, the present results lend support for the conclusion that extrinsic reward effects depend on the type of reward and its contingency. Additionally, it can be concluded that tangible contingent rewards tend to have a consistent detrimental effect on intrinsically motivated behaviors: The average magnitude of these effects varies between small ($d = –0.24$) and large ($d = –0.84$). Although the findings show a partial discrepancy between the measures of free-choice behavior and self-reported interest, more emphasis and confidence should be placed on the free-choice intrinsic motivation measure. The logic behind this argument stems from the fact that the free-choice measure is not typically affected by demand characteristics due to the unobtrusive way it is assessed; therefore, the free-choice measure of intrinsic motivation is regarded as a more valid measure of intrinsic motivation (Deci et al., 1999a).

5.3 Supplementary analyses

In addition to the preceding primary meta-analyses, two supplementary meta-analyses were conducted to examine some debated issues in the field of intrinsic motivation

research. The first issue relates to the longevity of the undermining effect. Although Deci et al. (1999a) examined this issue and found the effect durable, others (e.g., Cameron et al., 2001) are more skeptical. Therefore, a re-analysis of the data is necessary. The second issue concerns a suggestion that the undermining of intrinsic motivation by extrinsic rewards is merely a methodological artifact. Some authors have suggested that the act of reward withdrawal, not the extrinsic reward per se, is actually responsible for undermining intrinsic motivation (Carton & Nowicki, 1998; Shaw & Gupta, 2015). There is also a debate about to what extent the exact timing of reward administration might explain the findings. Because the previous meta-analytical studies have not addressed these issues, exploring these issues was deemed necessary. The results of these two supplementary analyses are presented next.

5.3.1 Duration of the undermining effect

As mentioned above, a debate exists regarding the durability/longevity of the undermining effect. Some intrinsic motivation scholars tend to suggest (at least implicitly) that this negative effect is or can be long-lasting (Deci et al., 1999a; Deci & Ryan, 1985; Lepper et al., 1973; S. Tang & Hall, 1995), while some behavioral-oriented scholars (e.g., Cameron et al., 2001; Carton & Nowicki, 1998; Dickinson, 1989; Goswami & Urminsky, 2017; W. E. Scott, 1976; Skaggs et al., 1992) have argued that the so-called "undermining effect" is only transitory and that intrinsic motivation will eventually return to its original level. Behaviorists have argued that if a negative effect occurs, it is evident only if the subsequent level of intrinsic motivation is measured immediately after rewards are withdrawn (Mawhinney et al., 1989; see also Goswami & Urminsky, 2017). For instance, Dickinson (1989, pp. 7, 12) has argued that a possible decline of intrinsic motivation in a post-reward situation is likely a result of a person being unable to meet set performance standards used as a basis for rewarding. According to Dickinson (1989, p. 12), a decrease in free-choice behavior is transient and will dissipate if task engagement is continued or will likely not occur at all if performance standards are met (see also Mawhinney, 1990).

Although the longevity of reward effects on intrinsic motivation is an important issue, somewhat surprisingly, it has not attracted much attention. Most of the reviewed studies assessed intrinsic motivation only immediately after the reward contingency had been withdrawn. In their meta-analysis, Deci et al. (1999a) examined whether the negative effect of expected tangible rewards on free-choice behavior was observable only immediately after the reward contingency was terminated or whether it persisted longer. Deci et al.'s (1999a) results demonstrated that the negative effect was evident even one week after the reward administration's termination. However, Cameron et al. (2001) have disputed this finding by arguing that of seven studies measuring free-choice intrinsic motivation more than once, the

undermining of intrinsic motivation by engagement-contingent rewards was statistically significant only in two studies at a later measurement point. Based on this, Cameron et al. (2001) concluded that the negative effect is transitory. Unfortunately, Cameron et al. (2001) did not perform a meta-analysis on these seven studies to examine whether the mean effect size would have remained statistically significant. Additionally, some caution might be in order when interpreting Cameron et al.'s (2001) conclusion because at least two of the reviewed studies (Chung, 1995; Loveland & Olley, 1979) had low sample sizes (five or six subjects per group, respectively) and thus had low statistical power to detect statistically significant effects (Shadish et al., 2002, pp. 45–46; Valentine, 2009, p. 139).

A supplementary analysis was conducted to shed light on this debate. Studies were classified into four categories that reflect different time points of assessment: 1) immediate measurement, 2) measurement done within 1 week, 3) measurement done 1 to 3 weeks after the experiment had ended, and 4) measurement done after 3 weeks. The analysis was limited to the free-choice measure of intrinsic motivation and studies using children as subjects. University students (and adults) were excluded from the analysis because, except for two studies by Wiechman and Gurland (2009) and Deci (1971, Exp. 1), all studies measured free-choice behavior immediately after the experimental phase in which rewards were offered for the reward group members.

Altogether, 53 studies were included in the analysis. Of the included effects sizes, 32 were measured immediately following the withdrawal of expected tangible rewards, 6 were measured within one week, 10 were measured between 1 to 3 weeks, and 5 measurements were done more than three weeks after the reward contingency had been terminated. The mean effect size for these studies was $d = –0.52$ (95% CI = –0.66, –0.38)[53]. First, it was examined whether this set of studies was homogeneous. The results of a heterogeneity test showed these effects were not homogeneous, $Q_w(52) = 144.23$, $p < 0.0001$, $I^2 = 64\%$. This finding suggests that the effect of expected rewards on free-choice intrinsic motivation may partly depend on the moment of measurement. Therefore, a moderator analysis was carried out using the moment of measurement as a moderator variable. However, the results did not support this hypothesis, $Q_b(3) = 5.12$, $p = 0.16$. Still, performing the analyses separately for each subgroup (i.e., each timepoint of intrinsic motivation measurement) was decided.

[53] Five studies were left out of the analysis because the moment of intrinsic motivation assessment remained unknown. As Chapter 4 explained, some effect sizes were extracted from meta-analyses by Deci et al. (1999a) and Cameron et al. (2001) because the full-text versions of some papers were unavailable. For these five excluded studies, the composite effect size was, $d = –0.96$ (95% CI = –1.38, –0.53), $Q_w(4) = 2.47$, $p = 0.65$, $I^2 = 0.00\%$.

First, an analysis was performed to examine the effect of immediate measurement on free-choice behavior. A total of 32 studies were included in this analysis. The results showed that when free-choice behavior was assessed immediately after reward withdrawal, extrinsic rewards had a significant negative effect on free-choice behavior, d = –0.49 (95% CI = –0.66, –0.33). However, this set of effects showed signs of heterogeneity, $Q_w(31) = 81.66$, $p < 0.0001$ $I^2 = 62.04\%$; thus possible outliers were searched for. Altogether, five studies (Boggiano et al., 1982; Danner & Lonky, 1981, Exp. 2; Fabes et al., 1988; Pittman et al., 1982, Exp. 1; Swann & Pittman, 1977, Exp. 2) were excluded to obtain homogeneity, $Q_w(26) = 36.20$, $p = 0.10$, $I^2 = 28.18\%$. The magnitude of the overall effect size for the remaining 27 studies was d = –0.45 (95% CI = –0.58, –0.31), showing that expected tangible rewards undermine intrinsic motivation right after the reward has been withdrawn.

The next phase of analysis examined whether the effect of expected tangible rewards was evident in studies that measured free-choice behavior within one week after the end of the experimental phase. For six studies using this type of delayed measurement, the summary effect size was negative but nonsignificant, d = –0.15 (95% CI = –0.38, 0.08). A test for heterogeneity showed these effects were homogeneous, $Q_w(5) = 4.43$, $p = 0.489$, $I^2 = 0.00\%$.

In the third category comprising ten studies, free-choice behavior was measured 1 to 3 weeks after the experimental phase. The results showed that rewards led to a statistically significant undermining of intrinsic motivation even 1 to 3 weeks after the reward contingency's termination, d = –0.78 (95% CI = –1.14, –0.41). Because this set of effects showed signs of heterogeneity, possible outliers were searched for, $Q_w(9) = 27.33$, $p = 0.001$, $I^2 = 67.07\%$. Experiment 1 by Morgan (1983) was excluded because the effect size (d = –1.94) in that study was much larger than in any other studies in this category. After excluding that study, the remaining nine studies became homogeneous, $Q_w(8) = 5.86$, $p = 0.66$, $I^2 = 0\%$. The results showed a statistically significant undermining of free-choice behavior by expected tangible rewards (d = –0.60, 95% CI = –0.82, –0.39) for the remaining nine studies.

The last category of studies contained only five studies (Loveland & Olley, 1979; Morgan, 1981, Exp. 2, 1983, Exp. 1; Ogilvie & Prior, 1982; Ross, 1975). This category measured free-choice intrinsic motivation over three weeks after the experimental phase. Precisely, Morgan (1983, Exp. 1) and Ross (1975) measured free-choice behavior about a month after the experimental phase ended, Morgan (1981; Exp. 2) conducted the measurement six weeks after the experimental phase, while Loveland and Olley (1979) and Ogilvie and Prior (1982) waited seven weeks or more before the final measurement of intrinsic motivation. The composite effect size for these five studies showed that the undermining effect is a persistent and observable phenomenon event after a long period of time, d = –0.55 (95% CI = –1.06, –0.05). A test for heterogeneity showed these effects were not homogeneous,

$Q_w(4) = 11.20$, p = 0.02, $I^2 = 64.27\%$. When the most extreme effect size was removed (Morgan, 1983, Exp. 1), the remaining four studies became homogeneous, $Q_w(3) = 2.70$ p = 0.44, $I^2 = 0\%$. For these four studies, the results showed a significant undermining of intrinsic motivation, albeit the composite effect became somewhat smaller ($d = –0.33$, 95% = –0.65, –0.004). Nonetheless, this result highlights that the negative effects of expected contingent rewards on intrinsic motivation can persist over a month.

In summary, these findings highlight that expected contingent rewards can have long-lasting detrimental effects on free-choice intrinsic motivation. Table 14 summarizes these findings. These findings align with Deci et al.'s (1999a) findings, who reported in their meta-analysis that the undermining effect was not merely a transitory phenomenon. Moreover, by providing a more detailed analysis of the durability of the reward effect on free-choice intrinsic motivation, the present study extends our understanding of this issue. These results run against the arguments of those researchers who argue that negative effects (if evident) are only temporary (Bates, 1979; Blocker & Edwards, 1982; Cameron et al., 2001; Carton & Nowicki, 1998; Dickinson, 1989; Eisenberger & Cameron, 1996; Goswami & Urminsky, 2017[54])

Table 14 Longevity of the effects of expected contingent (tangible) rewards on children's free-choice behavior after outliers were excluded from the analysis.

Time of assessment	*k*	Effect size *(d)*	95% CI
Immediate	27	–0.45	–0.58, –0.31
Within 1 week	6	–0.15	–0.38, 0.08
Between 1 to 3 weeks	9	–0.60	–0.82, –0.39
After 3 weeks	4	–0.33	–0.65, –0.004

Note.
All reported effect sizes are homogeneous.
k = number of studies after possible outliers have been excluded
d = Cohen's d
95% CI = 95% confidence interval
The table was adapted from Deci et al. (1999).

Although this meta-analysis shows that undermining intrinsic motivation by expected contingent rewards can last a long time, it must be pointed out that this

[54] Recently, Goswami and Urminsky (2017) reported a series of studies showing that completion-contingent rewards initially undermined intrinsic motivation for solving math problems but that this effect dissipated quickly. Because Goswami and Urminsky (2017) conducted these studies online using Amazon's Mturk platform, gave task-noncontingent rewards to the control group participants ($1.75 for participating in the experiment), required participants to engage in the experimental task or an alternative task during the post-reward phase, their results are not entirely comparable with studies included in the present meta-analysis.

finding can be generalized only to children. Because no studies using university students or adult participants were included in the analysis, the findings should not be generalized to these populations. University students and adults were excluded from the analysis because only two studies (Wiechman & Gurland, 2009; Deci, 1971, Exp. 1) utilized a delayed measurement of free-choice intrinsic motivation[55]. Future research would benefit from studying the undermining effect's longevity in these populations.

5.3.2 Impact of the reward withdrawal announcement and the timing of reward administration

Another debate relates to the question of whether announcing reward withdrawal might be responsible for the observed negative effects, not the extrinsic reward. Some scholars (Carton, 1996; Carton & Nowicki, 1998; Shaw & Gupta, 2015; Skaggs et al., 1992) have suggested that an observed negative effect is not caused by an extrinsic reward *per se* but by an explicit announcement that a reward will be withdrawn. For example, Carton and Nowicki (1998) postulate that discriminative stimulus (i.e., reward withdrawal) causes observed negative effects, while Shaw and Gupta (2015) hypothesize that reward withdrawal can act as a form of punishment (see also Ledford et al., 2013). Partly for this reason, Cameron and Pierce (2002, p. 170) deem that the undermining effect is not a relevant phenomenon outside the artificial setting of an experimental laboratory because reward withdrawal does not reflect reward practices that are used in everyday contexts.

Studies using expected contingent rewards were scanned for an explicit statement that the study participants were actually informed about the withdrawal of the reward contingency to examine this possibility. For example, the reward group subjects in Deci's (1971) Experiment 1 were explicitly told that they would not receive further rewards, clearly highlighting that the reward contingency was withdrawn. Likewise, Carton and Nowicki (1998, p. 72) stated, "Okay, that is it. There is no more money to be earned" to emphasize that previously given rewards were withdrawn. Thus, each study was classified based on whether it explicitly announced or mentioned that reward administration was discontinued. If the paper

[55] Wiechman and Gurland (2009) measured free-choice persistence right after the experimental phase. However, they employed more than one experimental phase; rewards were not given in that session after which the delayed free-choice persistence was measured. Deci (1971) used a three-session design. The experimental sessions were held on three different days. He gave rewards only during the second session. At the beginning of session 3, Deci (1971) informed the reward group subjects that no more rewards would be given. Of course, whether this constitutes a delayed measurement of intrinsic motivation is somewhat debatable.

did not explicitly state such a piece of information, then that study was assigned to the category "reward withdrawal not explicitly disclosed."

Furthermore, information was searched and coded whether a promised reward was given before or after assessing free-choice behavior. If the information was unavailable or unclearly stated, a study was assigned to the category "reward given after the free-choice period." This information was coded because giving a promised reward only after the free-choice period may have sustained feelings of reward expectancy that may (inadvertently) endure and motivate behavior during the free-choice period (cf. Ryan et al., 1991; Deci et al., 1999a, p. 655). On the other hand, some authors have suggested that negative feelings associated with a delay in reward administration might be the cause of the undermining effect (Carton, 1996; Reiss, 2005, 2013; Reiss & Sushinsky, 1975).

Coding these pieces of information enabled exploring the extent to which these (potentially confounding) factors might explain the interaction between extrinsic rewards and intrinsic motivation. As with the preceding analysis (see Chapter 5.3.1), this analysis was also restricted to free-choice intrinsic motivation and extrinsic rewards that were expected and contingent. A total of four different categories were formed based on the extracted information: whether a reward withdrawal was informed explicitly (yes vs. no) and whether the reward was given before the free-choice period (yes vs. no).

Altogether, 86 effect sizes[56] examining the effects of expected contingent rewards[57] on free-choice behavior were included in the analysis[58]. First, the overall effect showed a significant undermining of free-choice behavior by expected contingent rewards (d = –0.43, 95% CI = –0.56, –0.30) as expected; unsurprisingly these effects were heterogeneous, $Q_w(85) = 416.95$, $p < 0.0001$, $I^2 = 79.61\%$. Next, it was examined whether the effect of expected contingent rewards was moderated by the time of reward administration (before vs. after the free-choice period) and the announcement of reward withdrawal (explicitly informed vs. not stated). Based on the previously described classification, four categories emerged:

1. Reward withdrawal explicitly announced – reward given before the free-choice period.
2. Reward withdrawal explicitly announced – reward given after the free-choice period.

[56] An averaged effect size was calculated whenever a study included two or more reward groups and compared them to a single no-reward control group.

[57] The term "expected contingent rewards" refers to engagement-contingent rewards, completion-contingent rewards, and performance-contingent rewards.

[58] Seven studies (yielding 8 effect sizes) were excluded from the analysis because full-text versions of those studies were unavailable.

3. Reward withdrawal not explicitly announced – reward given before the free-choice period.
4. Reward withdrawal not explicitly announced – reward given after the free-choice period.

A subgroup analysis showed that the mean effect of expected contingent rewards on free-choice intrinsic motivation did not differ among these four categories, $Q_b(3) = 0.72$, $p = 0.87$. This finding suggests that the observed negative effect is not simply caused by the explicit announcement that rewards are no longer given, nor the timing of reward administration. Effects of expected contingent rewards on free-choice behavior for each category are presented in Table 15.

Table 15 The effect of the explicitness of reward withdrawal and timing of reward administration.

	k	Effect size *(d)*	95% CI
1. Explicit announcement of reward withdrawal + rewards given before the FC period	11	–0.28	–0.66, 0.11
2. Explicit announcement of reward withdrawal + rewards given after the FC period	6	–0.47	–0.97, 0.02 [a 59]
3. Implicit announcement of reward withdrawal + rewards given before the FC period	47	–0.44	–0.61, –0.26[a]
4. Implicit announcement of reward withdrawal + rewards given after the FC period	22	–0.47	–0.72, –0.21 [a]

Note.
k = number of effects
FC period = free-choice period
d = Cohen's d
95% CI = 95% confidence interval
[a] = The composite effect was heterogeneous

All composite effects displayed in Table 15 should be interpreted with caution. An analysis of heterogeneity for each subgroup showed that the composite effect sizes are heterogeneous in all but one subgroup. As the main analysis indicated, the effect of expected contingent rewards on free-choice behavior is somewhat moderated by reward contingency and the age group of the subjects. Nonetheless, the results described in Table 15 and section 5.3.1 seem to highlight that the undermining of intrinsic motivation by expected tangible contingent rewards is neither a temporary phenomenon nor solely caused by a methodological artifact such as an explicit announcement of reward withdrawal. The present results thus

[59] This set of studies was heterogeneous, $Q_w(5) = 42.82$, $p < 0.0001$, $I^2 = 88.32\%$. However, when a clear outlier (Parker et al., 2017) was excluded, the composite effect size became statistically significant ($d = –0.73$, 95% CI = –1.25, –0.22) but the set of studies remained heterogeneous, $Q_w(4) = 15.22$, $p = 0.004$, $I^2 = 73.72\%$.

challenge, for example, Carton and Nowicki's (1998) suggestion that the reward withdrawal procedure operates as a discriminative stimulus responsible for the undermining of intrinsic motivation.

Even though the above-presented supplemental analysis suggests that the negative effects of contingent rewards may occur even if the information about reward withdrawal is conveyed only indirectly or implicitly, prior research suggests that ensuring reward expectancy does not persist during the free-choice period is still necessary (Deci et al., 1999a, p. 655; Ryan & Deci, 2017, p. 126). A review of Carton and Nowicski's (1998) two experiments[60] clearly demonstrates the effect of persisting reward expectancy when no indication is given to subjects that rewards will not be forthcoming in the future. For those subjects who were led to believe that reward contingency was still in effect, a completion-contingent reward had a very strong positive effect on free-choice performance (d = 1.71, 95% CI = 1.21, 2.21; k = 2 experiments) in Carton and Nowicski's (1998) experiments. Conversely, the composite effect was negative when the reward termination was explicitly announced (d = –1.04, 95% CI = –1.49, –0.58; k = 2 experiments). When comparing the positive composite effect size of Carton and Nowicki's (1998) study to the largest positive effect size in the category of completion-contingent rewards (Turnage & Mushinsky, 1976, d = 0.88; see Table 10), it becomes clear that persisting reward expectancy can inflate the measure of free-choice persistence (see also Blom, 1983; Woolley & Fishbach, 2018)[61]. This finding is congruent with those remarks emphasizing the need to ensure reward expectancy or ego-involvement does not persist during the free-choice period because this can bias the results (Deci et al., 1999a; Ryan et al., 1991; Ryan & Deci, 2017, pp. 171–172; Vansteenkiste & Deci, 2003).

60 From Carton and Nowicki's (1998) study, only those reward group subjects were included in the main analysis who were explicitly informed that the reward contingency had been withdrawn.

61 The result of a recent study by Woolley and Fishbach (2018; Exp. 3) also seems to provide indirect support for the necessity to ensure reward expectancy does not persist. Woolley and Fishbach (2018, Exp. 3) conducted an online experiment using the MTurk platform and a puzzle task. When examining self-reported intrinsic motivation immediately after the experimental task and without announcing that no more monetary rewards would be forthcoming, Woolley and Fishbach (2018) found that immediately given engagement-contingent rewards enhanced self-reported interest compared to a no-bonus group. Although Woolley and Fishbach (2018) technically utilized a "no-reward control group" in their experiment, their experiment was excluded from the meta-analysis because all participants participated for monetary rewards. Blom's (1983) doctoral dissertation also indicates that reward expectancy may persist in the free-choice period when reward withdrawal is not informed.

These results (see Table 15) are interesting and provide evidence that the undermining effect is not merely a methodological artifact caused by the explicit announcement of reward withdrawal, the timing of reward administration, or potential aversive feelings or distracting stimuli associated with these two explanations (see Carton & Nowicki, 1998; Perry et al., 1977; Reiss, 2013). Nonetheless, these findings should be interpreted with caution. First, many studies failed to provide explicit information on the issue of reward withdrawal or the exact time of reward administration. These pieces of information may have been omitted simply because the authors could not disclose the information within given space limits. Thus, it is possible or even probable that some studies were misclassified into the wrong category. This means that some studies might have been classified into a group of "reward withdrawal not explicitly stated," although, in reality, subjects were explicitly informed about reward discontinuation. Likewise, it is likely that in some studies, a promised reward was given before the free-choice period, but the authors simply did not report this information in their paper. However, it is impossible to evaluate the degree to which these potential problems may have biased the effect size estimates presented in this supplemental meta-analysis. Nonetheless, these findings provide some support for a conclusion that the negative effects of contingent extrinsic rewards will most likely occur when one infers that the reward contingency has ended, whether another person (e.g., an experimenter) explicitly informs about the termination of the reward contingency or the information is inferred implicitly from available contextual cues (e.g., the experimenter states the experiment is over). Given the importance of this issue, future research is encouraged to give this issue attention.

5.4 Results for the meta-analysis of observational studies

As stated in Chapter 3, one goal of this study is to examine the effect of extrinsic rewards on intrinsic motivation in a more natural environment. Therefore, a meta-analysis of correlational and quasi-experimental studies conducted in work settings was performed. As mentioned in the method chapter, only studies done in the work domain were included in the analysis, thus excluding studies using hypothetical scenarios to examine the relationship between rewards and intrinsic work motivation. (e.g., vignette experiments). The term "observational meta-analysis" is used to differentiate this meta-analysis from the two meta-analyses based on controlled experimental studies.

Regarding this observational meta-analysis, the main interest is to explore the association between rewards and intrinsic work motivation in work settings among diverse samples of workers. A special interest is placed on examining the

relationship between performance-based rewards (PBRs) and intrinsic work motivation, as this reward contingency has been at the center of debate in recent years (see, e.g., Deci et al., 2017; Gerhart & Fang, 2014, 2015). Three distinct types of extrinsic rewards/reward contingencies were identified from the reviewed literature. Therefore, these three reward contingencies were included in the analysis: positive feedback, base salary (i.e., task-noncontingent rewards), and performance-based rewards (i.e., performance-contingent rewards)[62]. The analysis protocol was basically identical to the hierarchical approach the two meta-analyses of controlled experimental studies used. Therefore, the possibility of publication bias was assessed only at the level of a particular reward type or reward contingency.

5.4.1 All rewards

All studies were included in the first phase of analysis to examine the overall association between all rewards and intrinsic work motivation. Altogether, 42 samples from 35 published papers were included in the analysis (N = 73,740). At this global level of analysis, each study contributed only one effect size to the analysis. The result showed a nonsignificant association between all rewards and intrinsic work motivation (r = 0.07, 95% CI = –0.03, 0.17). This finding indicates that extrinsic rewards and intrinsic work motivation are uncorrelated at the global level of analysis. This set of studies was expectedly extremely heterogeneous, $Q_w(41) = 4370.60$, $p < 0.0001$, $I^2 = 99.06\%$. The 95% prediction interval for the correlations ranges from –0.53 to 0.62.

Two moderator analyses were conducted to explore the source of heterogeneity. Somewhat unexpectedly, these analyses showed that neither the type of reward (verbal vs. tangible) [$Q_b(1) = 0.55$, $p = 0.46$] nor the reward contingency did not moderate the effects, $Q_b(2) = 1.16$, $p = 0.56$. Nevertheless, it was decided to perform additional analyses using reward contingency as the moderator variable.

5.4.2 Self-reported positive feedback

Three studies were identified that examined the relationship between self-reported feedback and intrinsic work motivation. For these three studies, the analysis showed a significant positive composite correlation between self-reported positive feedback and intrinsic work motivation, r = 0.19 (95% CI = 0.11, 0.27; N = 690). This set of correlations was homogeneous, $Q_w(2) = 2.44$, $p = 0.30$, $I^2 = 17.87\%$. Although the

[62] In the case of one included study (Reychav & Sharkie, 2010), the specific reward contingency could not be identified. Therefore, this study was included only in the overall analyses of all rewards and tangible rewards.

pooled correlation coefficient shows that, on average, the relationship is positive, an analysis of the 95% prediction interval (–0.35, 0.64) shows that the true correlation between feedback and intrinsic work motivation varies quite significantly among comparable populations. A forest plot of studies can be seen in Figure 18.

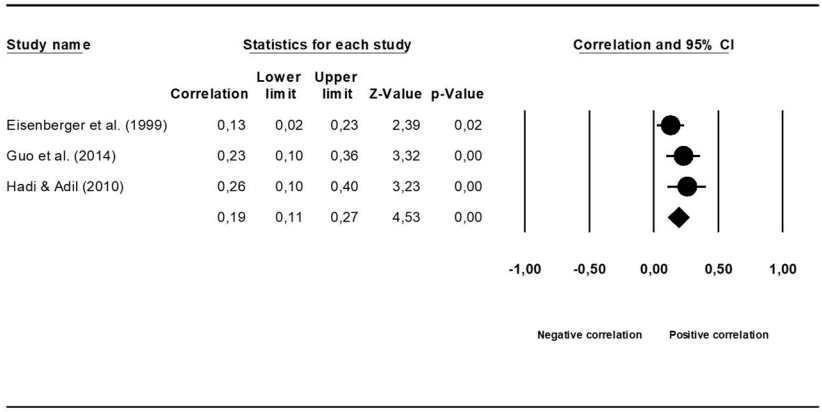

Figure 18 The forest plot for the correlation between self-reported positive feedback and self-reported intrinsic work motivation. The sample size of each study is depicted in the "Total" column.

Assessment of publication bias

The same methods were utilized as in the meta-analyses of experimental studies to assess the possibility of publication bias. A fail-safe N showed that 18 studies should be included in the analysis to reduce the mean correlation coefficient to statistically nonsignificant. The trim-and-fill method suggests that two studies might be missing from the left side of the mean effect. When these two potentially missing studies are imputed, the adjusted composite correlation coefficient becomes slightly smaller but remains statistically significant (r = 0.13, 95% CI = 0.03, 0.22). The funnel plot is presented in Figure 36 (see Appendix 5).

Albeit the composite correlation between intrinsic motivation and self-reported feedback suggests a beneficial relationship exists between these constructs, a small number of found and included studies (n = 3) means this finding should be interpreted with caution. For example, Borenstein (2019, p. 171) cautions that the results may be untrustworthy when a publication bias analysis contains fewer than ten studies.

Table 16 Summary of the results on the relationship between self-reported positive feedback and self-reported intrinsic work motivation and assessment of the potential impact of publication bias.

Positive feedback	*k*	*r*	95% CI	Fail-safe N	Number of imputed studies	Adjusted effect size (trim-and-fill)	Adjusted 95% CI
Self-reported intrinsic work motivation							
All studies	3	0.19	0.11, 0.27	18	2	0.13	0.03, 0.22

Note.
k = number of studies
r = the weighted summary correlation coefficient
CI = confidence interval
het = heterogeneous set of effects
hom = homogeneous set of effects
outliers excl. = possible outliers have been excluded from the analysis
– = no adjustment

5.4.3 Tangible rewards/incentives

Forty-one studies examined the relationship between tangible incentives[63] and intrinsic work motivation. The class of tangible incentives includes the following reward contingencies: base salary, performance-based rewards, and one contingency that could not be classified (see Reychav & Sharkie, 2010). For these 41 effects, the (weighted) mean correlation coefficient is positive but nonsignificant, $r = 0.064$ (95% CI = –0.037, 0.164; $N = 73{,}388$). The analysis showed that this set of effects was extremely heterogeneous, $Q_w(40) = 4361.64$, $p < 0.0001$, $I^2 = 99.08\%$. This heterogeneity is reflected clearly in the 95% prediction interval that ranges from –0.54 to 0.62. An inspection of the prediction interval suggests that the correlation varies significantly among different populations. The relationship can be quite negative or positive.

A moderator analysis was carried out to explore the source of heterogeneity. Reward contingency was used as a moderator variable. The results showed that the magnitude of effects was not significantly different for the correlations between base salary and intrinsic work motivation and performance-based rewards and intrinsic work motivation, $Q_b(1) = 0.60$, $p = 0.44$.

63 It should be noted that some included studies utilized reward measures that reflected both tangible rewards (e.g., money, promotion) and intangible verbal rewards (e.g., verbal compliments).

5.4.4 Base salary

Six studies examined the relationship between base salary (i.e., task-noncontingent rewards) and intrinsic work motivation. For these six studies, the mean correlation was positive and statistically significant (r = 0.16, 95% CI = 0.09 0.24; N = 2537) but heterogeneous, $Q_w(5)$ = 18.50, p = 0.002, I^2 = 72.97%. First, whether a study design (cross-sectional vs. longitudinal) moderated the effect was examined. However, this was not the case, $Q_b(1)$ = 0.14, p = 0.71. Next, possible outliers were searched for. After removing one study (Salamin, 2000), the set of effects became homogeneous, $Q_w(4)$ = 7.67, p = 0.105, I^2 = 47.84%. For the remaining five studies, the mean correlation showed a statistically significant positive relationship between base salary and intrinsic work motivation, r = 0.19 (95% CI = 0.13, 0.25; N = 2151). The 95% prediction interval for this relationship is 0.02 to 0.36. Overall, it can be concluded that, on average, a higher base salary is associated with higher self-reported intrinsic work motivation. Figure 19 shows a forest plot of all studies in the base salary–intrinsic work motivation analysis.

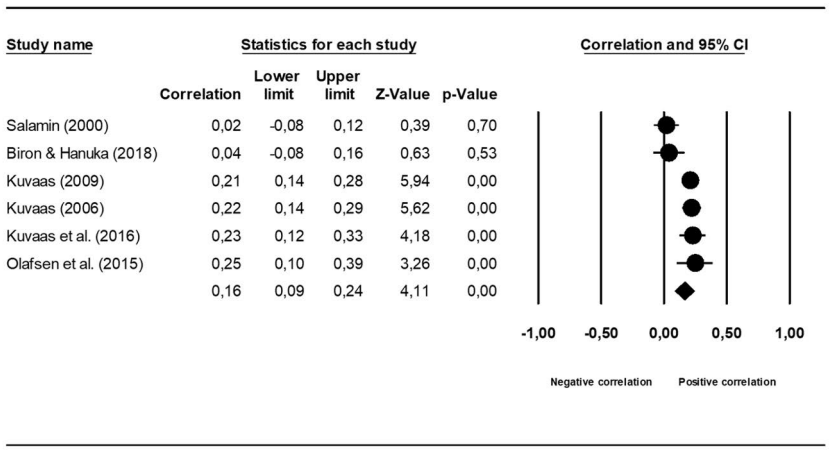

Figure 19 The forest plot for the correlation between base salary and self-reported intrinsic work motivation. The sample size of each study is depicted in the "Total" column.

Assessment of publication bias

An examination of publication bias was performed by examining the funnel plot and using Rosenthal's fail-safe N and Duval and Tweedie's (2000) trim-and-fill method (Borenstein et al., 2009). First, the funnel plot was fairly symmetrical, suggesting an absence of publication bias (see Figure 37, Appendix 5). Second, for the set of all

studies, the fail-safe N method showed that 99 missing studies with an effect size of 0.00 should be included before the results became statistically nonsignificant. For the homogeneous set of studies, the fail-safe N produced almost identical results, while the trim-and-fill method suggested that only one study might be missing from the left side of the mean effect. The corrected effect size estimate is almost identical ($r = 0.187$) to the original effect size estimate ($r = 0.195$). Based on these pieces of information, publication bias does not seem greatly concerning.

Table 17 Summary of the results on the association between base salary and self-reported intrinsic work motivation and assessment of the potential impact of publication bias.

Base salary	*k*	*r*	95% CI	Fail-safe N	Number of imputed studies	Adjusted effect size (trim-and-fill)	Adjusted 95% CI
Self-reported intrinsic work motivation							
All base salary studies (het)	6	0.16	0.09, 0.24	99	0	–	–
Base salary (outliers excl., hom)	5	0.19	0.13, 0.25	96	1	0.19	0.13, 0.24

Note.
k = number of studies
r = the weighted summary correlation coefficient
CI = confidence interval
het = heterogeneous set of effects
hom = homogeneous set of effects
outliers excl. = possible outliers have been excluded from the analysis
– = no adjustment

5.4.5 Performance-based reward

As the meta-analytical results of the controlled experimental studies indicated, performance-contingent rewards (henceforth performance-based rewards; PBRs) can undermine intrinsic motivation, but this detrimental effect seems somewhat dependent on the utilized measure of intrinsic motivation. Additionally, because the current meta-analytical findings presented in Chapter 5.1 and the previous meta-analyses (e.g., Deci et al., 1999a; S. Tang & Hall, 1995) are based on nonwork study subjects (i.e., children and university students), this has led some compensation scholars (Bartol & Locke, 2000; Eisenberger, Rhoades, et al., 1999; Gerhart & Fang, 2014, 2015; Rynes et al., 2005; see also Fay & Frese, 2000) to assert that these findings do not (necessarily) generalize to work settings.

Although Gerhart and Fang (2014, 2015, 2017), for example, acknowledge the potential motivational risks that performance-based rewards (PBRs) can produce in the work domain, they (at least implicitly) argue that the competence-enhancing aspect of these rewards is stronger than the controlling aspect. Gerhart and Fang (2014) believe the net motivational effect should be positive. This view somewhat contrasts with that of self-determination theory researchers (e.g., Deci et al., 1999a; Kuvaas et al., 2020; Ryan & Deci, 2017; Thibault Landry et al., 2019). Despite recognizing the complexities associated with PBRs' effects and the potential to enhance the feeling of competence, self-determination theory researchers generally tend to view that the controlling aspect of PBRs is often more salient, leading to intrinsic motivation's deterioration. Despite having great theoretical interest, importance, and practical relevance, extant research has not yet synthesized the results via a meta-analytical study that would have brought clarity to this issue. Thus, this doctoral thesis synthesizes the extant findings through a meta-analysis to clarify the debate on the effects of performance-based rewards (PBRs) on intrinsic work motivation.

Altogether, 29 published papers were included in the analysis. These published papers contained 36 independent samples (N = 72,863) and yielded 46 correlation coefficients. When a study reported multiple correlations, these correlations were collapsed into a single effect size estimate as generally suggested in the literature (Borenstein et al., 2009, pp. 217–223, 241) unless there was a theoretically relevant reason not to do this[64]. This resulted in a final set of 38 correlations. All studies

[64] In two cases (Kuvaas et al., 2016; Wilkesmann & Schmid, 2014), not aggregating reported correlations or aggregating only some of them was decided. Kuvaas et al. (2016) reported three correlations between performance-based rewards and intrinsic work motivation, two of which dealt with the relationship between one-time performance-based rewards (the amount of quarterly and annual performance-based rewards) and intrinsic work motivation, while the third dealt with a merit pay increase which is a permanent salary increase based on work performance (Milkovich & Wigdor, 1991, pp.

included in the analyses are presented in Table 18. Additionally, Figure 20 depicts a forest plot of all studies examining the relationship between performance-based rewards and self-reported intrinsic work motivation.

For these 38 correlation coefficients examining the association between performance-based rewards and self-reported intrinsic motivation, the results showed a nonsignificant mean correlation between these two variables, $r = 0.05$ (95% CI = –0.06, 0.16). As expected, these effects showed a high level of heterogeneity, meaning there is an extremely high variation in the effect sizes across studies, $Q_w(37) = 4269.52$, $p < 0.0001$, $I^2 = 99.13\%$. The 95% prediction interval ranges from –0.57 to 0.63, indicating that the true correlation coefficient varies substantially. For some populations, the correlation between performance-based rewards and intrinsic work motivation is highly negative but quite positive for others.

Due to the high level of heterogeneity, possible moderators were considered. First, it was examined whether the type of comparison group would moderate the effects. Each study was classified into one of two possible categories: 1) all study respondents were under a performance-based reward (PBR) plan, or 2) some study respondents were under a PBR plan while others received only a fixed salary (i.e., PBR vs. fixed). A test for heterogeneity demonstrated no statistically significant difference between these two categories, $Q_b(1) = 0.65$, $p = 0.42$[65].

Other possible moderator variables were also considered. For example, whether the type of reward measure might operate as a moderator variable was contemplated. All extracted effects were classified into two categories based on whether a particular performance-based reward measure was subjective or objective. However, this approach was discarded because this classification method produced a practically identical classification of studies as the previous moderator analysis. Because no other potential moderators were coded that would have encompassed all or most studies, it was decided to look for outliers. Seven studies were excluded as potential outliers to achieve homogeneity of effects (Cho & Perry, 2012; Fang & Gerhart, 2012; Jordan, 1986; Lopez, 1981; Ren et al., 2017; Thibault Landry, Forest, et al.,

9–10). As these represent different types of performance-contingent rewards (see Milkovich & Wigdor, 1991), combining correlations for annual and quarterly performance-contingent rewards into a single aggregated correlation coefficient while separately reporting a correlation coefficient for the relationship between merit pay increase and intrinsic work motivation was decided. Somewhat similarly, Wilkesmann & Schmid (2014) reported two separate correlations: one for performance-based pay (versus seniority-based salary scheme) and the other for merit pay. Like in the previous case, including two separate correlation coefficients was theoretically meaningful.

65 For 32 samples where all respondents were under a performance-based reward scheme, the mean correlation coefficient was $r = 0.069$ (95% CI = –0.05, 0.19). For six studies where respondents with a performance-based reward scheme was compared to fixed pay respondents, the mean correlation was $r = –0.06$ (95% CI = –0.32, 0.22).

2017, Study 1; Wenzel et al., 2019). Despite this action, homogeneity of effects was not achieved, $Q_w(30) = 76.45$, $p < 0.0001$, $I^2 = 60.76\%$. However, the mean correlation for the remaining 31 studies was statistically significant, indicating a weak positive correlation between performance-based rewards and intrinsic work motivation ($r = 0.05$, 95% CI = 0.02, 0.07). Since the summary correlation coefficient remained heterogeneous after excluding almost 20% of all studies as outliers, it was decided to continue analyses with the original sample of 38 effects.

Table 18 All studies included in the analysis of the correlation between performance-based rewards and self-reported intrinsic work motivation.

Study	Sample size	Correlation (*r*)	95% CI
Cho & Perry (2012)	57 712	0.44	0.43, 0.45
Daley (1987)	315	0.03	–0.08, 0.14
Deckop & Circa (2000)	62	–0.09	–0.33, 0.16
Eisenberger & Aselage (2009) Study 1	421	0.16	0.07, 0.25
Eisenberger & Aselage (2009) Study 2	180	0.21	0.07, 0.35
Eisenberger, Rhoades, & Cameron (1999) Study 3	338	0.20	0.10, 0.30
Fang & Gerhart (2012)	453	0.34	0.26, 0.42
Hartmann & Slapnicar (2012)	139	–0.19	–0.35, –0.03
Hewett & Leroy (2019) Study 3	150	0.07	–0.09, 0.23
Jordan (1986)	48	–0.55	–0.71, –0.34
Kominis & Emmanuel (2007)	218	0.08	–0.05, 0.21
Kuvaas (2006)	634	0.02	–0.06, 0.10
Kuvaas et al. (2016) Merit pay	322	0.14	0.03, 0.25
Kuvaas et al. (2016) PBR	322	–0.07	–0.14, 0.01
Kuvaas et al. (2020)	304	–0.01	–0.08, 0.07
Li et al. (2017)	196	0.12	–0.02, 0.26
Lopez (1981)	186	0.22	0.17, 0.28
Malik et al. (2015	275	0.12	0.00, 0.23
Malik et al. (2019)	220	0.06	–0.07, 0.19
Mallin & Pullins (2009)	275	0.16	0.04, 0.27
Ren et al. (2017)	222	0.31	0.19, 0.42
Salamin (2000)	386	–0.01	–0.11, 0.09
Thibault Landry, Gagné et al. (2017) Study 1	130	0.17	–0.00, 0.33
Thibault Landry, Gagné et al. (2017) Study 2	144	0.06	–0.10, 0.22
Thibault Landry, Gagné et al. (2017a) Study 3	142	0.08	–0.09, 0.22
Thibault Landry, Forest et al. (2017) Study 1	236	–0.21	–0.29, –0.12
Thibault Landry, Forest et al. (2017) Study 2	934	0.08	0.04, 0.13
Thibault Landry et al. (2019) Sample 1	417	–0.05	–0.11, 0.02
Thibault Landry et al. (2019) Sample 2	399	–0.04	–0.11, 0.03
Thibault Landry et al. (2019) Sample 3	336	–0.07	–0.14, 0.01
Van der Hauwaer & Bruggerman (2015)	189	0.12	–0.03, 0.25
Van Herpen et al. (2005)	460	0.00	–0.09, 0.09
Wenzel et al. (2019)	3666	–0.31	–0.34, –0.28
Wilkesmann & Schmid (2014) merit pay	2045	0.03	–0.02, 0.07
Wilkesmann & Schmid (2014) PBR	2045	0.05	0.01, 0.09
Yoon et al. (2015)	271	0.06	–0.14, 0.10
Zhang et al. (2015) Study 1	222	–0.01	–0.14, 0.12
Zhang et al. (2015) Study 2	216	0.07	–0.06, 0.20

Note.
r = Pearson correlation coefficient
CI = confidence interval

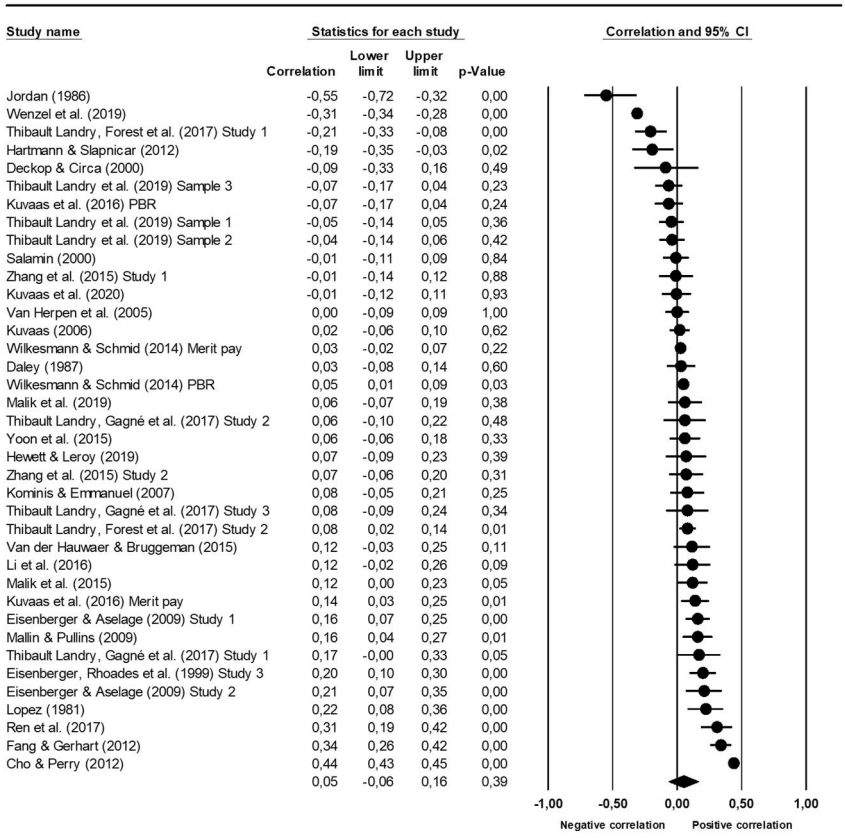

Figure 20 The forest plot for the correlation between performance-based rewards and self-reported intrinsic work motivation.

As all relevant study-level moderators were exhausted and the homogeneity of effects was not achieved, attention was shifted to examining the role of another possible moderator variable found in a subset of studies. This examined and theoretically derived moderator variable was *the functional significance of performance-based rewards* (Deci et al., 1999a; Deci & Ryan, 1985). To what extent the functional significance of performance-based rewards might affect the relationship between PBRs and intrinsic motivation was examined.

According to cognitive evaluation theory (Deci & Ryan, 1985; Ryan & Deci, 2017), extrinsic rewards can be interpreted two ways. First, when an extrinsic reward is experienced or interpreted as indicative of one's competence (i.e., given for successful completion of a task), such can enhance the sense of competence and mastery, and thus enhance intrinsic motivation. In this case, the reward is considered to have an informational functional significance or informational meaning. Conversely, CET states that when a reward arouses feelings of external pressure or is perceived to control one's behaviors, the psychological meaning or the reward's functional significance is controlling. CET specifies that this controlling aspect undermines autonomy need satisfaction, and consequently intrinsic motivation. Furthermore, in CET (Deci et al., 1999a, p. 628; Ryan & Deci, 2017, p. 133), it is specified that regarding performance-based rewards, the effect on intrinsic motivation can be positive or negative because PBRs can simultaneously provide competence feedback while pressuring people to perform better.

Of all 38 correlational effect sizes, five published papers (8 individual samples) yielding 13 correlation coefficients were included in this supplemental analysis. Eight bivariate correlations between the controlling aspect of PBRs and self-reported intrinsic work motivation and five correlations between the informational aspect of PBRs and self-reported intrinsic work motivation were extracted from these studies. Because five studies reported correlations between intrinsic work motivation and both aspects of PBRs, combined correlation coefficients were calculated and used in the analysis between intrinsic work and the functional significance of PBRs. This was done to avoid problems associated with treating each correlation coefficient as an independent sample, such as inflating sample size and biasing the precision of the composite effect (Borenstein et al., 2009, pp. 225–241). The weighted mean correlation between performance-based rewards and intrinsic motivation for these eight studies was nonsignificant (r = –0.11, 95% CI = –0.24, 0.03; N = 6354), but this set of effects was not homogeneous, $Q_w(7) = 230.80$, $p < 0.0001$, $I^2 = 96.97\%$. Figure 21 depicts a forest plot of this supplementary analysis. The 95% prediction interval is –0.53 to 0.36.

An analysis was carried out to examine the effects of excluding potential outliers. After removing two studies as outliers (Thibault Landry, Forest, et al., 2017, Study 2; Wenzel et al., 2019), the composite correlation remained heterogeneous, $Q_w(5) = 12.10$, $p = 0.033$, $I^2 = 58.68\%$. However, the summary effect became statistically significant (r = –0.10, 95% CI = –0.15, –0.04). This finding suggests the relationship between PBRs and intrinsic work motivation is negative when the controlling aspect of PBRs is more dominant than the informational aspect.

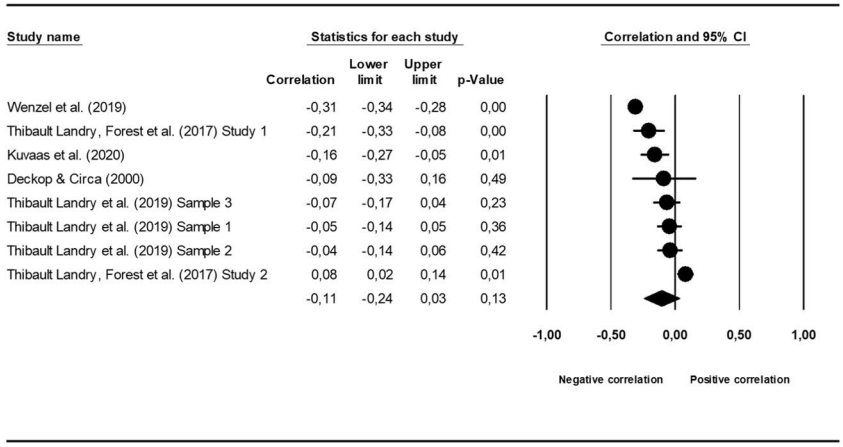

Figure 21 The forest plot of the correlation between the functional significance of performance-based rewards and self-reported intrinsic work motivation

A moderator analysis was also conducted using the specific functional significance of PBR (informational vs. controlling) as a moderator variable. In this analysis, all 13 correlation coefficients were treated as independent samples. When each reported correlation between intrinsic work motivation and controlling/informational meaning of PBRs were treated as an independent sample, the relationship showed a nonsignificant mean correlation, $r = –0.09$ (95% CI = –0.19, 0.02; $Q_w(12) = 254.21$, $p < 0.001$, $I^2 = 95.28\%$). The moderation analysis showed that these effects were not homogeneous, $Q_b(1) = 4.26$, $p = 0.039$. This finding implies that the mean effect of performance-based rewards on intrinsic work motivation significantly differs for controlling and informational performance-based rewards in observational studies.

For the eight effects concerning the relationship between the controlling meaning of performance-based rewards and intrinsic motivation, the analysis showed a statistically significant negative mean correlation of $r = –0.15$ (95% CI = –0.26, –0.04; N = 6534), but this composite correlation was heterogeneous, $Q_w(7) = 101.46$, $p < 0.0001$, $I^2 = 93.10\%$. Wenzel, Krause, and Vogel's (2019) study was excluded as an outlier because the 95% confidence intervals did not overlap with the 95% confidence intervals of the composite effect. However, this action did not remove heterogeneity, $Q_w(6) = 21.39$, $p = 0.002$, $I^2 = 71.95\%$. The mean correlation for the remaining seven effects was still negative and statistically significant, $r = –0.12$ (95% CI = –0.20, –0.05; 95% PI = –0.35, 0.11). Study 2 by Thibault Landry, Forest

et al. (2017) was also removed to achieve homogeneity, despite a marginal overlap of the 95% confidence intervals. This resulted in a homogeneous set of effects, $Q_w(5) = 6.28$, p = 0.28, $I^2 = 20.48\%$. The composite correlation coefficient for the remaining six effect sizes showed a statistically significant negative relationship between the controlling aspect of PBRs and intrinsic motivation ($r = –0.15$, 95% CI = –0.20, – 0.10; N = 1754). Based on these results, it can be concluded that when the controlling aspect of performance-based rewards increases, such is associated with lower self-reported intrinsic work motivation. Furthermore, assessing the 95% prediction interval suggests that although the true correlation coefficient varies a bit, it will likely be negative in 95% of all comparable populations (95% PI = – 0.26, – 0.03).

For the five studies examining the relationship between the informational functional significance of PBRs and intrinsic work motivation, the composite correlation coefficient was nonsignificant ($r = 0.02$, 95% CI = –0.07, 0.11; N = 2322). Due to the heterogeneity of the aforementioned set of effects, possible outliers were searched for, $Q_w(4) = 18.03$, p = 0.001, $I^2 = 77.81\%$. However, no clear outliers were identified. Overall, the results show no statistically significant relationship between the informational meaning of performance-based rewards and intrinsic work motivation. Based on the 95% prediction interval, the true correlation coefficient will likely fall between –0.29 and 0.33, meaning the relationship will be moderately negative in some populations and moderately positive in others.

It is necessary to point out that the results of these subgroup analyses should be interpreted with some caution because 10 out of 13 correlations were extracted from two published papers conducted by a single research group (Thibault Landry et al., 2019; Thibault Landry, Forest, et al., 2017). For analyzing informational PBR effects, all five correlations came from these two papers, while five out of eight used in the analysis of controlling PBR effects also came from these papers.

Overall, the results of the preceding supplementary analyses provide partial workplace support for CET's postulate (Ryan & Deci, 2017, pp. 130–133, 159) by showing that the effect of performance-contingent rewards on intrinsic work motivation depends on the psychological meaning or functional significance of the expected PBR. The mean correlation coefficient estimate between the functional significance of PBR and intrinsic work motivation was negative, albeit the statistical significance of this mean effect was somewhat dependent on the chosen method of analysis. The mean correlation was negative but nonsignificant when all eight studies were included. However, when two outliers were excluded, the mean correlation became statistically significant but remained heterogeneous.

Additionally, when all correlation coefficients were included in the analysis as independent studies, this more nuanced subgroup analysis demonstrated that the controlling aspect of performance-based rewards was negatively associated with

intrinsic work motivation. In contrast, the relationship between the informational aspect of PBRs and intrinsic work motivation was positive but nonsignificant. As these two aspects represent simultaneously operating and competing psychological processes (Deci et al., 1999a, p. 628), performance-based rewards can undermine the need for autonomy while enhancing experienced competence. The balance between these two competing psychological processes will largely determine how PBRs affect intrinsic motivation (Thibault Landry et al., 2019; see also Thibault Landry, Forest, et al., 2017). If these competing effects are equally strong, they can nullify each other's effect (Gagné & Forest, 2008), which can partly explain why the overall composite correlation for all 38 performance-based reward studies showed a nonsignificant and very heterogeneous relationship between performance-based rewards and intrinsic work motivation.

Summary of results. The results indicate the mean effect (i.e., correlation) of performance-based rewards on intrinsic work motivation is nonsignificant. Furthermore, the analysis shows that the correlation coefficients vary extensively between studies. This is also highlighted by the width of the prediction interval (95% PI = –0.57 to 0.63). This finding suggests that no consistent relation exists between performance-based rewards and intrinsic work motivation. Because the set of correlations was extremely heterogeneous, the reported mean correlation coefficient is not necessarily a very accurate indicator of the direction or magnitude of the true mean effect (Borenstein, 2019, p. 82). A discussion about potential reasons for the heterogeneity of effects is presented in Chapter 6.1.4.

Finally, the supplementary subgroup analysis suggests the relationship between performance-based rewards and intrinsic work motivation at least partially depends on the reward's psychological meaning. The results indicate that when performance-based rewards are experienced as controlling, they correlate significantly and negatively with intrinsic work motivation, while no association was found for the relation between intrinsic work motivation and the informational aspect of PBRs. A summary of all results is presented in Table 19.

Assessment of publication bias

As in the previous instances of publication bias assessment, the assessment was performed by examining the funnel plot and using Rosenthal's (1979) fail-safe N and Duval and Tweedie's (2000) trim-and-fill methods (Borenstein et al., 2009). Assessing the funnel plot shows that studies are mostly clustered in the upper region of the funnel. Based on the visual evaluation of the funnel plot alone (see Figure 38, Appendix 5), no decisive conclusions can be drawn. The trim-and-fill method suggests that ten studies are missing from the left side of the overall correlation when all 38 studies are included. However, including these studies would change the

composite correlation relatively little as the adjusted composite correlation estimate would be $r = –0.02$ (–0.18, 0.14). Furthermore, Rosenthal's fail-safe N suggests that over 4300 missing studies with a mean correlation of 0.00 should be included to nullify the observed composite correlation. Based on the preceding evaluation, publication bias seems not to pose a major threat to the presented findings. Table 19 summarizes the composite correlations and results of publication bias analyses.

Table 19 Summary of the results on the association between performance-based rewards and intrinsic work motivation and assessment of the potential impact of publication bias.

Performance-based rewards	*k*	*r*	95% CI	Fail-safe *N*	Number of imputed studies	Adjusted effect size (trim-and-fill)	Adjusted 95% CI
Self-reported intrinsic work motivation							
All PBR studies (het.)	38	0.05	–0.06, 0.15	4373	10	–0.02	–0.18, 0.14
Subgroup analyses							
PBR functional significance (separate correlations treated as independent samples) (het.)	13	–0.09	–0.19, 0.02	225	0	–	–
PBR functional significance (combined correlations) (het.)	8	–0.11	–0.24, 0.03	197	0	–	–
PBR functional significance (combined correlations) (outliers excl., het.)	6	–0.10	–0.15, –0.04	33	0	–	–
Controlling aspect of PBRs (het.)	8	–0.15	–0.26, –0.04	293	1	–0.18	–0.28, –0.08
Controlling aspect of PBRs (hom.)	6	–0.15	–0.20, –0.10	52	1	–0.15	–0.20, –0.10
Informational aspect of PBRs (het.)	5	0.02	–0.07, 0.11	0	2	0.07	–0.01, 0.15

Note.

k = number of studies

r = the weighted summary correlation coefficient

CI = confidence interval.

het. = heterogeneous set of effects

hom. = homogeneous set of effects

Separate correlations = Each reported correlation coefficient between the controlling aspect of PBRs and intrinsic work motivation and between the informational aspect of PBRs and intrinsic work motivation were included as independent samples whenever both were reported in the same study.

Combined correlations: A composite correlation coefficient was created and used in analyses when a study reported correlations between intrinsic work motivation and both types of PBR's functional significance.

– = no adjustment.

5.5 Summary of the meta-analytical findings of observational studies

The primary findings are summarized in Figure 22. Unlike the meta-analysis of free-choice intrinsic motivation, the meta-analysis of observational studies on the relationship between all extrinsic rewards and intrinsic work motivation shows no overall association between these two variables. Although no overall association was found, some interesting patterns emerged from the analyses of specific reward types and reward contingencies.

Self-reported positive feedback (r = 0.19, k = 3 studies) and base salary (i.e., a task-noncontingent rewards) (r = 0.19; k = 5 studies) correlated significantly and positively with self-reported intrinsic work motivation. In contrast, the mean correlation between performance-based rewards and intrinsic work motivation was positive (r = 0.05; k = 38 effects[66]) but statistically nonsignificant. Notably, the relationship between PBRs and intrinsic work motivation was extremely heterogeneous. The 95% prediction interval ranges from –0.57 to 0.63, indicating that the effect sizes vary substantially. No study-level moderator variables were found that would have explained this high level of heterogeneity, albeit some possible reasons are discussed in Chapter 6.1.4.

Interestingly, subgroup analysis examining the relationship between PBRs' functional significance and intrinsic work motivation showed that the controlling and informational aspects of PBRs operate simultaneously but in opposite directions. When performance-based rewards are experienced as controlling, the mean correlation is negative and statistically significant (r = –0.15; k = 6 studies). Instead, the relationship between the informational aspect of performance-based rewards and intrinsic work motivation was nonsignificant (r = 0.02; k = 5 studies). Overall, the results suggest that the controlling aspect (i.e., controlling functional significance) is stronger than the informational aspect, as postulated in cognitive evaluation theory (Ryan & Deci, 2017, p. 133). Although these subgroup analyses were based on a limited number of studies, they nonetheless lend support to cognitive evaluation theory's (Deci & Ryan, 1985; Ryan & Deci, 2017) postulate that a reward's effect on intrinsic motivation depends on the psychological meaning of the reward.

[66] From 36 studies.

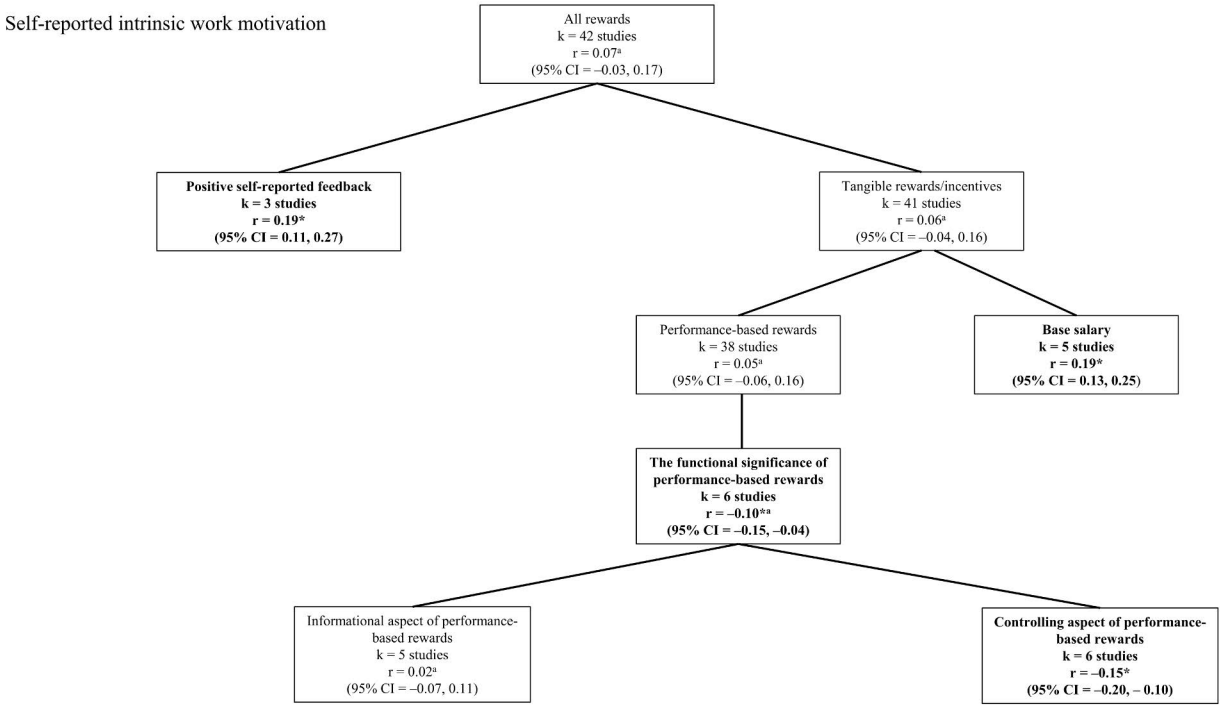

Figure 22 A summary of the results on the relationship between extrinsic rewards and self-reported intrinsic work motivation. Reported composite effect sizes are correlation coefficients. The 95% CI represents the confidence interval for each particular summary effect. Statistically significant composite correlations are highlighted with a superscript "*" and boldface text. If a composite correlation is not homogeneous, a superscript "a" indicates this. The letter k denotes the number of studies included. The analyses of the relationship between performance-based rewards' functional significance and intrinsic work motivation represent supplementary analyses.

6 Discussion and conclusions

6.1 Summary and general discussion

This doctoral thesis aimed to examine the effects of extrinsic rewards on intrinsic motivation separately in controlled experimental and natural work settings. Special interest was focused on resolving the old but still lively debate on the undermining of intrinsic motivation by extrinsic rewards that has plagued the field of inquiry for decades. Two main questions were formed to answer this overall goal:

1. Under what reward contingencies and populations will extrinsic rewards have a negative effect, no effect, or positive effect on intrinsic motivation in controlled laboratory experiments? What is the magnitude of the effect?
2. What is the association between extrinsic rewards and intrinsic motivation in organizational settings? How strong is this association?

Two different types of empirical data were utilized and meta-analytically synthesized to answer these questions. First, the meta-analysis of controlled experimental studies consisted of 142 empirical studies from 124 published peer-reviewed papers. From this pool of controlled experiments, two separate meta-analyses were conducted using the random-effects model: one examining the effects of extrinsic rewards on the free-time behavioral measure of intrinsic motivation (i.e., free-choice behavior) and the other examining the effects of rewards on the attitudinal measure of intrinsic motivation (i.e., self-reported interest/enjoyment). Second, using a data set of 42 observational studies from 35 published papers, this third meta-analysis examined the relationship between rewards and self-reported intrinsic work motivation in organizational settings.

By statistically synthesizing past primary studies, this meta-analytical review study aimed to reconcile the debate on the effects of extrinsic rewards on intrinsic motivation that has continued for almost five decades in the field of psychology (see, e.g., Cameron et al., 2001; Deci, 1971; Deci et al., 1999a; Eisenberger, Pierce, et al., 1999; Eisenberger & Cameron, 1996; Lepper et al., 1973, 1999; Reiss, 2013; Reiss & Sushinsky, 1975). A new meta-analysis was needed because the last direct meta-analyses were published at the turn of the millennium (see Deci et al., 1999a; Cameron et al., 2001), after which several new primary studies have been published.

Moreover, while Deci et al.'s (1999a) meta-analysis provided strong support for the deleterious effects of rewards on intrinsic motivation, Cameron et al.'s (2001) meta-analysis did not, thus fueling this long-lasting debate.

This persistent debate has also caught the attention of many organizational behavior scholars and compensation researchers (e.g., Bareket-Bojmel et al., 2017; Fang & Gerhart, 2012; Gerhart & Fang, 2014, 2015; Huffman & Bognanno, 2018; Kuvaas et al., 2016, 2020; Ledford et al., 2013; Thibault Landry, Gagné, et al., 2017). However, the lack of a comprehensive quantitative synthesis of the evidence drawing from organizational literature and reliance on evidence stemming from individual studies has caused conflicting opinions, somewhat wild claims (see, e.g., Ledford et al., 2013; Shaw & Gupta, 2015), and uncertainty about the potential negative or positive effects of extrinsic incentives on intrinsic work motivation in the work domain (see, e.g., Fang & Gerhart, 2012; Kuvaas et al., 2020). The present study fills this gap in the literature.

As this meta-analytical review separately synthesized research findings from randomized controlled laboratory experiments and observational studies conducted in work settings, this meta-analytical review provides a comprehensive understanding of the reward effects on intrinsic motivation in two different settings.

As mentioned, three primary meta-analyses were performed. Due to the inherent complexity of summarizing and discussing the findings of three separate meta-analyses simultaneously, the following discussion is separated into two sections. The first section summarizes the findings of controlled experimental studies (i.e., *free-choice meta-analysis and self-report meta-analysis)*, discusses the theoretical contributions of these particular meta-analyses, and highlights avenues for future research in the realm of experimental research. Similarly, a separate summary of findings and discussion are presented for the meta-analysis based on observational studies. Finally, significant theoretical differences between experimental research and nonexperimental (i.e., observational) organizational research on the interplay between extrinsic rewards and intrinsic motivation are highlighted and discussed. Furthermore, this thesis's main theoretical contributions, practical implications, and limitations are presented and discussed.

6.1.1 Controlled experimental laboratory studies

As mentioned above, the first goal of this study was to shed light on the long-lasting debate on rewards' effects on intrinsic motivation in controlled experimental conditions. Following previous meta-analyses, this study focused on two measures of intrinsic motivation: free-choice behavioral measure and self-reported interest.

First of all, the *free-choice meta-analysis* provides strong support for the overall deleterious effects of extrinsic rewards. The analysis indicated the overall effect of

extrinsic rewards on free-choice intrinsic motivation was indeed negative and statistically significant (d = –0.28, k = 104 studies). This finding essentially replicated Deci, Koestner, and Ryan's (1999a) finding. Although the overall negative effect informs us that, on average, all extrinsic rewards undermine an individual's persistence in intrinsically motivated behavior, it should be acknowledged that this overall effect is dependent on the specific mixture of studies included in the analysis. Therefore, concentrating on this overall effect is less meaningful; examining reward effects on intrinsic motivation at more specific levels of analysis is more significant from theoretical and practical perspectives.

Subsequent lower-level analyses demonstrated that when extrinsic rewards are given unexpectedly or are not tied to doing a particular task, intrinsic motivation remains unaffected compared to no-reward controls, while positive feedback tends to be beneficial for the maintenance of intrinsic motivation. In contrast, the effects of tangible and expected contingent rewards on *free-choice intrinsic motivation* show consistent statistically significant negative effects. Indeed, engagement-contingent rewards, completion-contingent rewards and performance-contingent rewards all significantly undermine free-choice intrinsic motivation compared with no-reward controls; the magnitude of effects varies from small (d = –0.24) to large (d = –0.84). However, some caution is needed when interpreting these findings because, in some cases, the composite effects were heterogeneous, and the homogeneity of effects was achieved only after excluding multiple outliers.[67] Despite this limitation, these findings are in line with Deci et al.'s (1999a) and Tang and Hall's (1995) findings. The current findings show that contingently given expected rewards typically deteriorate intrinsically motivated behaviors after rewards are withdrawn (i.e., no longer available), providing strong support for the undermining effect. Additionally, the findings support the general postulates of cognitive evaluation theory (Deci & Ryan, 1985).

[67] This concern relates to the overall effects of engagement-contingent rewards, completion-contingent rewards, and performance-contingent rewards. These reward contingencies showed statistically significant negative mean effects (d = –0.57, d = –0.36, and d = –0.23, respectively) on free-choice intrinsic motivation also when all relevant studies were included (i.e., before outliers were excluded). However, the reported mean effects were heterogeneous. Although the heterogeneity of the mean effects lessens the confidence we can place in the mean effects (see Borenstein, 2019; Cooper et al., 2009), the 95% prediction intervals can be used to examine the variability of effect sizes. The 95% prediction intervals for engagement-contingent (95% PI = –1.75 to 0.61), completion-contingent (95% PI = –1.31 to 0.58) and performance-contingent rewards (95% PI = –1.15 to 0.69) suggest that the effects vary significantly. Additionally, the prediction intervals show that the effects can be very negative in some populations.

At a more nuanced level of analysis, the results suggest that age may play a role in the intrinsic motivation–rewards relationship. The results indicate that positive feedback enhances only young adults' (i.e., university students) free-choice intrinsic motivation while leaving children's intrinsic motivation unaffected. In contrast, the findings suggest that expected rewards harm children's intrinsic motivation more than that of university students. These findings replicate the meta-analytical findings reported by Deci et al. (1999a). Deci et al. (1999a) speculated that children might interpret rewards more readily as a means of control due to less developed cognitive capabilities than older persons. Although this explanation seems quite plausible, a complementary/alternative explanation for the observed age effect could also account for these effects. A review of expected reward studies shows that studies using university students focused more on "informational rewards" (i.e., performance-contingent rewards). In contrast, studies using child samples focused more on examining the effects of controlling rewards (i.e., engagement-contingent and completion-contingent rewards). Because the effects of the latter rewards are typically stronger than the former's, this may partly explain the observed age differences (see Borenstein, 2019, p. 203). However, this explanation cannot explain why positive feedback affects younger persons' free-choice intrinsic motivation less strongly than older ones (for a review, see Henderlong & Lepper, 2002).

Concerning the *self-report meta-analysis,* the findings are a bit more equivocal and generally do not provide support for the undermining hypothesis. The analysis showed no overall effect on self-reported interest/enjoyment for all rewards. The only statistically significant effects were found for positive feedback (d = 0.26), performance-contingent rewards (d = 0.10), and engagement-contingent rewards (d = –0.16). In all other cases, the composite effects were nonsignificant, albeit the pattern of effects was mostly similar to the results of free-choice behavior. It is also necessary to elaborate further on the effects of engagement-contingent and performance-contingent rewards on self-reported interest. First, age moderated the mean effect of engagement-contingent rewards on self-reported interest (see Figure 17). This type of reward harms children's intrinsic interest (d = –0.29) while having a nonsignificant effect on university students' self-reported interest (d = 0.03). Second, a more detailed analysis suggests that the enhancement of self-reported interest by performance-contingent rewards is limited to a condition in which maximum rewards groups are compared with no-reward controls who did not receive any feedback (d = 0.23). All other comparisons showed nonsignificant composite effect sizes.

Overall, the present meta-analytical results of the experimental studies highlight the importance of considering the type of reward and especially the type of reward contingency—for what the rewards are given for—thus echoing findings of early experiments (Deci, 1971, 1972a, 1972b; Greene & Lepper, 1974; Lepper et al., 1973)

and more recent meta-analytical findings (Deci et al., 1999a; Tang & Hall, 1995). The present meta-analytical results provide quite robust evidence for the undermining of free-choice intrinsic motivation, especially by contingently given expected rewards, but the evidence is partially discrepant and somewhat weaker for the attitudinal form of intrinsic motivation. Based on the evidence, self-reported interest seems less affected by extrinsic rewards than free-choice persistence. Both meta-analyses also suggest that positive feedback is conducive to maintaining and enhancing intrinsic motivation while demonstrating that task-noncontingent rewards, unexpected rewards, or negative feedback do not significantly affect intrinsic motivation.

Interestingly and in line with previous research (Deci et al., 1999a), free-choice intrinsic motivation was undermined the most by a condition in which reward group subjects received non-maximum rewards while participants in control groups received no feedback (d = –0.84). The trend was similar for self-reported interest, albeit the composite effect was nonsignificant (d = –0.12). Also, supplementary analyses on the effects of performance-contingent rewards showed a relatively strong and significant undermining of both free-choice behavior (d = –0.66, k = 3) and self-reported interest (d = –0.70, k = 2) in a situation when some reward group participants failed to attain expected rewards. As a whole, these findings suggest this reward contingency tends to specifically undermine behaviorally measured intrinsic motivation in many situations.

As Deci and his colleagues (Deci et al., 1999a, 1999b; Deci, Koestner, et al., 2001; Deci, Ryan, et al., 2001; Ryan & Deci, 2017) have stated, less-than maximum rewards and a failure to attain pursued rewards represent perhaps the most ecologically valid types of performance-contingent rewards because not everyone will attain these rewards or received rewards are smaller than expected. This latter situation can occur, for example, if only a limited number of best-performing persons will receive the maximum rewards or simply because a person's task performance did not exceed a set performance standard. In real life, even good individual level (work) performance may be left unrewarded due to budgetary reasons or because organizational performance goals have not been met (Kallio & Kallio, 2014; Weibel et al., 2010).

In addition to the primary analyses, two supplementary meta-analyses provide interesting and theoretically relevant findings that help reconcile the heated debate and deepen our understanding of the undermining effect. The first supplementary analysis examined the undermining effect's longevity. The second examined to what extent the undermining of intrinsic motivation by extrinsic rewards might be caused by a methodological artifact related to the announcement of reward withdrawal and timing of reward administration.

The first supplementary meta-analysis showed that the negative effect of expected contingent rewards (i.e., engagement-, completion-, and performance-contingent) on free-choice behavior is quite long-lasting. Unlike some authors, who assert that the negative effect is limited to the immediate moment after the reward is withdrawn (Carton & Nowicki, 1998; Goswami & Urminsky, 2017; Mawhinney et al., 1989), the present meta-analytical findings do not concur with these suggestions.

Findings demonstrate quite clearly that the undermining of intrinsic motivation by expected contingent rewards is persistent and can be found over a month after a reward's withdrawal (see Table 14 in Chapter 5.3.1). In essence, this finding replicates and extends Deci et al.'s (1999a) finding. Considering that included experimental studies utilized predominantly one-time reward administration procedures, the negative effects of expected contingent rewards on free-choice intrinsic motivation can be viewed as quite persistent. However, it must be pointed out that these findings generalize only to child populations because the longevity of the reward effect on more mature subjects' free-choice intrinsic motivation has not been systematically examined (except for Deci, 1971 Exp. 1; Wiechman & Gurland, 2009).

Another interesting and theoretically relevant finding of this meta-analysis relates to a discussion of whether the announcement of reward withdrawal or the timing of reward administration might be responsible for the negative effects. For example, Carton and Nowicki (1998) have suggested that announcing reward withdrawal may act as a discriminative stimulus responsible for the observed negative effects. Somewhat similarly, Shaw and Gupta (2015) suggest that reward withdrawal may be perceived as a punishment. Moreover, some authors have suggested that negative feelings associated with a delay in reward administration might be the cause of the undermining effect (Carton, 1996; Reiss, 2005, 2013; Reiss & Sushinsky, 1975). This discussion carries significant theoretical relevance because it basically boils down to a question of whether the observed undermining of intrinsic motivation by extrinsic rewards is actually caused by the use of rewards or is it a result of a methodological artifact such as an announcement that rewards will not be forthcoming anymore (i.e., a confounding factor).

Based on the findings of the performed supplementary meta-analysis examining this issue, the negative effect is seemingly not caused by a confounding factor; the composite effect sizes were negative in each of the four categories and showed statistically significant effects in all but one[68]. This finding suggests that contingent, expected tangible rewards decrease free-choice behavior compared to no-reward controls regardless of whether the rewarded study participants were explicitly

[68] For details, see Chapter 5.3.2.

informed about reward withdrawal or whether the reward was given before or after the free-choice period. This finding is theoretically relevant because it contributes to our understanding of the phenomenon by tentatively showing that the undermining of intrinsic motivation is not simply a result of a methodological artifact. However, due to the limitations Chapter 5.3.2 described, these findings should be viewed only as tentative.

Overall, the meta-analytical findings of controlled experimental studies show that tangible extrinsic rewards tend to have a stronger (detrimental) influence on intrinsically motivated behaviors than self-reported intrinsic motivation. When rewarded groups are compared with no-reward controls, the meta-analytical findings show that extrinsic rewards are harmful to intrinsically motivated behaviors when attaining these rewards is contingent on task engagement, completion, or performance. In contrast, the composite effect sizes for these rewards are systematically weaker and mostly nonsignificant for the self-reported interest measure of intrinsic motivation. While completion-contingent rewards do not affect self-reported interest, engagement-contingent rewards undermine self-reported interest only for children, and performance-contingent rewards have a small positive effect compared with controls who do not receive equivalent positive feedback. Despite these differences, supplementary analyses show significant undermining of both free-choice behavior (d = –0.66) and self-reported interest (d = –0.70) by performance-contingent rewards when some reward group members fail to attain pursued rewards.

Furthermore, and aligning with previous research syntheses (Cameron et al., 2001; Deci et al., 1999a; S. Tang & Hall, 1995), the present meta-analytical findings reaffirm the unharmful effect of task-noncontingent and unexpected rewards on free-choice behavior or self-reported interest while showing the beneficial motivational effects of providing positive feedback. The results also demonstrate that negative feedback does not necessarily lead to deterioration of intrinsic motivation as sometimes assumed (e.g., Ryan & Deci, 2017, p. 156). However, as the results regarding negative feedback effects on free-choice behavior and self-reported interest are based on a very small number of included studies (k = 2 and k = 4, respectively) with wide prediction intervals, no general conclusions should be made.

When assessing the present meta-analytical findings stemming from controlled experimental studies and how they relate to the ongoing debate, the findings provide support for the detrimental effects of contingent extrinsic rewards, especially regarding the free-choice behavioral measure of intrinsic motivation and the findings of the previous meta-analytical studies by Deci et al. (1999a) and Tang and Hall (1995). The present meta-analytical findings thus align, for example, with Tang and Hall's (1995, p. 379) conclusion: "the overjustification effect has been consistently demonstrated in situations when it should be expected to occur." In general, this

thesis helps support the conclusion that contingent extrinsic rewards tend to undermine intrinsically motivated behaviors (i.e., free-choice behavior) while having less effect on self-reported interest and enjoyment. However, because the free-choice behavior measure of intrinsic motivation is considered a more valid measure of intrinsic motivation (Deci et al., 1999a; Ryan & Deci, 2017, p. 141)[69] due to the unobtrusive way it is assessed and because significantly fewer effect sizes were missing from the free-choice analysis than the self-report analysis, assigning more confidence on these results seems reasonable.

6.1.2 Potential avenues for future experimental research

Based on the results and issues highlighted in this thesis, several avenues for future research were identified: 1) performance-contingent rewards, 2) longevity of the reward effect in older populations, 3) discrepancies between the attitudinal and behavioral measures of intrinsic motivation, and 4) need for studies using adult subjects.

The first avenue for future research relates to furthering our understanding of the effects of performance-contingent rewards on intrinsic motivation. The results showed that performance-contingent rewards undermined free-choice intrinsic motivation when the reward was maximum, and the control group did not receive equivalent positive performance feedback ($d = –0.26$). The picture gets somewhat puzzling when trying to understand why the composite effect size ($d = –0.02$) was nonexistent for studies using positive feedback control groups. An analysis of studies using positive feedback controls indicates that this finding may be due to a confounding variable: positive performance feedback.

[69] The validity of the free-choice behavior measure of intrinsic motivation has also evoked some questions (Guay et al., 2000; Wicker, Brown, & Paredes, 1990). For instance, Wicker, Brown, and Parades (1990) have suggested that the free-choice behavior measure is sensitive to the attraction of alternative activities (e.g., magazines) in the experimental room. On the other hand, Guay et al. (2000) argue that the free-choice behavioral measure may be problematic if a situation simultaneously affects multiple dimensions of motivation. Guay et al. (2000) found that PCRs undermined not only free-choice behavior and self-reported intrinsic motivation but also identified regulation (i.e., autonomous extrinsic motivation). This finding suggests that free-choice behavior may measure different types of motivation depending on the situation (for a more detailed discussion, see Ryan et al., 1991). Vallerand (1997, p. 283) has also remarked that one problem of the free-choice behavior measure of intrinsic motivation relates to circular logic. The strength of underlying (intrinsic) motivation is inferred from the consequence (i.e., task persistence) that the underlying motivational state is argued to have initially caused (Bandura, 1977, p. 203; Vallerand, 1997, p. 283)

From early on, the literature on the undermining effect has recognized that performance-contingent rewards can convey positive competence information because the attainment of a performance-contingent reward is tied to good task performance (e.g., Boggiano & Ruble, 1979; Karniol & Ross, 1977; Ryan et al., 1983). In essence, attaining a performance-contingent reward provides positive competence information because the reward acts as a sign of excellent performance (Deci et al., 1999a), meaning performance-contingent rewards have an *inherent* competence-affirming component (Ryan & Deci, 2017, p. 133).

Analyzing performance-contingent reward studies in which comparable positive feedback was given to the control group subjects revealed that the reward group subjects almost always received two different types of competence affirming information: attainment of expected performance-contingent rewards and (typically) verbally given affirmation of good performance (i.e., positive feedback from an experimenter). For example, in Study 1 by Houlfort et al. (2002, p. 285), performance-contingent reward group subjects received positive feedback during the experimental phase (e.g., "You are doing really well) and after task completion ("You found at least six differences, this is an excellent level of performance"), as well as the promised reward of $5. In Marsden et al.'s (2015) more recent study, the performance-contingent reward group members were told they could earn up to $20 if their performance was good enough. Ultimately, all reward group subjects were informed they had performed well and, therefore, they had earned a bonus of $15. The subjects in the no-reward control group were simply told that they had performed well.

From a theoretical standpoint, this simultaneously and usually verbally given positive performance feedback can be seen as representing a potentially confounding variable, as this feedback distorts the results by obscuring the *individual effects* of these two different kinds of competence-affirming factors (i.e., reward attainment and verbally given positive performance feedback). When PCR group subjects receive both types of competence-enhancing information, differentiating the effect of *inherent* competence information conveyed by a PCR *per se* from the effect of verbally given positive feedback is impossible. In these studies, the PCR group received twice the amount of competence-affirming feedback compared to the control group, who received only verbally given positive feedback, meaning PCR groups received positive feedback from two sources while controls received it from a single source.

Preliminary support for the previous theoretical argument is provided by an analysis of maximum performance-contingent reward studies in which no-reward control groups did not receive performance feedback. As stated, this reward contingency undermined free-choice intrinsic motivation (d = –0.26). In these studies, performance-contingent rewards were typically administered without any

additional positive feedback. For instance, Enzle et al. (1991) gave a monetary reward ($3) in an envelope without additional verbal feedback. Likewise, Vansteenkiste and Deci (2003) simply informed reward recipients they had won the competition and would receive the promised reward of $3. In these studies, reward groups were compared with no-feedback control groups. This class of performance-contingent reward studies provides a better approximation of the inherent competence-affirming effect of performance-contingent rewards because, in no-feedback PCR studies, the reward effect is not confounded with the effect of additional positive feedback given by an experimenter.

Additional support for this theoretical point comes from two studies that seem to have empirically addressed this question, even if somewhat indirectly or implicitly. Vansteenkiste and Deci's (2003) study provides the first piece of evidence. As well as including a no-reward control group, Vansteenksiste and Deci (2003) had four reward conditions: 1) winning a competition-contingent reward, 2) losing a competition-contingent reward, 3) losing the aforementioned reward but receiving positive performance feedback that indicated to a subject that she or he had performed better than 70% of the earlier subjects, or 4) losing the reward but receiving positive feedback and a performance-contingent reward ($3) for attaining the set performance standard. The current object of interest is in the last two conditions. While the group receiving positive feedback and monetary rewards showed a very strong undermining of free-choice behavior ($d = –1.13$) compared to the no-reward control group, there was no difference between the no-reward control group and the group that lost the reward but received positive feedback ($d = –0.04$).

Boggiano and Ruble's (1979) study provides another partial piece of evidence. In that study, some performance-contingent reward subjects received positive feedback, while others in this group received either no feedback or feedback indicating relative incompetence. Boggiano and Ruble's (1979) results showed the hypothesized pattern. No difference in free-choice persistence existed between the positive-feedback control group and the performance-contingent reward group that also received positive performance feedback. In contrast, these two groups spent more time engaged in the experimental activity during the free-choice period than the performance-contingent reward group that did not receive feedback[70].

Based on the reviewed studies and theoretical analysis presented above, it is suggested that future research should try differentiating the effects of these two forms of competence information on the need for competence and intrinsic motivation. This differentiation could be done by incorporating the following

[70] It must be noted that Boggiano and Ruble's (1979) study showed this pattern only for the older elementary schoolchildren. For the preschool children, the results showed an opposite pattern for the two performance-contingent reward groups.

treatment conditions: 1) a performance-contingent reward condition with positive feedback, 2) a performance-contingent reward condition without feedback, 3) a positive feedback control group, and 4) a no-feedback control group. Through this experimental design, broadening our theoretical understanding of PCR's effects on intrinsic motivation might be possible by uncovering how much the disparity between the frequency or amount of received feedback could explain the results.

The second avenue for future research is related to the durability of reward effects. Although the present meta-analysis and Deci et al.'s (1999a) show that undermining intrinsic motivation by expected tangible rewards does not seem to be a temporary phenomenon, more research is needed to confirm this. Because all evidence comes from studies using children as subjects, it is necessary to examine whether the negative effects are long-lasting for older populations (e.g., university students, adults).

Despite not being included in the present analysis, some evidence related to the longevity of reward effects on intrinsic motivation in older populations exists. In fact, Pope and Harvey's (2015) randomized field study explored this issue by examining how monetary rewards for weekly gym attendance during the fall semester affected university students' self-reported enjoyment of exercising at the end of the spring semester. Pope and Harvey (2015) found no difference in self-reported enjoyment between reward and control group subjects. In contrast, Leuven, Oosterbeek, and van der Klauuw's randomized field study (2010) examined the effect of performance-contingent monetary rewards (vs. no rewards) on university students' academic performance. They found that a monetary reward had a long-lasting negative effect on low-ability students' academic performance; the effect persisted even three years after the reward contingency was withdrawn. Opposite results were found for high-ability students. Although Leuven et al. (2010) did not measure intrinsic motivation, they hypothesized that change in intrinsic motivation mediated the observed effects. Finally, via a survey, Moller and Sheldon (2020) examined whether interest in sports after university differed for those who had received a performance-contingent athletic scholarship during their studies and those who had not received a scholarship. The results showed that the receivers of such a scholarship experienced significantly less current enjoyment in playing their particular target sport, even many years after their university studies (d = –0.33). These few studies suggest that extrinsic rewards may have long-lasting effects on intrinsic motivation also in older populations. Therefore, future research would benefit from examining the longevity of the undermining effect in controlled experimental conditions using older samples of participants.

The third avenue for future research concerns examining the partial discrepancy of reward effects on behavioral and self-report measures of intrinsic motivation. From early on, some authors (e.g., Luyten & Lens, 1981; McLoyd, 1979; Pretty &

Seligman, 1984) have expressed doubts about whether the free-choice and self-report measures of intrinsic motivation measure the same phenomena. These doubts stem from somewhat modest and sometimes fluctuating correlations between these two measures. In some studies, the correlation between these variables has been negative (e.g., Luyten & Lens, 1981) or nonexistent (Wicker, Brown, Wiehe, et al., 1990), while others have reported moderately positive correlations between these measures of intrinsic motivation (e.g., Harackiewicz et al., 1984; Wiechman & Gurland, 2009). Deci et al. (1999a) examined this issue and reported that, based on 17 studies, the mean correlation between free-choice behavior and self-reported interest was positive and statistically significant ($r = 0.35$). However, they also remarked that the correlations varied extensively. A review of more recent evidence concurs with Deci et al.'s (1999a) observation. Based on an analysis of six studies,[71] free-choice behavior and self-reported interest showed a statistically significant positive relationship ($r = 0.24$, 95% CI = 0.15, 0.33), which was also homogeneous, $Q_w(5) = 4.13$, $p = 0.53$, $I^2 = 0\%$. It is notable that the mean correlation between these measures is somewhat modest; the reported correlations in these six studies vary between 0.07 and 0.38.

Moreover, as the present meta-analytical findings and the earlier ones (e.g., Deci et al., 1999a) have pointed out, the effect sizes tend to be stronger for free-choice behavior than for self-reported interest. Several reasons for this have been suggested. First, Deci et al. (1999a) point out the possibility that self-report measures of interest can be susceptible to demand characteristics. Unlike free-choice intrinsic motivation, which is measured covertly, the purpose of self-report measures can be quite clear to the subjects, which in turn can affect the responses they give (Ryan & Deci, 2017, p. 141). Second, Quattrone (1985) has suggested that a typical sequence of measuring an attitudinal response only after measuring a behavioral response first may change (weaken or erase) the internal attitudinal (motivational) state that would have been observed otherwise. It is also suggested that an individual's evaluation of their interest in a task can change even after the task engagement has ended; this change is partly driven by past experiences, other persons, and ego-related reasons (Thoman et al., 2017, pp. 35–37)[i].

Deci and colleagues (Deci et al., 1999a; Ryan & Deci, 2017, p. 141) have also hypothesized that an individual might erroneously interpret that enjoyment stemming from reward attainment represents the enjoyment of the task. Positive feelings related to reward attainment may cause an individual to project these

[71] Four of these studies were published articles included in the primary meta-analyses of this thesis (Cameron et al., 2005; Houlfort et al., 2002; Vansteenkiste & Deci, 2003; Wiechman & Gurland, 2009). Two studies came from an unpublished doctoral dissertation by Steiner (2011), included only in this analysis.

positive feelings with interest in the task at hand. In that case, the individual not only evaluates how interesting and enjoyable the task in itself is, but they also evaluate enjoyment that stems from reward attainment, causing misleading results regarding the effect of rewards on self-reported interest. Neuropsychological research (Ashby et al., 2002; Hidi, 2016) provides partial, albeit indirect, support for the explanation that self-report measures of intrinsic interest may sometimes be confounded with liking the reward. For example, Ashby, Valentin, and Turken (2002, p. 245) state that neuropsychological and neurobiological research on reward effects has shown that reception of (unexpected) rewards releases dopamine in the brain, which in turn can increase positive affect. Likewise, Reeve and Lee (2019) suggest that dopamine is associated with reward attainment. Because both dopamine (Di Domenico & Ryan, 2017) and positive affect (Isen & Reeve, 2005; Kruglanski et al., 2018) are also associated with intrinsic motivation, the proposed "liking hypothesis" (reward → dopamine → positive affect → task/reward liking) may have some merit.

However, to the author's best knowledge, extant research has not empirically tested Deci et al.'s (1999a) hypothesis. Future research could explore to what extent self-report measures of intrinsic motivation are prone to these sorts of biases. One possible way to assess to what extent self-reported interest is confounded with the enjoyment of reward attainment is to manipulate the size of promised rewards. By varying reward size among several experimental groups and measuring reward satisfaction, reward enjoyment, sense of autonomy, and positive affect, examining how strongly reward size correlates with these measures and the measures of self-reported interest and free-choice persistence might be possible. This might give us some clarification on this matter.

Investigating whether the self-report scales of intrinsic motivation contribute to partially discrepant findings between self-report measures and free-choice measures of intrinsic motivation might be worthwhile. Rummel and Feinberg (1988) stated in their meta-analysis that one weakness of the utilized self-report measures is that they are often based only on a very limited number of items. Although this issue plagued especially some early studies (e.g., Morgan, 1981; Sarafino, 1984, Study 2), also some newer ones (e.g., Houlfort et al., 2002, Exp. 2) have used only single-item scales to measure attitudinal intrinsic motivation. This causes concerns about the internal validity and reliability of these self-report measures (Deci et al., 1999a; Rummel & Feinberg, 1988).

Additionally, a review of the reviewed literature highlights that self-report measures have measured multiple dimensions of intrinsic motivation such as interest and enjoyment (e.g., Deci, 1971; Ryan et al., 1983), task satisfaction (Arnold, 1976; Staw et al., 1980), and liking of a task (e.g., Arkes, 1979; Hennessey, 1989; Morgan, 1983)—generally assumed to represent different dimensions of intrinsic motivation (Deci, 1992). However, to the author's best knowledge, research in the field of

extrinsic rewards and intrinsic motivation has not actively nor systematically tried to examine whether these different dimensions of intrinsic motivation are similarly affected by extrinsic rewards.

Likewise, the field has not systematically investigated whether these different dimensions of intrinsic motivation play an equal role in initiating, maintaining, or manifesting intrinsically motivated behaviors[72] and to what extent they all represent the same underlying unitary construct (see Hidi, 2000; Reeve, 1989). In fact, there is an ongoing discussion that the construct of interest—albeit interrelated and overlapping with the constructs of intrinsic motivation and enjoyment—should be treated as an independent psychological construct (O'Keefe & Harackiewicz, 2017, p. viii; Hidi, 2000, 2006).

Some answers to these questions stem from empirical examinations of intrinsic motivation. For example, Reeve (1989) distinguished enjoyment and interest as distinct dimensions of intrinsic motivation via two experiments. Reeve's (1989) results also suggest that enjoyment and interest are "driven" by different determinants: enjoyment is energized more by perceived performance, while interest is energized by experiences of novelty, change and complexity of the task. Recently, Davison (2018) suggested and empirically showed that the enjoyment dimension of intrinsic motivation can be further distinguished into five sub-dimensions. Davidson's (2018) finding seems to suggest that we must pay more attention to the dimensionality of self-reported intrinsic motivation. Furthermore, Davidson (2018, p. 58) speculated that interest and enjoyment may play a different roles in task engagement. While interest may operate as the initial spark motivating one to engage in a task in the first place, enjoyment may play a more vital role in sustaining task engagement (see also Reeve, 1989). Finally, early research by Daniel and Esser (1980) showed that extrinsic awards might affect different affective experiences of intrinsic motivation differently. Based on the above discussion, it is suggested that future research pay more attention to the self-report measurement of intrinsic motivation by examining and clarifying previously discussed issues.

The fourth and final avenue relates to the usage of adults as subjects. As the present meta-analytical findings are generalizable only to fairly young populations (children, university students), more research is needed among older populations. A lack of research using adult study participants (other than university students) has led some authors to essentially argue that these findings carry little relevance to organizational settings (Gerhart & Fang, 2014; Rynes et al., 2005; Shaw & Gupta, 2015). Only two studies included in the analyses used (young) adults as subjects (Albrecht et al., 2014; Marsden et al., 2015). In Marsden et al.'s (2015) study, the

[72] Deci (1987) has argued that affective experiences associated with doing an intrinsically motivated activity should not be considered as antecedents of intrinsic motivation.

mean age was 24.6 years, while in Albrecht et al.'s (2014), it was 24.16 years. Therefore, it is suggested that future research examine the undermining of intrinsic motivation by extrinsic rewards using more mature subjects.

6.1.3 Observational studies

The second goal of this thesis was to investigate the relationship between rewards and intrinsic motivation in organizational settings. Regarding the findings of the *observational meta-analysis*, the results showed a nonsignificant overall correlation between all extrinsic rewards and intrinsic work motivation ($r = 0.07$). More detailed analysis showed that self-reported positive feedback ($r = 0.19$, k = 3 studies) and base salary (i.e., task-noncontingent rewards) ($r = 0.19$; k = 5 studies) correlated significantly and positively with self-reported intrinsic work motivation, although the magnitudes of both mean correlations are somewhat moderate. Because the data was analyzed using the random-effects model and both composite correlation coefficients are based on a quite limited number of studies (3 and 5, respectively), too much emphasis should not be placed on the magnitude or precision of the effect size estimates (Borenstein, 2019, p. 131; Borenstein et al., 2009, pp. 363–364). Still, these identified relationships offer interesting information about and insight into the potentially beneficial relationship between intrinsic work motivation and these two types of extrinsic incentives.

The relationship between performance-based rewards (PBRs) and intrinsic work motivation is perhaps the most interesting type of relationship from theoretical and practical standpoints. The meta-analysis showed that the mean correlation between these variables was positive ($r = 0.05$; k = 38 effects) but nonsignificant. Furthermore, this set of studies was extremely heterogeneous, as indicated by a test for heterogeneity, an extremely high I^2 value of over 99% and a wide prediction interval (95%) that ranges from –0.57 to 0.63. This means that the effects vary substantially. According to Borenstein (2019), interpreting the 95% prediction interval in this situation is more useful than interpreting the mean effect. This high level of heterogeneity suggests that additional unidentified moderator variables may be responsible for the heterogeneity of effects (Lipsey & Wilson, 2001, pp. 162–163). Unfortunately, no study-level variables that would have moderated the composite correlation were found. This begs the question of whether the high degree of heterogeneity reflects too lax inclusion criteria or merely reflects the fact that the effects vary significantly due to the complexity of the phenomenon under study. Possible reasons for this heterogeneity will be discussed shortly.

Before discussing possible reasons for the heterogeneity, turning attention to the psychological meaning of performance-based rewards is necessary. Interestingly, subgroup analyses of reward's functional significance shed some light on the

relationship between PBRs and intrinsic work motivation. While a significant—albeit heterogeneous—negative composite correlation ($r = –0.15$; $k = 6$ studies) was found for the relationship between the controlling aspect of PBRs and intrinsic work motivation, the composite correlation was positive albeit nonsignificant ($r = 0.02$; $k = 5$ studies) for the relationship between the informational aspect of PBRs and intrinsic work motivation. These findings are important because they underscore the need to consider the interpretation that a recipient of a PBR gives to the reward (Ryan & Deci, 2017, p. 130; Thibault Landry et al., 2019, 2020; Thibault Landry, Gagné, et al., 2017) when examining how PBRs affect intrinsic motivation. Furthermore, the results showed that the overall association between PBRs functional significance and intrinsic motivation was negative, suggesting that, on average, the controlling aspect is stronger than the informational aspect ($r = –0.10$).

However, although the reason for carrying out these analyses was firmly grounded on theoretical postulates of SDT/CET, they were not explicitly hypothesized *a priori*. This partial post hoc nature of these analyses weakens the amount of confidence we can place in these results (Wood & Eagly, 2009, p. 462). Nonetheless, these findings provide (indirect) support for the theoretical postulates of cognitive evaluation theory (Deci & Ryan, 1985; Ryan & Deci, 2017) regarding the underlying psychological mechanism through which extrinsic rewards affect intrinsic motivation. Moreover, these findings support CET's (Deci & Ryan, 1985; Ryan & Deci, 2017) postulate that reward effects on intrinsic motivation depend on the psychological meaning of the reward. By showing these mechanisms work in opposite directions, the present meta-analytical findings underscore the (natural) variability of PBR effects and highlight why focusing more on examining the different psychological aspects of PBRs and not just the overall effect is necessary. Also, this finding seems to conflict with those views (e.g., Eisenberger, Pierce, et al., 1999; Eisenberger, Rhoades, et al., 1999; Gerhart & Fang, 2015) that emphasize the relative dominance of the competence-affirming (i.e., informational) aspect of PBRs over the controlling aspect in organizational settings.

Regarding the findings of the observational meta-analysis, the positive correlation between self-reported feedback and intrinsic work motivation was not surprising given that previous meta-analytical research (Cameron et al., 2001; Cameron & Pierce, 1994; Deci et al., 1999a; Eisenberger & Cameron, 1996; S. Tang & Hall, 1995) has established that positive feedback enhances intrinsic motivation in controlled laboratory settings. The finding that base salary correlates positively with intrinsic work motivation is intriguing because this finding suggests that paying higher base salaries may be a beneficial strategy for supporting intrinsic motivation at work. Although neither the present nor the past meta-analyses of controlled experimental studies have found evidence of an effect, this opens up an interesting avenue for future research. As suggested by Kuvaas and colleagues (2006; 2016; see

also Deci et al., 2017) high base salary may signal that the employer values the employee. A higher base salary may also serve as an indicator of expertise which in turn may enhance competence need satisfaction and, ultimately, intrinsic work motivation (Thibault Landry et al., 2016).

To summarize, the present observational meta-analysis found positive associations between positive feedback and intrinsic work motivation, and intrinsic work motivation and base salary. Conversely, performance-based rewards had a nonsignificant effect (i.e., correlation) on intrinsic work motivation. This finding suggests no consistent relationship exists between performance-based rewards and intrinsic work motivation, albeit the supplementary analysis suggests that the effect depends on the psychological meaning of expected PBRs. Because the main analysis of PBR effects showed that the set of correlations was extremely heterogeneous, potential reasons for this are discussed next.

6.1.4 Possible explanations for observed heterogeneity and potential avenues for future observational research

The results that the preceding section described showed that the direction and magnitude of the correlations between intrinsic work motivation and performance-based rewards vary extensively between studies. This section will discuss possible reasons for the observed heterogeneity of effects and suggest avenues for future research. Although the main focus of this section lies in discussing the relationship between incentives and intrinsic motivation, more general-level issues pertaining to observational studies as a whole will also be discussed. Three possible reasons for heterogeneity of effects between performance-based rewards and intrinsic work motivation were identified (issues 1–3). Additionally, two general-level issues were identified that need to be discussed (issues 4–5).

1. Socio-contextual factors and other competing extrinsic contingencies
2. Operationalization of performance-based rewards (measurement issues)
3. Reward magnitude and basis for reward allocation
4. Inadequacy of bivariate meta-analysis
5. Lack of randomized field experiments

6.1.4.1 Socio-contextual factors and other competing extrinsic contingencies

The first possible explanation for the nonsignificant correlation and heterogeneous effects relates to socio-contextual factors. As pointed out by previous empirical

research and theoretical work (e.g., Banko, 2007; Gagné & Forest, 2008; Harackiewicz & Sansone, 2000; Ryan et al., 1983; Ryan & Deci, 2017; Thibault Landry et al., 2020), the effects of performance-related rewards somewhat depend on or are moderated by the aspects of social context and how these rewards are used in organizations. For example, CET suggests that the style of reward administration (controlling vs. noncontrolling) partially affects whether a promised performance-based reward is experienced as more controlling or informational. Research has provided support for this postulate (Ryan et al., 1983; Thibault Landry et al., 2020). Harackiewicz and Sansone (2000, pp. 91–92) also emphasize the role of the context when trying to understand how performance-related rewards affect intrinsic motivation. Harackiewicz and Sansone (2000, pp. 91–92) postulate that the effect partially depends on the amount of external evaluative pressure present in a situation or context.

For instance, two recent laboratory experiments by Thibault Landry, Zhang, Papachristopoulos, and Forest (2020) showed that performance-related rewards given in an autonomy-supportive (vs. controlling) fashion led to higher psychological need satisfaction, lower psychological need thwarting, and enhanced self-reported intrinsic motivation and performance on an anagram task. Likewise, Banko (2007) provided some evidence that the effects of rewards are at least partially dependent on the context in which they are given. Banko (2007) found that rewards given in an autonomy-supportive environment enhanced intrinsic motivation. In contrast, when rewards were administered in a controlling environment, the rewards did not undermine intrinsic motivation when the effect was compared with a no-reward group exposed to a similar context (see also Ryan et al., 1983; Vansteenkiste & Deci, 2003). Gagné and Forest (2008) also acknowledge the importance of social context. In their model of compensation, Gagné and Forest (2008) suggest that the effect of performance-based rewards on intrinsic work motivation partially depends on the work climate. Aligning with the previous discussion, Mallin and Pullins (2009) showed that sales commission undermined intrinsic work motivation when managers used the incentive system controllingly. Based on the above-cited empirical findings and theoretical suggestions, future research should focus more on examining the role of contextual factors.

The second possible explanation and an avenue for future research is related to competing extrinsic contingencies that are embedded in work settings. Extant organizational behavior research on the subject has almost exclusively focused on examining only the effects of extrinsic rewards on intrinsic work motivation while ignoring the presence of other extrinsic incentives or motivators that affect intrinsic work motivation simultaneously. Empirical findings show that many types of extrinsic "motivators" such as deadlines (Reader & Dollinger, 1982), work pressure (Pelletier et al., 2002; Van Yperen et al., 2016), performance evaluation,

(Harackiewicz et al., 1987; Slijkhuis et al., 2013), competition (Deci et al., 1981; Reeve & Deci, 1996), performance management systems used as a means of control (Mouritzen & Opstrup, 2019, pp. 41–42, 151–160), and goal imposition (Mossholder, 1980) can undermine intrinsic motivation.

Thus, it can be argued that if a work context is laden with multiple controlling extrinsic contingencies that remain unmeasured or unidentified, it is possible that the reward effect (positive or negative) is suppressed and remains undetected. For example, Banko's (2007) study demonstrated that a reward did not undermine intrinsic motivation when the social context contained many controlling cues (e.g., explicit deadlines, performance evaluation). Likewise, a study by Vansteenkiste and Deci (2003) suggests that pressuring context alone is sufficient to undermine intrinsic motivation (see also Enzle et al., 1996).

When we look at the findings reviewed above, the evidence highlights a need to consider not only the characteristics of the pay (system) but also other socio-contextual factors when examining the effects of (performance-based) rewards on intrinsic motivation. It is suggested that the effects of performance-based rewards on intrinsic work motivation should be examined in tandem with other variables that might obscure, suppress, or alter the relationship between rewards and intrinsic work motivation. Incorporating measures such as performance evaluation, performance pressure, or how managers use rewards to motivate employees would allow us to get a more detailed and comprehensive understanding of the simultaneous (negative) effects of performance-based rewards and other extrinsic motivators on intrinsic work motivation.

A demonstration that a performance-based reward has a statistically significant and independent (detrimental or positive) effect on intrinsic work motivation while multiple potential confounding factors are controlled would provide more convincing evidence for the damaging or enhancing motivational effects of rewards at work. The lack of a strong evidence base has provoked, for example, Shaw and Gupta (2015, p. 285) to state that "the corrosive effects of financial incentives on intrinsic motivation in the workplace are mythical". They argue—albeit somewhat unfounded—that possible negative effects are related to defective design and implementation of reward systems and not rewards per se. Adopting the above-outlined approach to studying the effects of rewards and other extrinsic incentives on intrinsic work motivation would enhance the practical understanding of the phenomenon and the relevance of research.

6.1.4.2 Operationalization of performance-based reward measures

The second issue is related to the operationalization and measurement of performance-based rewards. Examining included studies revealed that multiple ways

have been used to operationalize and measure performance-based rewards. Utilized measures include—among others—objective or self-reported pay data (e.g., Kuvaas et al., 2016, 2020; Salamin, 2000), self-reported perception, or expectation that good work performance or a high level of effort leads to performance-based rewards (i.e., perceived instrumentality) (e.g., Eisenberger, Rhoades, et al., 1999; Eisenberger & Aselage, 2009; Thibault Landry, Gagné, et al., 2017), perceived strength of the work performance–reward linkage from a human resource manager's perspective (Fang & Gerhart, 2012), and the mere presence or absence of performance-related pay (e.g., Van der Hauwaert & Bruggeman, 2015; van Herpen et al., 2005; Wilkesmann & Schmid, 2014). This brief review illustrates that there is high variability in utilized measures, which may have caused some variability in effect sizes among individual studies and affected the meta-analytical results.

Recently, Kuvaas and his colleagues (2020) raised an interesting point concerning the validity of some self-report measures of performance-based rewards. Kuvaas et al. (2020, p. 526) suggest that scales measuring perceived instrumentality between pay and performance "may actually reflect favorable self-attributions such that the higher the pay level, the more pay will be attributed to [own] performance." Interestingly, Kuvaas et al. (2016) demonstrated that the perceived instrumentality of performance-based pay had very low correlations with actual (objective) reward amounts and extrinsic work motivation. While perceived instrumentality showed a weak positive correlation with the actual amount of annual performance-based rewards ($r = 0.16$, $p < 0.01$), it was not associated with the amount of quarterly administered performance-based rewards ($r = 0.10$, $p = n.s.$). Likewise, Gagné and Howard (2019) found no relationship between performance-based pay and perceived instrumentality, while St-Onge (2000) reported only a weak correlation between a perceived pay-for-performance link and the actual pay-for-performance performance link ($r = 0.12$, $p < 0.05$). Finally, Nordgren Selar et al. (2020) found that the pay system's perceived instrumentality correlated only quite weakly with the objective amount of performance-based salary rise ($r = 0.15$, $p < 0.01$). These findings raise the question of how well these measures reflect what they should reflect.

Another closely related but often dismissed issue in the literature concerns an implicit assumption that a mere linkage between work performance and rewards means an employee is willing (i.e., is motivated) to exert effort to acquire promised rewards. Thus, scales measuring only how explicit linkage exists between work performance and pay may provide imprecise information if one is not motivated to pursue promised rewards for some reason (e.g., rewards are not desirable). In such a situation, inferring that a positive (or a negative) relationship exists between a measure of performance-based rewards and intrinsic motivation would be erroneous. For example, Kuvaas et al.'s (2016) results seem to point in this direction. Although

the evidence reviewed above offers only a limited view on these issues, it highlights some potential issues and limitations that may occur when performance-based rewards are operationalized using self-report scales focusing solely on instrumentality perceptions.

Another measurement issue relates to the (construct) validity of utilized self-report scales. For example, studies by Malik et al. (2015, 2019) and Li et al. (2017) used performance-contingent reward measures that are somewhat ambiguous as they contained items reflecting not only tangible performance-based rewards (e.g., money and promotion) but also intangible rewards such as recognition (i.e., positive feedback). As highlighted by past research (Cameron et al., 2001; Cameron & Pierce, 1994; Deci et al., 1999a; Eisenberger & Cameron, 1996; S. Tang & Hall, 1995; see also Rigby & Ryan, 2018) and the current meta-analytical findings, positive feedback positively affects intrinsic motivation. Using scales consisting of items measuring conceptually different kinds of rewards (i.e., constructs) known to have different effects is, therefore, potentially problematic. This can distort the results and question the extent to which a particular measure actually reflects the construct it was intended to reflect (see Shadish et al., 2002, pp. 72–75). More emphasis should be placed on ensuring to scale validity. Future research should try separating the effects of positive feedback and tangible incentives from each other and examine how these variables independently explain changes in intrinsic work motivation. The issue discussed above is important because performance-based rewards are often given in tandem with positive performance feedback from one's supervisor, which may act as a confounding factor when examining the PBR–intrinsic work motivation relationship.

Similar criticism can be directed at some studies assessing rewards' informational and controlling aspects. As Ryan and Deci (2017, pp. 133, 159) note, how rewards are used affects how they are eventually experienced. Some of the self-report scales designed to measure rewards' psychological meaning seem to measure not only the functional significance of expected rewards but also how managers use these rewards to motivate employees (e.g., Thibault Landry et al., 2019; Thibault Landry, Forest, et al., 2017). Differentiating these two aspects would be beneficial because such would allow us to examine and differentiate to what extent observed variance in self-reported intrinsic motivation is explained by performance-based rewards *per se* and how much is caused by managerial behaviors (i.e., how extrinsic rewards are used) that represent a related but nonetheless distinct construct.[73] In fact,

[73] Nielsen, Boye, Holten, Jacobsen, and Andersen's (2019) recent study showed that transactional leadership behaviors (i.e., providing contingent rewards) at time 1 negatively correlated with intrinsic work motivation at time 1 ($r = –0.065$, $p < 0.05$) and also at time 2 ($r = –0.051$, $p < 0.05$).

CET (Ryan & Deci, 2017, p. 160) postulates that a person's experience of the interpersonal context can affect his or her intrinsic motivation directly and indirectly by changing the psychological meaning of a promised extrinsic reward. Based on the points raised above, it is suggested that future research should pay more attention to the operationalization and measurement of performance-based rewards.

6.1.4.3 The amount of promised reward and the basis for reward allocation

There are also two other issues that past research has not adequately addressed that would warrant further investigation. The first issue relates to the level of performance measurement used to determine reward allocation (individual, team, organizational); the second concerns the amount of promised, expected, or delivered rewards. These issues should be considered when examining the impact of monetary rewards on intrinsic work motivation.

As mentioned, the first issue concerns whether rewards are dependent on individual-, team-, or company-level performance. In the randomized experimental studies included in the present meta-analysis, performance-contingent rewards were solely based on individual-level performance. In contrast, in real-life work organizations, reward attainment can be dependent on multiple performance indicators that measure performance at different levels of operation. Performance can be measured and rewarded at the individual level (e.g., sales commission, merit pay), team level (team PBRs), or divisional and organizational level (profit sharing, stock plans, gain sharing) (Nyberg et al., 2018; Rynes et al., 2005). Combining these different performance measures and rewards into a single measure can be problematic because the literature suggests that collective rewards can be less effective in producing desired behavior and performance than individual-level rewards (Nyberg et al., 2018). This reduced incentive effect stems from the fact that an employee's ability to increase the probability of reward attainment decreases when the promised reward is based on collective rather than individual performance (Nyberg et al., 2018; see also Hakonen et al., 2011). Moreover, Gagné and Forest (2008) have suggested that group-based incentives such as gain sharing may be more conducive to satisfying the need for relatedness than individually based rewards. Indeed, Hakonen et al. (2011) found that one way the interviewed people perceived group-based incentives was as potential sources of recognition and respect. Hakonen and her colleagues (2011) hypothesized that these two aspects might satisfy the need for relatedness, facilitating intrinsic motivation.

Based on the preceding argumentation, it is possible that—on average—group-based rewards are not only less controlling (i.e., less motivating) but also provide less competence information than rewards that depend on individual-level

performance because the linkage between group-level performance and the expected reward is weaker. Thus, treating individually and collectively based rewards as a uniform type of performance-contingent rewards can be potentially problematic.

A review of included observational studies indicates that only two (Jordan, 1986; Kuvaas, 2006) explicitly evaluated the effect of collective/group rewards on intrinsic work motivation. In Kuvaas's (2006) study, some respondents received only collective rewards for good performance; for others, the reward was based on individual and collective level components. The result showed no relationship between a performance-related bonus and intrinsic work motivation. Conversely, in Jordan's (1986) quasi-experimental study, the expected performance-contingent reward was solely group-based. When employees under a group-based incentive plan were compared to employees receiving only fixed base pay, the results showed that the performance-based reward expectancy had a large, statistically significant negative effect on self-reported intrinsic work motivation ($d = -1.39$). Because only a few studies with mixed results have examined this issue, more studies are needed to establish how much the above-described issue may affect the results.

The second issue warranting further research is related to the amount of (performance-based) rewards and their possible relationship to intrinsic work motivation. The amount of expected or administered rewards was reported only in a small subset of all studies (Hewett & Leroy, 2019; Kuvaas, 2006; Kuvaas et al., 2016, 2020; Mallin & Pullins, 2009; Salamin, 2000; Thibault Landry, Gagné, et al., 2017). It is also noteworthy that some of these studies did not include this variable in statistical analyses, albeit describing the average reward amount (e.g., average salary).

Concerning this discussion, Milkovich and Wigdor (1991) raise an important point by remarking that the ability of rewards to energize behavior depends on whether employees value offered rewards. Research suggests the amount of performance-based reward should exceed a threshold of 5–10% (compared to base salary) to motivate behavior (Mitra et al., 1997, 2016; Heneman et al., 2000, p. 221). A recent study by Mitra et al. (2016) demonstrated that among a sample of Finnish university employees, a merit pay increase should be at a minimum of 8.4% to make employees willing to work even slightly harder than previously and between 11 and 13% to elicit more positive behavioral intentions. Hewett's (2014) doctoral dissertation also supports this idea. Hewett (2014) demonstrated that only when a bonus was sufficiently large (between 6.5 and 13.5%) did it elicit positive effects on extrinsic motivation. Smaller bonuses (less than a 6.5% increase compared to base salary) were not associated with extrinsic motivation, indicating a lack of incentive effect. Interestingly, Hewett's (2014) study showed that a merit pay increase between 2.9 and 12.9% was insufficient to enhance extrinsic motivation.

When reviewing included studies, it becomes clear that the magnitude of promised or given rewards tended to be below the critical threshold established by previous research. For example, in Hewett and Leroy's (2019) study, averagely performing employees received a mean performance bonus of 0.27% of base pay; very good performance earned a mean bonus of 5.62%. For those whose performance was outstanding, the average bonus was 8.98%. In Kuvaas' (2006) study, the mean ratio of performance-based pay to base salary was only 4.41%, while in Kuvaas et al.'s (2016) study, the mean quarterly and annual performance-based rewards were 2.32% and 7.87%, respectively. Although some exceptions exist (e.g., Mallin & Pullins, 2009), the average amount of performance-based rewards in reviewed studies was below the threshold described. As only four out of 32 correlational studies reported the ratio of performance-contingent reward to base pay, this extracted information could not be used as a potential moderator in the meta-analysis of correlational studies.

Preceding qualitative analysis suggests that the relatively small amount of promised rewards may provide one possible explanation for why the present meta-analysis of workplace (i.e., observational) studies did not find a significant (negative or positive) overall correlation between performance-contingent rewards and intrinsic work motivation. In fact, and as already discussed, self-determination theory (Ryan & Deci, 2017, p. 145) recognizes that small rewards may leave intrinsic motivation unaffected because these rewards lack the necessary power to motivate behavior; thus, small rewards' controlling and informational aspects can be quite nonexistent. Likewise, expectancy theory recognizes that small rewards may have little motivating effect because of their low instrumentality and valence (Gerhart & Rynes, 2003, p. 123). Based on the preceding discussion, it is suggested that future research should place more emphasis on investigating the effects of reward size and the basis of reward determination (individual vs. collective) on intrinsic work motivation, as they provide fruitful avenues for future research.

6.1.4.4 Inadequacy of bivariate meta-analysis

The next issue concerns the suitability of using a meta-analysis to synthesize complex literature. As mentioned, the primary meta-analysis of observational studies showed no statistically significant relationship between performance-based rewards and intrinsic work motivation. In contrast, the preceding discussion and upcoming review of selected studies highlight the inherent complexity of the phenomenon under study, raising questions about the adequacy and applicability of a meta-analytical method in this situation.

As already discussed in section 6.1.4.1, other competing extrinsic motivators may affect the rewards–intrinsic work motivation relationship. Thus, a meta-analysis

analyzing only the relationship between two variables may bias the results because bivariate meta-analysis does not allow statistically controlling the effects of other possible (confounding) factors nor consider possible interaction effects or suppressor variables.

A few selected studies are reviewed to illustrate this potential problem. First, Mallin and Pullins' (2009) study showed a statistically significant positive bivariate correlation between the amount of sales commission and intrinsic motivation (r = 0.16, $p < 0.01$), while their multivariate regression analysis showed that sales commission was not significantly associated with intrinsic motivation. Interestingly, their results demonstrated that when a sales control system was used in a controlling fashion, it moderated the relationship between the commission and intrinsic motivation so that the extrinsic incentive–intrinsic motivation relationship became negative (b = –0.13, p = 0.05). Likewise, Kuvaas et al. (2016) reported nonsignificant negative bivariate correlations for the annual performance pay–intrinsic work motivation and quarterly performance pay–intrinsic work motivation relationships. In contrast, when Kuvaas et al. (2016) analyzed their longitudinal data set using structural equation modeling, the results showed that annual performance-contingent reward had a statistically significant negative effect on intrinsic motivation (β = –0.12), while quarterly performance pay was still unassociated with intrinsic work motivation (β = –0.02).

Another example comes from Hewett and Leroy's (2019) recent study. Hewett and Leroy (2019) found that while the bivariate relationship between the amount of performance-based rewards and intrinsic work motivation was nonsignificant (r = 0.07), a multivariate analysis showed that when the reward magnitude was high and the manager's perceived discretionary power in reward administration/allocation was low, the performance-based reward significantly undermined intrinsic work motivation. The last example comes from a study by Li et al. (2017). Their study showed that while no statistically significant bivariate correlation between rewards for creative performance and creativity-related intrinsic work motivation (r = 0.12, *n.s.*) existed, a multivariate regression analysis demonstrated this relationship was moderated by challenge and threat appraisals. Li et al.'s (2017) results showed that depending on how the reward is perceived, it could have either a negative or positive relationship with intrinsic work motivation.

As the previous discussion underlines, a meta-analysis of bivariate correlations between rewards and intrinsic work motivation may not be sufficient to capture the complexity of the phenomenon under study. Although the previous discussion focused on the PBR–intrinsic work motivation relationship, a similar limitation concerns the found positive relationship between base salary and intrinsic motivation. Indeed, it is possible that a third variable (e.g., job characteristics) could explain this relationship. For example, Olafsen et al. (2015) reported a positive

bivariate relationship between base pay and intrinsic work motivation. However, this relationship disappeared when Olafsen et al. (2015) analyzed their data using structural equation modeling. Somewhat similarly, Nordgren Selar et al. (2020) found that the positive bivariate relationship between pay level and task performance was, in fact, explained by other variables such as job autonomy, feedback and demographic variables. Therefore, a future meta-analysis on this subject might consider using a model-based approach (e.g., path analysis or structural equation modeling) because this method would allow a meta-analyst to statistically control the effects of other variables (B. J. Becker, 2009; Hunter & Schmidt, 2004). This approach might produce a more comprehensive view of how different reward contingencies (e.g., performance-based rewards) are associated with intrinsic work motivation.

6.1.4.5 Lack of randomized field experiments

As well as the numerous issues already raised as potential agendas for future research, it is necessary to raise one final point. Based on the literature review, future research is encouraged to try conducting randomized field experiments when studying the undermining effect in organizational settings. Although randomized field experiments represent a more difficult and resource-intensive method than traditional survey methodology, randomized field experiments would enable examining and establishing causal relations between constructs (Eden, 2017).

It is somewhat striking that not even a single study included in the meta-analysis of observational studies used randomization or manipulated the independent variable. In fact, most studies used cross-sectional data and relied on self-report measures in data collection. This is clearly a limitation because studies using solely self-report measures are susceptible to a risk of common method bias (Podsakoff et al., 2003). Also, reliance on cross-sectional data impedes drawing conclusions of causal relations between variables (Spector, 2019). As Eden (2017, p. 94) notes, "[l]acking evidence for causality leaves major unfinished business. Practical applications of results without evidence of causality borders on malpractice." Because the debate between rewards and intrinsic motivation has always concerned the cause-and-effect relationship between these two constructs, such underlines a need for randomized field experiments in organizational settings.

6.2 Significant theoretical differences between experimental and observational studies as sources of confusion?

As highlighted throughout this chapter, some discrepancies exist between the findings of the experimental and observational meta-analyses. Although some potential reasons have already been discussed, there are significant theoretical differences between experimental and observational studies that the literature has rarely addressed: 1) the level of generality of intrinsic motivation assessment, 2) timing of intrinsic motivation assessment, 3) examination of the effects of attained rewards vs. expected rewards, and 4) a time lag between behavior and reward attainment. These substantial differences might give some clues why the reward effect on intrinsic motivation is stronger in experimental studies than in observational studies and act as agendas for future research.

6.2.1 Measurement of intrinsic motivation in experimental and observational studies—are studies measuring the same "construct"?

The current meta-analytical findings show some level of convergence between experimental and observational findings regarding the effects of rewards on self-reported intrinsic motivation. In contrast, the free-choice meta-analysis showed a somewhat different pattern of effects than the meta-analysis of observational studies for contingent rewards, indicating that attention should be given to this issue. Although only speculation, it is suggested that one potential reason for the discrepant results stems from the fact that experimental and observational studies assess intrinsic motivation at different levels of generality.

Hidi (2000, p. 326) has raised an interesting and important question concerning interpreting the reward effects on intrinsic motivation, namely the developmental stage of interest[74]. Hidi (2000) suggests that tasks typically used in experimental studies may represent or elicit so-called "situational interest." Situational interest represents a less-developed form of intrinsic motivation more susceptible to the influence of contextual factors (Hidi, 2000; Hidi & Renninger, 2006; Renninger & Stephanie Su, 2012). Intrinsic motivation is quite volatile at this stage because it requires support or "nutriments" from the environment to be sustained. Therefore, extrinsic contingencies may quite easily affect situational interest (Harackiewicz &

[74] Although Hidi and colleagues (Hidi, 2000; Hidi & Renninger, 2006; Renninger & Stephanie Su, 2012) use the term "interest" in their theoretical framework, I follow Harackiewicz and Knogler's (2017, p. 335) approach, which defines interest as a prototypical construct of intrinsic motivation.

Knolger, 2017, p. 336.) In contrast, Hidi (2000) has suggested that a more well-developed type of individual interest or intrinsic motivation may be less prone to the effects of extrinsic incentives because, at this stage, intrinsic motivation is characterized by a long-term and well-developed interest in that particular subject or activity. At this stage, intrinsic motivation is argued to be "a relatively enduring disposition" (Renninger & Stephanie Su, 2012, p. 170), and therefore it may be more stable and resilient to external influences (Harackiewicz & Knolger, 2017, p. 337).

Quite similar propositions can be found in Vallerand and Ratelle's (2002) hierarchical model of intrinsic and extrinsic motivation[75] that differentiates different levels of motivation. Vallerand and Ratelle (2002) have suggested that the effects of environmental factors (e.g., rewards) are somewhat dependent on the generality of intrinsic motivation. In their model, Vallerand and Ratelle (2002, p. 39) hypothesize that intrinsic motivation can manifest itself at three levels representing different levels of generality: the situational or state level, contextual level and global level. Situational intrinsic motivation is in question when a person is doing a specific activity at a specific time (e.g., solving a puzzle during an experiment). At the contextual (or domain-specific) level, intrinsic motivation is directed at or related to a broader class of activities (e.g., sports, work, education). This type of intrinsic motivation is considered a moderately stable form of intrinsic motivation. The last motivation level is the global level, which reflects a person's general motivational orientation toward all activities. This global level of motivation represents "relatively stable individual differences in one's motivational orientation toward the social world" (Ryan & Deci, 2002, p. 21).

Situational, contextual, and global intrinsic motivations can be differentiated further from each other based on the stability of these motivations and how susceptible they are to the influences of external contingencies. While situational motivation is quite unstable and thus easily affected by environmental factors, the stability of motivation increases, and vulnerability decreases while moving to more general forms of intrinsic motivation (i.e., contextual and global levels) (Vallerand & Ratelle, 2002). Like Hidi (2000), also Vallerand and Ratelle (2002) remark that situational motivation is typically assessed in experiments—which is the most unstable form of these three motivational levels and thus most prone to external influence.

Although these two frameworks use different terminologies to describe different levels or developmental stages of intrinsic motivation, they seem to share some commonalities. Integrating the core tenets of Hidi's (2000; Hidi & Renninger, 2006)

[75] Extrinsic motivation and amotivation are also included in Vallerand and Ratelle's (2002) model. For clarity, extrinsic motivation and amotivation will not be discussed further.

four-phase model of interest development and Vallerand and Ratelle's (2002) hierarchical model of motivation seem to suggest that situational intrinsic motivation is more easily affected by extrinsic contingencies (e.g., rewards and pressures) than more developed and less task-specific types of intrinsic motivations.

Analyzing the current meta-analytical findings using the preceding integrated theoretical framework as a theoretical lens can be seen as providing a potential explanation for the divergent results of the experimental and observational meta-analyses. As already noted by Hidi (2000) and Vallerand and Reid (2002), experimental laboratory studies typically use tasks that tap into the situational type of intrinsic motivation. This view is further reinforced when examining the wording of items typically used to measure self-reported interest and enjoyment. Quite often, the items measured interest in or enjoyment of the experimental task. For example, Houlfort et al. (2002, p. 287) asked the subjects to rate to what extent they found searching for the differences (i.e., doing the experimental task) interesting, while Harackiewicz (1979, p. 1357) asked, "How much did you enjoy the puzzle?" Likewise, in his seminal study, Deci (1971) asked the subjects to rate how interesting and enjoyable the experimental task (i.e., solving Soma puzzles) was. Conversely, when reviewing studies conducted in work contexts, it becomes clear that these studies have measured intrinsic work motivation at the contextual/domain level. Some exemplary items are "my job is so interesting that it is a motivation in itself" (Kuvaas et al., 2016, p. 672), "my job is enjoyable" (Eisenberger & Aselage, 2009, p. 100), and "doing my job, I feel a great personal satisfaction" (Wenzel et al., 2019, p. 248).

The integrated theoretical framework seems to suggest a conclusion that a lack of (overall) undermining or enhancement of intrinsic work motivation by extrinsic rewards might be partly explained in that contextual (or well-developed) intrinsic motivation is less susceptible to these effects. Future research could examine whether rewards' effects depend on the generality of intrinsic motivation being assessed. Especially assessing reward effects on task-specific intrinsic work motivation in work settings would allow us to acquire a more accurate and profound understanding of reward effects on intrinsic motivation in organizational settings. Likewise, examining the relationship between more enduring or well-developed domain-specific types of intrinsic motivation and extrinsic rewards in experimental settings would also advance our understanding of the phenomenon.

Regrettably, prior research has paid little attention to this issue. Although a few experimental studies have examined this issue—at least indirectly—findings are unequivocal. Pritchard et al. (1977) examined the effect of a performance-contingent reward on university students' intrinsic motivation using a chess problem task. The study participants had varying degrees of experience playing chess and were consequently allocated to three groups based on reported experience level (low,

moderate, high). Pritchard et al. (1977) reported a substantial and statistically significant undermining of free-choice behavior (d = –0.96) but only a marginally significant undermining of self-reported interest (d = –0.76, p <0.06) when intrinsic motivation was assessed a week later. If an assumption is made that moderate and high amounts of previous experience in chess can be equated with a more developed form of intrinsic motivation (cf. Hidi, 2000, pp. 327–328), Pritchard et al.'s (1977) findings seemingly suggest that rewards can undermine even more developed forms of intrinsic motivation. A more recent study by Marinak and Gambrell (2008) studied how engagement-contingent rewards affected children's intrinsic motivation for reading. Drawing on Hidi and colleagues' (Hidi, 2000; Hidi & Renninger, 2006; Renninger, 2000) and Vallerand and Ratelle's (2002) frameworks, assuming that intrinsic motivation to read represents a more developed form of intrinsic motivation (at least to some degree) seems reasonable. Marinak and Gambrell (2008) found that given task-incongruent rewards had a large negative effect on children's free-choice persistence (d = –0.83).

In contrast, Arnold (1976, 1985) reported that completion-contingent rewards or engagement-contingent rewards did not affect voluntary subjects' (university students) self-reported intrinsic interest in a computer game when the initial intrinsic motivation for the task was high. As only voluntary persons interested in computer games participated in the experiment, Hidi (2000, p. 327) interprets that the participants in Arnold's (1976, 1985) studies displayed a more developed form of intrinsic motivation and interest in the experimental task.

Because only a limited amount of experimental research exists on this issue in the reviewed extrinsic rewards–intrinsic motivation literature, further research is needed to examine the validity of this hypothesis. However, a recent nonexperimental study by Moller and Sheldon (2020) sheds some light on this issue. Moller and Sheldon's (2020) study showed that performance-contingent rewards could undermine well-developed intrinsic motivation for sports, thus challenging Hidi's (2000) hypothesis that more well-developed interest is less prone to the effects of extrinsic incentives. Given the importance of this issue (i.e., whether well-developed intrinsic motivation is less susceptible to the effects of extrinsic rewards or not), further examination of this hypothesis offers theoretically interesting and fruitful avenue for future research[76].

[76] Theoretical (Vallerand, 1997) and empirical (Lavigne & Vallerand, 2010) research on situational and contextual motivation suggest their relationship is bidirectional. Furthermore, a recent qualitative study of medical professionals by van der Burgt et al. (2020) suggests that extrinsic factors can affect contextual motivation negatively via situational motivation. However, Burgt et al.'s (2020) findings suggest that extrinsic factors must be recurring and persistent for the changes occurring at the level of

6.2.2 Timing of intrinsic motivation assessment, reward expectancy and time lag

The final significant differences between experimental and observational studies are related to the timing when intrinsic motivation is assessed, whether rewards are actually administered/attained or only expected, and the time lag between task performance and reward attainment. These issues highlight notable differences between these fields that are important to understand when interpreting the findings.

The first issue is related to the moment when intrinsic motivation is assessed. In experimental studies, behavioral and self-reported intrinsic motivation are assessed after the reward's withdrawal. Conversely, in organizational settings, the reward contingency is normally still in place when respondents are asked to assess how intrinsically motivated they are for their jobs (cf. Bruno, 2013; Hendijani & Steel, 2020). Recognizing this difference is important. First, evaluating intrinsic motivation when the extrinsic reward contingency is still in place reflects a mixture of intrinsic and extrinsic motivation (Deci et al., 1999a). This can be seen, for example, in Margol and Mynatt's (1986) experimental study, as they measured self-reported interest during the baseline and the experimental/reward phases. Their study showed that while the no-reward control group's self-reported interest remained quite stable from the baseline to the experimental phase, for the reward group, Margol and Mynatt's (1986) study showed significant inflation of the intrinsic interest ratings. Although this is just an isolated example, it nonetheless highlights the potentially problematic nature of assessing intrinsic motivation when also extrinsic rewards motivate actions.

While this is not necessarily a great concern for controlled laboratory experiments assessing free-choice intrinsic motivation covertly after all extrinsic motivators have been removed—albeit still possible (see Ryan et al., 1991), it is definitely an issue for typical organizational studies. Recognizing this difference is critical because it underscores that intrinsic motivation is assessed at different times in experimental and observational studies. More importantly, this difference represents a clear theoretical difference between these two fields. It is also important to recognize that the dominant theoretical frameworks generally predict that the effects are observable after extrinsic rewards are no longer available (see Deci et al., 1999a). For example, while CET recognizes that the negative motivational effects can be evident during task engagement when a reward contingency is still in place (Deci & Ryan, 1985, p. 65; Vansteenkiste et al., 2010, p. 108), CET typically predicts

situational motivation to have recursive effects on contextual motivation (for a more detailed discussion, see Vallerand, 1997).

and assesses the reward effect on intrinsic motivation after the reward contingency is terminated.

Second, many of the reviewed organizational studies measured reward expectancy and its association with intrinsic work motivation, while controlled experimental studies assessed the factual impact of attained rewards on intrinsic motivation. Although this difference may seem insignificant, it represents a theoretically significant difference. As Kuvaas et al. (2016, p. 677) have quite attentively remarked, receiving a reward and the possibility of receiving it are not entirely comparable. Because reward expectancy represents an abstract situation (i.e., a possibility of receiving a reward in the future) while reward attainment is an actual occurrence, this difference may affect the rewards–intrinsic motivation relationship.

Finally, it is necessary to recognize that the time lag between performing an activity and receiving a reward for it is quite short in experimental studies. This stands in contrast to organizational studies, in which the delay between these two phases can be quite lengthy. For example, merit pay increases are typically given annually (Milkovich & Wigdor, 1991, p. 115). In some situations, the behavior–reward time lag can span over many years, as Sutton and Brown (2016) note. Some experimental studies show that as the time lag between a target behavior and rewards increases, the motivational effects become less negative (Hitt et al., 1992; Sarafino, 1984; Tripathi & Agarwal, 1984), albeit the evidence is not unequivocal as Wolley and Fishbach's (2018) recent study indicated. Hidi (2000, p. 330) speculates that as the delay increases, rewards become less harmful to intrinsic motivation because delayed rewards are less prone to cause disturbance and conflict between the initial goal motivated by task-inherent rewards and the new goal motivated by rewards (cf. Kruglanski et al., 2018). It is also possible that a long time lag between task engagement and subsequent reward attainment may reduce reward salience, which plays an important role in the process of how a reward will affect intrinsic motivation (Hewett & Conway, 2016; Ross, 1975; see also Hendijani & Steel, 2020).

To what extent these identified differences between controlled experimental studies and observational studies might explain the partial incongruity between the meta-analytical findings stemming from these two different contexts remains to be seen. Recognizing these differences is important because they help us understand the substantial theoretical differences between these two research fields.

6.2.3 Summary

In conclusion, multiple theoretically relevant issues (e.g., the generality of intrinsic motivation and timing of intrinsic motivation measurement) were identified that may explain why the effect sizes are generally smaller in observational than controlled

experimental studies. These identified issues highlight theoretically relevant differences between controlled laboratory studies and applied studies conducted in organizational settings not typically addressed in the literature. When the above-discussed issues are integrated with other issues raised in this doctoral thesis (e.g., potential validity issues with self-report measures of intrinsic motivation, "insufficient" incentives, and competing extrinsic contingencies in organizational studies), we can begin to understand the inherent complexities related to examining and understanding the phenomenon. This integrated view also helps one understand why the present meta-analytical results for controlled experiments and observational studies are not entirely comparable. Overall, identifying multiple issues seems to call for a more comprehensive and methodologically rigorous approach to studying the reward effect on intrinsic motivation, especially when research is done in organizational settings.

Moreover, it could be argued that examining the rewards–intrinsic work motivation relationship should not be done in isolation but in tandem with other relevant contextual variables. Investigating the effects of tangible rewards alongside other relevant factors (e.g., performance pressure, feedback, interpersonal ambiance, performance evaluation practices, and manager's reward behaviors) embedded in reward and performance measurement systems would illuminate how the system as a whole affects intrinsic motivation at work. Although an important suggestion, this suggestion is by no means a new one. Past and more recent research have emphasized the importance of interpersonal contextual factors when studying motivation (Deci et al., 1981, 1989; Gagné & Forest, 2008, 2020; Kanfer, 2012; Kanfer & Chen, 2016; Ryan et al., 1983) and the effects of incentives (Milkovich & Wigdor, 1991).

6.3 Theoretical contribution

This doctoral thesis contributes in several ways to the intrinsic motivation literature. First, by quantitatively synthesizing research conducted in controlled laboratory environments, this thesis contributes to the long-lasting debate on the effects of extrinsic rewards on intrinsic motivation by providing new insight into this debate. By showing that the negative effects of expected, contingently administered rewards on free-choice intrinsic motivation are real and robust, this thesis helps answer the question of when rewards undermine intrinsically motivated behaviors. Based on the synthesized evidence, extrinsic rewards undermine behaviorally manifested intrinsic motivation when they are tangible, expected, and contingent on good task performance, task completion or task engagement. The present results also show that performance-contingent rewards are especially potent tools for damaging free-choice intrinsic motivation. This is evident when a person is unable to meet all performance standards, receiving less-than maximum rewards or failing to attain

performance-contingent rewards completely. All in all, the current findings concur with a long line of meta-analytical research (Deci et al., 1999a; Rummel & Feinberg, 1988; S. Tang & Hall, 1995) that has demonstrated that extrinsic rewards can and do undermine intrinsic motivation. Therefore, the current findings cast doubt on claims that the undermining effect is a limited and easily avoidable phenomenon (Cameron et al., 2001; Eisenberger & Cameron, 1996).

The second important contribution relates to findings that the undermining of intrinsic motivation by extrinsic rewards is not just a methodological artifact nor a temporary issue. The free-choice meta-analysis's supplementary results show that the negative effects are observable regardless of whether rewards were given before or after a free-choice period or whether the subjects were explicitly told about the reward withdrawal or only indirectly hinted about it. Moreover, the meta-analytical results show that the undermining of intrinsically motivated free-choice behavior is persistent, thus replicating and extending Deci et al.'s (1999a) findings.

Third, the finding that rewards' effects on self-reported interest are much weaker and mostly statistically nonsignificant is, on its own, significant and important because it stands in contrast to the previous meta-analyses reporting either negative (Deci et al., 1999a) or positive effects (Cameron et al., 2001). This discrepancy suggests that additional research is needed on the theoretical underpinnings of intrinsic motivation. Thus, whether this finding reflects the inherent methodological weaknesses of self-report measures of intrinsic motivation as suggested by Deci et al. (1999a) or indicates a need for a more systematic examination of the theoretical basis and dimensionality of intrinsic motivation is unclear. This question is yet to be answered.

The fourth contribution relates to the quantitative synthesis of extrinsic rewards–intrinsic work motivation research. As the field of work and organizational psychology has lacked a meta-analysis on this subject, argumentation for or against using extrinsic rewards in intrinsically motivated work settings has relied on the somewhat limited evidence base and isolated examples. This thesis clearly contributes to the literature by synthesizing the evidence base.

Fifth, it is notable that all three meta-analyses clearly demonstrate the benefits of providing positive feedback. For positive feedback, each meta-analysis showed a positive effect on intrinsic motivation or a positive association between these variables. Likewise, the results suggest that unexpected rewards and task-noncontingent rewards are unharmful to intrinsic motivation, concurring with the previous meta-analytical findings. The finding that base salary (i.e., task-noncontingent rewards) and intrinsic work motivation have a positive mean correlation helps one comprehend when rewards can potentially be used without damaging intrinsic work motivation. Table 20 provides a stripped-down summary of the results.

Sixth, by highlighting possible methodological shortcomings, this study helps one understand why previous empirical research on the extrinsic rewards–intrinsic work motivation relationship has produced mixed findings. This problem pertains especially to the PBR–intrinsic work motivation relationship, which seems more complex than what the current meta-analytical results demonstrate. Although no relationship was found for the relationship between these two variables, the individual correlations varied extensively. This high variability of effect sizes in organizational studies suggests that unidentified moderators or other unmeasured variables could be responsible for the heterogeneity. As discussed in section 6.1.4, it seems somewhat likely that a lack of methodological rigor and inherent characteristics of the studies (e.g., weak incentive schemes, ambiguous measures), to name a few, may be responsible for the lack of relationship. Some studies seem to have been "underpowered" in the sense that they have used relatively weak incentive schemes. This begs the question of how well the current literature represents the "true" relationship between PBRs and intrinsic work motivation in organizational settings.

The seventh contribution is partially intertwined with the preceding discussion as it concerns the overall relationship between performance-contingent rewards and intrinsic motivation. The biggest discrepancy between these three meta-analyses relates to performance-contingent rewards. While performance-contingent rewards significantly undermine free-choice persistence in experimental studies, they seemingly have a small but positive effect on self-reported interest. For work settings, no consistent relationship exists between performance-contingent rewards and intrinsic work motivation, begging the question of what causes these discrepancies and which findings should be given the most weight when trying to infer the true relationship between PCRs and intrinsic motivation. In short, more emphasis should be given to the findings using the free-choice behavior measure of intrinsic motivation.

Several factors provide support for this argument. First, as discussed in this thesis, self-report measures of intrinsic motivation may be susceptible to biases. For example, for the free-choice meta-analysis of performance-contingent rewards, only one effect size of 29 effects (3.44%) had to be replaced with an imputed effect size of $d = 0.00$ due to missing statistics. For the self-self-report meta-analysis, the number of imputed effects was much higher. Altogether, 8 of 28 (28.51%) effects were imputed with $d = 0.00$. Because this procedure is conservative by nature (Pigott, 2009, p. 408), it attenuates the results. Second, given that multiple authors (Deci et al., 1999a; Fulmer & Frijters, 2009; Guay et al., 2000; see also Quattrone, 1985; Rummel & Feinberg, 1988) have discussed the potential weaknesses of the self-report measures of intrinsic motivation, more weight should be given to the results of the free-choice meta-analysis. Additionally, multiple potential issues were

identified that might distort the relationship between performance-contingent rewards and intrinsic motivation in organizational settings [77].

Eight, by underscoring major theoretical differences between the controlled laboratory experiments and observational organizational studies, this thesis helps one understand and potentially explain why these two fields of research may produce partially mixed findings. While experimental research examines how extrinsic rewards affect task-specific intrinsic motivation, organizational studies tend to measure intrinsic motivation at a higher level of analysis (i.e., more developed, domain-specific intrinsic motivation). Additionally, these two fields differ, for example, regarding when intrinsic motivation is assessed and whether rewards are actually given or not[78]. Overall, by synthesizing and attempting to integrate research evidence from two different fields of research—namely experimental social psychology and work and organizational psychology—this thesis tries to create a more comprehensive understanding of the phenomenon under study.

[77] See Chapter 6.1.3.
[78] See Chapter 6.2 for a detailed discussion.

Table 20 An overall summary of the results.

	Experimental context		Work context
	Free-choice intrinsic motivation (free-choice behavior)	Self-reported interest and enjoyment	Self-reported intrinsic work motivation
All rewards	Neg	No	No
Positive feedback	Pos*	Pos	Pos
Negative feedback	No	No	–
Tangible rewards	Neg	No	No
Unexpected rewards	No	No	–
Expected rewards	Neg	No	–
Task-noncontingent rewards	No	No	Pos
Engagement-contingent rewards	Neg	Neg*	–
Completion-contingent rewards	Neg	No	–
Performance-contingent rewards	Neg	Pos	No
[a] Perceived functional significance / psychological meaning of performance-contingent rewards	–	–	Neg

Table notes.
Neg = Statistically significant negative effect (experimental context) or correlation (work context)
Pos = Statistically significant positive effect (experimental context) or correlation (work context)
No = Nonsignificant effect or correlation
– = reward contingency not included in the analysis
* = moderated by age

6.4 Practical implications

The results of all three meta-analyses (*free-choice, self-report, observational*) have practical utility and implications for educational and work organizations. The discussion about practical implications will proceed mostly in the same order in which the results were presented. However, because the focus is on practical implications, the meta-analytical results of experimental and observational studies will be discussed simultaneously.

The current meta-analytical findings suggest that extrinsic rewards can have both harmful and beneficial effects on intrinsic motivation. Like past research has shown (see, e.g., Deci et al., 1999a), also the present meta-analysis echoes the need to consider reward type and reward contingency—for what reason(s) are rewards promised and given —and, by extension, how rewards are used when trying to predict how intrinsic motivation will be affected. This is evident by looking at the evidence stemming from the meta-analysis of controlled experiments. The findings on the reward effects on free-choice behavior particularly highlight this matter. Looking beyond the overall effects to avoid sweeping conclusions and oversimplifications of the complex literature that has plagued some of the previously conducted meta-analytical studies is thus necessary (e.g., Eisenberger & Cameron, 1996) (cf. Lepper et al., 1996).

First, the current findings suggest that, on average, giving positive feedback has beneficial effects on intrinsic motivation. This finding was evident in meta-analytical studies relying on experimental and observational data. From a practical perspective, this finding suggests that, on average, positive feedback can be an effective motivational tool for managers and teachers. Because positive feedback costs nothing and can be given during a task engagement or immediately following it, positive feedback can be an important tool to support intrinsic motivation. Albeit positive feedback tends to have beneficial effects, previous research indicates that one should pay attention to how and for what the feedback is given (Corpus et al., 2006; Deci et al., 1999a; Henderlong & Lepper, 2002). In their review article, Henderlong and Lepper (2002) suggested that positive feedback concentrating on social comparison could be unbeneficial for (children's) intrinsic motivation, while feedback providing knowledge of one's competence without unnecessary social comparisons could be used to enhance intrinsic motivation. Research by Corpus et al. (2006) partially supported this suggestion, as mastery feedback was found to enhance children's self-reported interest. In contrast, social-comparison feedback undermined this interest when uncertainty about one's task performance was present. In turn, Deci et al. (1999a) showed that when positive feedback was given in a controlling fashion, it undermined intrinsic motivation; the opposite effect occurred for positive feedback given informationally.

As regards unexpected rewards, the findings show that these rewards do not significantly affect intrinsic motivation. This means that unexpected rewards can be used to reward people without considerable risk of undermining intrinsic motivation. Albeit no enhancement effect was found, this type of reward may be utilized as a symbolic token of appreciation (Balkin et al., 2015; Deci et al., 1999a). Because unexpected rewards are given ex-post basis, these rewards do not (nor should) affect how an individual performs their work (Balkin et al., 2015). However, if given repeatedly, unexpected rewards may become expected in the minds of recipients (Deci et al., 1999a).

Regarding task-noncontingent rewards, the findings of controlled experimental studies indicate no significant effect on intrinsic motivation. In contrast, the findings from observational data suggest that a higher base salary (i.e., task-noncontingent reward) is positively associated with higher self-reported intrinsic work motivation. These findings suggest that task-noncontingent rewards can be given without a high risk of undermining intrinsic motivation; sometimes, these rewards may even be conducive to intrinsic (work) motivation. This echoes suggestions that higher base pay may signal that the employer values the employee (Kuvaas, 2006; Kuvaas et al., 2016; see also Deci et al., 2017). In addition, fair remuneration in the form of good base pay can yield other beneficial indirect effects, such as lower turnover intentions (Kuvaas et al., 2016; see also Heckert & Farabee, 2006). Additionally, via two meta-analytical studies, Cerasoli and colleagues (2014, 2016) showed that indirect (i.e., task-noncontingent) rewards are more conducive to higher-quality performance than direct rewards.

For extrinsic rewards contingent on task engagement, completion, or performance, the findings highlight their detrimental effects, especially when intrinsic motivation is assessed with a behavioral measure (i.e., task persistence after rewards are withdrawn). The effects of performance-contingent rewards are especially fascinating because of their widespread use in various real-world settings (e.g., work settings). On average, performance-contingent rewards are harmful to intrinsic motivation, although the effects somewhat depend on how much competence information they carry, how much they cause pressure to perform well, how they are used, and finally, how intrinsic motivation is measured. That the most detrimental effects were evident when a person received less-than maximum rewards or failed to attain pursued rewards is especially notable. When some persons receive less-than maximum rewards, both free-choice intrinsic motivation (d = –0.84) and self-reported interest (d = –0.12) are at risk. Likewise, when people do not receive the reward they aimed for, such significantly undermines free-choice behavior (d = –0.66) and self-reported interest (d = –0.70).

As pointed out by Deci et al. (1999b) and addressed in the discussion section of the experimental findings, one problem of using performance-based rewards in real-

life settings relates to the fact that many people (e.g., employees) will not succeed in attaining a maximum reward or any rewards. Sometimes, it is possible that even good individual-level performance may not yield desired rewards if a firm does not meet set organization-level goals (e.g., expected profitability level). As well as undermining intrinsic motivation, this situation seems likely to undermine extrinsic motivation (i.e., extrinsic regulation), fortify feelings of amotivation, and possibly diminish perceptions of fairness of the pay system (cf. Armstrong, 2015, p. 102). Thus, although the recipients of PBRs do not necessarily suffer from these negative consequences, the nonrecipients may experience them.

From a manager's standpoint, the ultimate outcome of interest is performance. As argued by some (e.g., Gerhart, 2017; Gerhart & Fang, 2014), even if extrinsic rewards damage intrinsic motivation, the enhancement of extrinsic motivation should yield a positive net effect on performance and, eventually, organizational performance. Although this logic may hold in certain situations when tasks are uninteresting (Weibel et al., 2010), easy (Shapira, 1976), or the quantity of performance is important (Cerasoli et al., 2014; Jenkins et al., 1998), another strand of research highlights the drawbacks of using salient and strong incentives to motivate people.

First, via a meta-analysis, Cerasoli, Nicklin, and Ford (2014) demonstrated that while intrinsic motivation is quite a strong predictor of performance quality and quantity, extrinsic incentives predominantly promote the quantitative aspect of performance. Additionally, Cerasoli et al. (2014) showed that the link between intrinsic motivation and performance diminished under directly performance-salient rewards compared to when the rewards were indirectly performance-salient. Another meta-analysis by Cerasoli, Nicklin, and Nassrelgrgawi (2016) showed similar results when examining the relationships between the satisfaction of the basic psychological needs, performance and directly versus indirectly performance-salient rewards. The relationship between psychological need satisfaction and performance was stronger under indirectly salient rewards than directly performance-dependent rewards.

The issue of performance quality is important in various domains. For example, Drucker (1999, p. 84) emphasizes the role of quality of work performance in contemporary knowledge-intensive work. Similarly, Kallio and Kallio (2014) emphasize that in the realm of scientific work, one high-quality study can be more valuable than hundred mediocre studies. A recent meta-analysis studying the relationships between different types of motivation and student outcomes showed that intrinsic motivation for studying was positively related to numerous positive outcomes such as objective academic performance and mastery-approach while extrinsic motivation (i.e., external regulation) was not (Howard et al., 2021). Another meta-analysis by Van den Broeck et al. (2021) reported conceptually similar results for the relationship among intrinsic work motivation, extrinsic work motivation (i.e.,

external regulation), and work outcomes (e.g., well-being, job-related attitudes, and job behaviors). While intrinsic work motivation was an important predictor of positive work-related outcomes, extrinsic work motivation based on incentives was not.

The problematic nature of using strong performance-based incentives to motivate people when work is highly complex and intrinsically motivated can be highlighted by reviewing the results of Heywood, Wei, and Ye's (2011) study. Through a longitudinal panel-data design, Heywood, Wei, and Ye (2011) examined the effects of a powerful piece-rate incentive system introduced in a Chinese university. To illustrate the magnitude of promised incentives, Heywood et al. (2011) remark that publication in a top-tier journal could almost double a full professor's yearly salary while a publication, even at the lowest level, would bring a reward equivalent to a 1,5-month salary. As expected, they found that the faculty's performance increased substantially. Average yearly research points (i.e., research performance) increased by over 69%. Although Heywood et al.'s (2011) study is an extreme example, it highlights a pitfall of strong incentive systems. Despite a marked increase in research performance in Heywood et al.'s (2011) study, one may ponder whether the performance increase came at the cost of scientific ingenuity and quality of work.

Based on indirect evidence, this outcome is possible. Research on the effects of performance-contingent rewards on creativity shows these rewards are not conducive to creativity (Byron & Khazanchi, 2012), while intrinsic motivation is a pivotal driver of it (Amabile & Pratt, 2016; de Jesus et al., 2013). Likewise, Cerasoli et al.'s (2014) meta-analytical results suggest that incentives play a relatively minor role in supporting the qualitative aspect of (work) performance compared to intrinsic motivation (see also DeVaro & Heywood, 2017). Indeed, meta-analytical evidence shows that extrinsic incentives tend to drive performance *quantity* (Cerasoli et al., 2014; Jenkins et al., 1998). Research has also shown that contingent extrinsic incentives can encourage people to choose easier tasks (Shapira, 1976), discourage cooperation, and encourage egoistic behaviors (Burks et al., 2009).

Perhaps the most relevant evidence comes from studies conducted in the field of higher education. For example, a qualitative study by Aboubichr and Conway (2021) examined the effects of performance management (PM) systems (and incentives embedded in these systems) on business school scholars' work behaviors in the United Kingdom. They found that PM systems lead to gaming the system in order to meet set performance requirements. Also others have warned that strong incentives to publish in top-tier journals possibly stifle the intellectual aspect of scholarly work (e.g., Aguinis et al., 2020; N. Butler & Spoelstra, 2014). Finally, Butler (2003) remarks that a significant increase in published papers occurred after a performance-

based system was introduced to Australia's higher education sector, although this seems to have happened at the expense of the quality of work (see also Kallio, 2014).

As the preceding discussion highlighted, studies show that intrinsic motivation is the central driver of high-quality work and creative outcomes, while extrinsic is more related to performance quantity. Given the fact that intrinsic motivation is a central energizer of scholarly work and scientific curiosity (T. E. Becker et al., 2018; Jindal-Snape & Snape, 2006; Stupnisky et al., 2019) and doing high-quality research takes time, it seems unlikely that the substantial (sudden) increase in research performance in Heywood et al.'s (2011) study did not come without any deterioration of research quality.

Although the preceding discussion has chiefly stressed the negative aspects of motivating intrinsically motivated people with rewards, it is necessary to emphasize that rewards can have both harmful and beneficial effects on intrinsic motivation, as the performed meta-analyses clearly demonstrate. Recapping that the effects depend on why rewards are given and how they are used is also necessary. Effects vary significantly, such as whether a reward is used to induce task engagement or the desired level of performance than when a reward is used unexpectedly or verbally to express gratitude for a job well done (see Ryan & Deci, 2017, p. 131). Examples of two field studies highlight this issue. First, a non-randomized study by Anderson (2016) found that a learning incentive program that utilized regular feedback and task-congruent rewards (see Steiner, 2011) enhanced students' levels of interest in and engagement with their studies compared to those who were not incentivized (see also Garaus et al., 2016). In contrast, in a randomized field study conducted in an Israeli high-tech semiconductor company, Bareket-Bojmel, Hockman, and Ariely (2017) showed that compared to baseline productivity, withdrawal of introduced cash reward reduced productivity while verbal feedback did not (see also Huffman & Bognanno, 2018; Pope & Harvey, 2015). Although these two reviewed studies represent isolated examples, they illustrate the complexities embedded in the relationship between extrinsic rewards and intrinsic motivation.

Based on this meta-analytical review's overall findings, it is suggested that practitioners should place more emphasis on using positive feedback and noncontingent tangible rewards (i.e., task-noncontingent and unexpected rewards) in environments where individuals are driven by intrinsic motivation. These types of rewards do not deteriorate intrinsic motivation and may be used to support intrinsic motivation. Conversely, it is not suggested to use highly contingent rewards (i.e., engagement-contingent, completion-contingent, and performance-contingent rewards) in environments where intrinsic motivation operates as the primary energizer of behaviors because, on average, these types of rewards tend to deteriorate intrinsic motivation. Moreover, contingent rewards are often used in tandem with other extrinsic motivators that may undermine intrinsic motivation.

Finally, although extrinsic rewards serve an important purpose, for example, in employee retention (Deci, 1973; Deci et al., 2017), research shows that other methods, such as autonomy support (Slemp et al., 2018) and provision of choice (Patall et al., 2008) are more effective tools for supporting intrinsic motivation and high-quality (autonomous) extrinsic motivation than contingent reward practices.

6.5 Limitations

Although meta-analysis has many advantages, such as the ability to statistically synthesize vast amounts of research, which can produce more accurate, objective, and transparent results (Borenstein et al., 2009), this study is not without limitations. Next, these limitations will be addressed. The discussion will proceed by first discussing general limitations concerning the whole meta-analytical review. After that, limitations explicitly related to a particular meta-analysis (experimental, observational) will be discussed separately. This type of approach was chosen to enhance the flow of the text. While addressing the general limitations, the following discussion draws more on experimental findings to address the arising questions and issues. This is done because psychological literature (i.e., experimental studies) on extrinsic rewards' effects on intrinsic motivation is more mature than organizational literature.

Overall limitations. The most significant overall limitation of the present study is the exclusion of grey literature, creating the possibility of publication bias. Unlike the previous meta-analyses by Deci et al. (1999a) and Cameron et al. (2001), which included doctoral dissertations, only peer-reviewed journal articles were included in the present meta-analytical review. As mentioned in the method section, studies with statistically significant findings have a better chance of being published than those with nonsignificant findings. This can bias the results, such as by superfluously increasing the magnitude of effect size estimates (Greenhouse & Iyengar, 2009).

By examining Deci et al.'s (1999a) and Cameron et al.'s (2001) meta-analyses, getting a rough estimation of the number of missing studies is possible. Deci et al. (1999a) included 20 unpublished doctoral dissertations, while Cameron et al. (2001) included 21. A more detailed examination of Deci et al.'s (1999a) study revealed that of the 20 dissertations, 33 free-choice behavior effect size estimates and 28 self-reported interest effect size estimates were extracted. What is notable is that 26 of 33 free-choice effects and 22 of 26 self-report effects examined the effects of performance-contingent, completion-contingent, or engagement-contingent rewards. Thus, it is evident that the decision to exclude (among others) dissertations resulted in a significant loss of potential studies.

An examination of Deci et al.'s (1999a) meta-analysis gives some idea about the effects of excluding grey literature on the composite effect size estimates. Somewhat

reassuringly, Deci et al. (1999a) found no statistically significant differences in the mean effect size estimates for unpublished dissertations and published studies for the free-choice behavior or self-reported interest measures. Therefore, it is possible that the exclusion of unpublished dissertations from the present meta-analysis does not inevitably mean the results of this meta-analysis would be biased. However, reckoning that published studies may overestimate the magnitude of the pooled effect size estimate is necessary (Klein et al., 2018; Schäfer & Schwarz, 2019).

Despite Deci et al.'s (1999a) findings providing some form of safeguard for the findings of the present meta-analyses, it should be noted that some new unpublished dissertations using experimental design have since been conducted (e.g., Banko, 2007; Gear, 2007; Steiner, 2011; H. Wehe, 2016). Also, because electronic search methods for locating unpublished dissertations are more advanced now than in the late 1990s, it is possible that the search procedures Deci et al. (1999a) and Cameron et al. (2001) utilized did not capture all of them. Indeed, some eligible unpublished doctoral theses were found (e.g., Blom, 1983; Kess, 1977; Mohr, 1982; Tennant, 1985), which the previous meta-analytical studies did not include in their analyses. Including these pieces of evidence in a future meta-analysis on the effects of extrinsic rewards on intrinsic motivation is advisable.

The same limitations and suggestions also apply to the meta-analysis of observational studies. However, as the author is unaware of any previously performed meta-analyses on the relationship between intrinsic work motivation and extrinsic rewards, assessing how many potential unpublished studies were excluded from the analysis is difficult. Some possibly eligible unpublished doctoral theses were found (e.g., Corduneanu, 2020; Dewett, 2002; Eder, 2007; Hewett, 2014).

The second general limitation relates to having only a single reviewer/coder. According to Rothstein and Bushman (2015), this may lead to errors, for example, in assessing study eligibility, coding, and effect size calculations. Because of the risk of bias, it is suggested in the *Cochrane Handbook for Systematic Reviews and Interventions* (Lefebvre et al., 2019) to use at least two independently working persons to assess whether a study should be included or excluded. However, including additional reviewers was impossible due to the nature of this research project (i.e., solo-authored doctoral thesis). Reasons for excluding read (full text) studies were recorded with care to reduce the threat of a single reviewer bias. However, in some cases, considerable deliberation was needed to decide whether a study met the inclusion criteria.

The third and final general-level limitation concerns English-language bias because only those studies written in English were included. This choice may have introduced bias (Rothstein & Hopewell, 2009). Next, the specific limitations related to the meta-analysis of experimental data are addressed.

Limitations related specifically to the meta-analysis of experimental studies. One potential limitation is related to the decision to concentrate on examining the main (average) effects of rewards on intrinsic motivation. Lepper et al. (1996, 1999) and Lepper and Henderlong (2000) argue that this procedure might conceal theoretically relevant moderator effects and produce imprecise results. Lepper and his colleagues (Lepper et al., 1996, 1999; Lepper & Henderlong, 2000) point out that because many studies in the intrinsic motivation literature have investigated what variables or settings can mitigate or even reverse the negative effects of rewards, focusing on the main effect(s) will lead to obscure results. Although this may represent a potential limitation, it can also be considered a strength. Showing that the negative reward effect is often evident after clumping together studies with partially different characteristics, theoretical conditions, and procedural variations provides support for the robustness of these findings (Matt & Cook, 2009, p. 552). It seems likely that the observed composite effects would have been larger (i.e., more negative) if only direct comparisons (excluding conditions designed to mitigate the reward effects) had been included in the analysis. However, at the same time, it is necessary to recognize that because the evidence is based on controlled experimental (laboratory) studies using almost exclusively quite young and youngish populations (children and university students), the generalizability of these results to older populations or beyond laboratory settings remains debatable.

Limitations related specifically to the meta-analysis of observational studies. Regarding the meta-analysis using observational data, three limitations were identified. First, because the results are correlational and based mostly on nonexperimental cross-sectional data, drawing inferences of causal relations between variables should not be done. Because of the hegemony of cross-sectional data in the sample of included studies, more longitudinal and field experimental studies are needed.

Second, because included studies utilized, for example, a wide variety of reward measures, this meta-analysis risks introducing an apples and oranges problem (Borenstein et al., 2009; Shelby & Vaske, 2008). Indeed, combining heterogeneous studies can blur the interpretation and meaning of findings. However, as Matt and Cook (2009, p. 553) and Borenstein et al. (2009) argue, this approach may be necessary if the aim is to generalize the findings.

The third limitation concerns the heterogeneity of (some) composite effect size estimates; this limitation is inextricably associated with the second limitation. This issue is especially associated with the composite effect size estimate for the relationship between performance-based rewards and intrinsic work motivation. Because the overall effect size estimate showed substantial heterogeneity, as the wide prediction interval indicates, the mean correlation is not the best indicator to describe the intrinsic work motivation–PBR relationship (Borenstein, 2019, pp. 82–

83). The inability to achieve homogeneity and the small number of relevant study-level moderators (i.e., variables present in all or almost all studies) that could have explained the observed variability of effect sizes (i.e., heterogeneity) suggest more research is needed.

As discussed earlier, future meta-analytical studies could try to identify additional moderator variables that could help explain the relationship between performance-based rewards and intrinsic motivation. It is also suggested that future research should pay more attention to the measurement issue (e.g., high variability of the used PBR measures) and its effect on results. Alternatively, more stringent inclusion criteria (e.g., including only studies that have employed a specific PBR measure) could be used. The current study also suggests that future primary research would benefit from a more detailed investigation of rewards' motivating power (e.g., the amount of variable pay) and the specific type of given or promised performance-based reward (e.g., individually based pay vs. collectively based year-end bonus).

6.6 Conclusion

In summary, this meta-analytical review provides support for the conclusion that extrinsic rewards can and do undermine intrinsic motivation. Although the effects of rewards are somewhat dependent on the utilized measure of intrinsic motivation (behavioral vs. self-report), type of reward and reward contingency, and the context of research (laboratory experiment vs. organizational), the results of this doctoral thesis support the existence of the deleterious effects of extrinsic rewards. Deleterious effects of extrinsic rewards on intrinsic motivation are evident and most readily observable when rewards are contingent and when intrinsic motivation is assessed behaviorally after rewards are withdrawn.

For the free-choice behavior measure of intrinsic motivation, the negative effects of contingent rewards are robust, pervasive, and clearly seen in experimental laboratory settings. For self-reported interest/enjoyment and intrinsic work motivation, the results generally do not provide compelling support either for the enhancement effect or for the undermining effect of contingent rewards on intrinsic motivation. Based on the analysis of the literature, the lack of an effect for the attitudinal measures of intrinsic motivation may be attributed partly to validity issues in the utilized measures.

Based on the synthesis of evidence, it is also clear that intrinsic motivation and extrinsic rewards can coexist in some situations. This coexistence is especially evident when no clear instrumental link exists between an activity and extrinsic rewards or when rewards are verbal. These findings align well with those of Deci et al. (1999a) reported in their meta-analysis.

Overall, the results of this meta-analytical review help to understand under what circumstances and populations extrinsic rewards will most likely yield negative or positive effects on intrinsic motivation. Based on the evidence, the issue is clearly complex as the effect depends on the type of promised reward, what one has to do to get the reward, and under what conditions and context the extrinsic rewards–intrinsic motivation relationship is examined. Although current evidence suggests that there are situations when extrinsic rewards can be used to support intrinsic motivation, the negative effects are most likely when rewards are utilized to motivate people to do something. This is an important observation because motivating people with rewards is the most often used function of extrinsic rewards in practice.

One major finding of this meta-analytical review is that no definite conclusion can be drawn from the current pool of evidence examining the relationship between performance-based rewards and intrinsic motivation at work. The synthesized mean correlation between these variables was statistically nonsignificant and very heterogeneous. The heterogeneity of effects is not all that surprising given that the pool of studies varied substantially, for example, regarding examined population, reward size, and how rewards were operationalized. Although some might interpret this null result as evidence showing that performance-based rewards do not pose a risk to intrinsic motivation in organizational settings, this interpretation is argued to be erroneous and premature (cf. Lepper et al., 1996; Ryan & Deci, 1996, p. 34), not least because of the many deficiencies and shortcomings observed in the reviewed literature. Furthermore, the synthesized evidence seemingly suggests that performance-based rewards harm intrinsic work motivation when the psychological meaning of these rewards is more controlling than informational. Although the evidence does not lend unequivocal support for the undermining effect in organizational settings, this finding is likely partly attributable to methodological differences and shortcomings. More research is needed to understand the relationship between rewards and intrinsic work motivation in organizational settings before any definite conclusions can be made.

In summary, this meta-analytical review showed that the undermining of intrinsic motivation by extrinsic rewards is not a myth, nor a methodological artifact as some assert (e.g., Cameron et al. 2001), but a clearly observable phenomenon under those situations in which it can be expected to occur (cf. Tang & Hall, 1995, p. 379). By synthesizing both experimental laboratory research and observational research conducted in the work setting and highlighting many theoretically relevant issues that should be considered when studying how extrinsic rewards affect intrinsic motivation, this thesis advances our understanding of the phenomenon and highlights multiple avenues for future research.

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Appendices

Appendix 1 A list of studies included in the meta-analyses of experimental studies.

Studies included in the meta-analyses of experimental studies and associated information

Study	Reward contingencies and measures	Additional remarks
Amabile et al. (1986) Exp. 1	E, F, S, 1	x
Amabile et al. (1986) Exp. 3	E, S, 2	x
Albrecht et al. (2014)	V, C, S, 3	Not included by Deci et al. (1999a) or Cameron et al. (2001). Although Albrecht et al. (2014) included a behavioral measure of intrinsic motivation, it was not included because task engagement was not volitional.
Anderson, R. et al. (1976)	E, V, F, 1	
Anderson, S. et al. (1989)	V, NV, S, 2	The study combined free-choice and self-report measures into a single composite measure of IM.
Anghelcev (2015)	C, S, 2	Not included by Deci et al. (1999a) or Cameron et al. (2001)
Arkes (1979)	C, F, S, 2	
Arnold (1976)	E, S, 2	
Arnold (1985)	E, C, S, 2	
Blanck et al. (1984) Exp. 1	V, F, S, 2	
Blanck et al. (1984) Exp. 2	V, F, S, 2	
Boggiano et al. (1985)	E, C, P, F, 1	
Boggiano & Ruble (1979)	E, P, F, 1	
Boggiano et al. (1982)	E, F, 1	

Brennan & Glover (1980)	E, F, 2	
Brockner & Vasta (1981)	C, F, S, 2	
Butler (1987)	V, S, 1	
Calder & Staw (1975b)	C, S, 2	
Cameron et al. (2005)	P, F, S, 2	Not included by Deci et al. (1999a) or Cameron et al. (2001). Only the training phase reward group (no rewards given during the test phase) and control group were included in the analyses.
Cameron et al. (2004)	C, F, S, 2	Not included by Deci et al. (1999a) or Cameron et al. (2001).
Carr et al. (1996)	E, F, 2	Not included by Deci et al. (1999a) or Cameron et al. (2001).
Carr et al. (2005) Exp. 2	E, F, 2	Not included by Deci et al. (1999a) or Cameron et al. (2001). Albeit Carr et al. (2005, p. 429) included six reward groups in their study, they reported statistics only for one comparison between a control group and one reward group ($t = –10.26$, $p < 0.001$). Because Carr et al. (2005) stated that the reward group in question spent the most time during the free-choice behavior out of all reward groups, the overall effect size estimate for all reward groups vs. the control was based on the aforementioned comparison.
Carton & Nowicki (1998) Exp. 1	C, F, 2	Not included in Deci et al. (1999a) meta-analysis. Reward group 2 was excluded because this group's subjects were not told about reward withdrawal.
Carton & Nowicki (1998) Exp. 2	C, F, S, 2	Not included in Deci et al. (1999a) meta-analysis. Reward group 2 was excluded for the same reason as described above.
Chung (1995)	E, P, F, 1	The effect sizes were extracted from Deci et al.'s (1999a) study.
Corpus et al. (2006) Exp. 1	V, S, 1	Not included by Deci et al. (1999a) or Cameron et al. (2001).
Corpus et al. (2006) Exp. 2	V, S, 1	Not included by Deci et al. (1999a) or Cameron et al. (2001).
Crino & White (1982)	V, S, 2	
Daniel & Esser (1980)	P, F, S, 2	
Danner & Lonky (1981) Exp. 2	V, E, F, S, 1	
Deci (1971) Exp. 1	C, F, S, 2	

Deci (1971) Exp. 3	V, F, S, 2	
Deci (1972a)	TN, F, 2	
Deci (1972b)	V, C, F, 2	
Deci et al. (1975)	V, F, 2	
DeLoach et al. (1983)	E, F, 1	
Dollinger & Thelen (1978)	V, P, F, S, 1	
Earn (1982) Exp. 1	TN, F, S, 2	
Eisenberger & Aselage (2009) Exp. 3	P, S, 2	Not included by Deci et al. (1999a) or Cameron et al. (2001).
Eisenberger, Rhoades, & Cameron (1999b) Exp. 1	P, F, S, 2	Not included by Deci et al. (1999a).
Eisenstein (1985)	U, C, F, 1	The effect sizes were extracted from Deci et al.'s (1999a) study.
Enzle et al. (1991)	P, F, 2	
Fabes et al. (1986)	E, F, S, 1	
Fabes (1987) Exp. 1	C, P, F, 1	
Fabes (1987) Exp. 2	C, F, 1	
Fabes et al. (1988)	E, F, S, 1	
Fabes et al.(1989)	E, F, 1	
Feehan & Enzle (1991) Exp. 1	C, F, 2	
Greene & Lepper (1974)	U, E, P, F, 1	
Griffith et al. (1984)	C, F, 1	
Hagger & Chatzisarantis (2011)	C, F, 2	Not included by Deci et al. (1999a) or Cameron et al. (2001).
Hagger et al. (2015)	V, F, S, 2	Not included by Deci et al. (1999a) or Cameron et al. (2001).
Haimovitz & Corpus (2011)	NV, S, 2	Not included by Deci et al. (1999a) or Cameron et al. (2001). The study was classified in the negative feedback category because after the third and final puzzle, the study participants in the feedback-condition(s) received information that indicated a failure. However, it should be noted that positive feedback was given to the subjects in the feedback group after the first two puzzles.

Hamner & Foster (1975)	E, C, S, 2	
Harackiewicz (1979)	V, E, P, S, 1	
Harackiewicz & Manderlink (1984)	P, S, 1	
Harackiewicz et al. (1984) Exp. 1	P, F, S, 2	
Harackiewicz et al. (1984) Exp. 2	U, P, F, S, 2	
Harackiewicz et al. (1984) Exp. 3	P, F, S, 2	
Harackiewicz et al. (1987)	P, S, 1	
Hennessey (1989) Exp. 1	E, F, S, 1	Not included by Deci et al. (1999a) or Cameron et al. (2001).
Hitt et al. (1992)	E, F, S, 2	
Houlfort et al. (2002) Exp. 1	P, F, S, 2	Not included by Deci et al. (1999a) or Cameron et al. (2001).
Houlfort et al. (2002) Exp. 2	P, S, 1	Not included by Deci et al. (1999a) or Cameron et al. (2001).
Karniol & Ross (1977)	E, P, F, 1	
Kast & Connor (1988)	V, S, 1	
Katz et al. (2006)	V, S, 1	Not included by Deci et al. (1999a) or Cameron et al. (2001).
Koestner et al. (1987)	V, F, S, 2	
Kruglanski et al. (1971)	TN, S, 1	
Kruglanski et al. (1972)	U, S, 1	
Kruglanski et al. (1975) Exp. 1	C, S, 1	
Kruglanski et al. (1975) Exp. 2	P, S, 1	The control group subjects in the money-intrinsic condition were excluded from the analysis because they had to return the money they earned while playing a stock market game (see Deci et al., 1999a, p. 665).
Lepper et al. (1973)	U, E, F, 1	
Lepper et al. (1982) Exp. 3	E, F, 1	
Loveland & Olley (1979)	E, F, 1	
Luyten & Lens (1981)	C, P, F, S, 2	

Margolis & Mynatt (1986)	E, F, 1	
Marinak & Gambrell (2008)	E, F, 1	Not included by Deci et al. (1999a) or Cameron et al. (2001).
Marsden et al. (2015)	P, F, S, 3	Not included by Deci et al. (1999a) or Cameron et al. (2001).
McGraw & McCullers (1979)	C, S, 2	
McLoyd (1979)	C, F, 1	
Morgan (1981) Exp. 1	E, F, S, 1	
Morgan (1981) Exp. 2	E, F, S, 1	
Morgan (1983) Exp. 1	E, F, S, 1	
Morgan (1983) Exp. 2	E, F, S, 1	
Mynatt et al. (1978)	E, F, 1	
Newman & Layton (1984)	E, F, 1	
Ogilvie & Prior (1982)	E, F, 1	The effect size was extracted from Deci et al. (1999a) / Cameron et al. (2001).
Okano (1981) Exp. 1	E, F, S, 1	The effect size was extracted from Deci et al. (1999a) / Cameron et al. (2001).
Okano (1981) Exp. 2	TN, E, F, S, 1	The effect size was extracted from Deci et al. (1999a) / Cameron et al. (2001).
Orlick & Mosher (1978)	V, U, P, F, 1	
Pallak et al. (1982)	V, U, P, F, 1	
Parker et al. (2017) Exp. 1	P, F, 2	Not included by Deci et al. (1999a) or Cameron et al. (2001).
Perry et al. (1977)	E, F, S, 1	
Pierce et al. (2003)	C, F, S, 2	Not included by Deci et al. (1999a) or Cameron et al. (2001).
Pittman et al. (1977)	P, F, S, 2	
Pittman et al. (1980)	V, F, 2	
Pittman et al. (1982) Exp. 1	TN, E, F, S, 1	
Pittman et al. (1982) Exp. 2	E, F, 1	
Porac & Meindl (1982)	C, F, 2	
Pretty & Seligman (1984) Exp. 1	NV, V, U, E, F, S, 2	

Pretty & Seligman (1984) Exp. 2	U, E, F, S, 2	
Reiss & Sushinsky (1975) Exp. 1	E, F, 1	
Rosenfield et al. (1980)	P, F, S, 2	Positive and negative feedback control groups. Maximum and less-than maximum performance-contingent reward conditions.
Ross (1975) Exp. 1	E, F, S, 1	
Ross (1975) Exp. 2	E, F, S, 1	
Ross et al. (1976)	TN, E, F, 1	
Ryan et al. (1983)	V, E, P, F, S, 2	
Salancik (1975)	P, F, S, 2	
Sansone (1986) Exp. 1	V, S, 2	
Sansone (1989)	V, S, 2	The effect size was extracted from Deci et al. (1999a).
Sansone et al. (1989) Exp. 1	NV, V, S, 2	
Sarafino (1984)	E, F, S, 1	
Shanab et al. (1981)	NV, V, F, S, 2	Deci et al. (1999a) or Cameron et al. (2001) did not include the negative feedback condition.
Shapira (1976)	C, S, 2	Deci et al. (1999a) excluded this study, while Cameron et al. (2001) included it.
Smith & Pittman (1978)	P, F, S, 2	
Sorensen & Maehr (1976)	C, F, 1	
Staw et al. (1980)	C, S, 2	
Swann & Pittman (1977) Exp. 1	TN, E, F, 1	
Swann & Pittman (1977) Exp. 2	E, F, 1	An engagement-contingent reward group that received positive feedback was excluded from the analysis because no equivalent control group was included in the study
Taub & Dollinger (1975)	P, S, 1	
Thill et al. (1998)	E, S, 1	Not included by Deci et al. (1999a) or Cameron et al. (2001).
Thompson et al. (1993)	E, F, S, 2	

Tripathi & Agarwal (1985)	V, E, F, S, 2	The effect size was extracted from Deci et al. (1999a).
Tripathi & Agarwal (1988)	E, P, F, S, 2	
Turnage & Muchinsky (1976)	TN, C, F, S, 2	Not included by Deci et al. (1999a) or Cameron et al. (2001).
Vallerand (1983)	V, S, 1	
Vallerand & Reid (1984)	NV, V, S, 2	The negative feedback condition was not included by Deci et al. (1999a) or Cameron et al. (2001).
Vansteenskiste & Deci (2003)	P, F, S, 2	Not included by Deci et al. (1999a) or Cameron et al. (2001). For the main analyses, conditions 1 (a control group), 2 (winning a competitively contingent reward), and 5 (losing a competitively contingent reward but receiving a performance-contingent reward) were included.
Vasta & Stirpe (1979)	C, F, 1	The present study calculated the effect size using a pre-post analysis for the completion-contingent reward group and the control group. Because the study did not report the pre-post correlation, an estimated correlation of 0.50 was used in calculations. Using an estimated value is an option when the correlation is not reported (Borenstein, 2009, pp. 227–228; Borenstein et al., 2009, pp. 232–238).
Warneken & Tomasello (2008)	V, E, F, 1	Not included by Deci et al. (1999a) or Cameron et al. (2001).
Weinberg & Jackson (1979)	P, S, 2	The effect size was extracted from Deci et al. (1999a).
Weiner (1980)	C, F, S, 2	
Weiner & Mander (1978)	E, P, F, S, 2	
Wicker et al. (1990)	C, F, S, 2	The effect size was extracted from Cameron et al. (2001). The study was excluded by Deci et al. (1999a)
Wiechman & Gurland (2009)	E, F, S, 2	Not included by Deci et al. (1999a) or Cameron et al. (2001).
Williams (1980)	E, F, S, 1	
Wimperis & Farr (1979)	TN, C, S, 2	
Zinser et a. (1982)	V, F, 1	

Abbreviations. NV = negative feedback; V = positive feedback: TN = task-noncontingent rewards; U = unexpected rewards; E = engagement-contingent rewards; C = completion-contingent rewards; P = performance-contingent rewards; F = free-choice behavior/persistence measure; S = self-report interest/enjoyment measure 1 = subjects were children; 2 = subjects were university students; 3 = subjects were adults.

Not included by Deci et al. (1999a) or Cameron et al. (2001): Either the study in question was published after the meta-analyses by Deci et al. (1999a), and Cameron et al. (2001) were published, the aforementioned meta-analyses did not locate the study, or the study was excluded for some unknown reason.

Appendix 2 A list of studies in the supplementary analysis of the effects of reward nonattainment on intrinsic motivation.

Studies used in the supplementary meta-analysis of partial reward nonattainment vs. control

Study	**Reward contingencies and measures**	**Additional remarks**
Burroughs et al. (2011)	NR, S, 2	Not included by Deci et al. (1999) or Cameron et al. (2001).
Pritchard et al. (1977)	NR, F, S, 2	
Vansteenskiste & Deci (2003)	NR, F, S, 2	For the supplementary analysis of partial reward nonattainment versus no-reward controls, condition 3 (losing a competitively contingent reward) was included in the analysis. Not included by Deci et al. (1999) or Cameron et al. (2001).
Wehe et al. (2015)	NR, F, 2	Not included by Deci et al. (1999) or Cameron et al. (2001).

Abbreviations. NR = partial or complete reward nonattainment; F = free-choice behavior/persistence measure; S = self-report interest/enjoyment measure 1 = subjects were children; 2 = subjects were university students; 3 = subjects were adults.

Not included by Deci et al. (1999) or Cameron et al. (2001): Either the study in question was published after the meta-analyses by Deci et al. (1999a), and Cameron et al. (2001) were published, the aforementioned meta-analyses did not locate the study, or the study was excluded for some unknown reason.

Appendix 3 A list of studies included in the meta-analysis of observational studies.

Studies included in the meta-analysis of observational data. All studies used self-reported measures of intrinsic motivation.

Study	Reward contingencies and measures	Additional information (e.g., type of employees)
Biron & Hanuka (2018)	BS, O, L	Knowledge workers at a multinational high-tech company.
Cho & Perry (2012)	PBR, S, C	Public sector employees.
Daley (1987)	PBR, S, C	Mid-level managers and senior executive service personnel.
Deckop & Circa (2000)	PBR, S, L	College faculty.
Eisenberger, Rhoades, & Cameron (1999) Study 3	V, PBR, S, C	Salespeople and sales-support employees. The study also reported a correlation between hourly pay and intrinsic work motivation. However, that correlation coefficient was excluded from the analysis because it was unclear whether the variable pay was subsumed into the amount of hourly pay.
Eisenberger & Aselage (2009) Study 1	PBR, S	A sample of alumni of one U.S.-based university.
Eisenberger & Aselage (2009) Study 2	PBR, S	A sample of alumni of one U.S.-based university.
Fang & Gerhart (2012)	PBR, O	White-collar employees from eight Taiwanese companies (various industries). A human resources manager of each company reported the perceived strength of the work performance – PBR linkage.
Guo et al. (2014)	V, S, C	Employees' work tasks were undefined. 55.71% had a bachelor's degree or higher.
Hadi & Adil (2010)	V, S, C	Male bankers.
Hartmann & Slapnicar (2012)	PBR, O, C	Upper-middle managers from the banking sector (12 different banks included).
Hewett & Leroy (2019)	PBR, O, C	Type of sample vaguely described. Office-based employees doing highly complex work (75% had completed a university degree and 40% post-graduate degrees).
Jordan (1986)[a]	PBR, O[a], L	Healthcare technicians.
Kominis & Emmanuel (2007)	PBR, S, C	Middle-level managers at a large UK-based financial institution.
Kuvaas (2006)	BS, PBR, S, C	Mostly knowledge workers from two units of a multinational conglomerate (energy-intensive industry).
Kuvaas (2009)	BS, S, C	Public sector workers (40% had completed a university degree).

Kuvaas et al. (2016)	BS, PBR, O, L	Salespeople.
Kuvaas et al. (2020)	PBR, O/S, L	Employees of an international relation company (a time-lagged study).
Li et al. (2017)	PBR, S, L	Office employees. Time-lagged design. Education level unspecified. PBR scale reflected both tangible and intangible (e.g., recognition) rewards.
Lopez (1981)	PBR, O[a]	Telephone operators. Median education level was high school.
Malik et al. (2015)	PBR, S, C	A heterogeneous sample of employees. The PBR scale reflected both tangible and intangible (e.g., recognition) rewards.
Malik et al. (2019)	PBR, S, C	A heterogeneous sample of employees. The PBR scale reflected both tangible and intangible (e.g., recognition) rewards.
Mallin & Pullins (2009)	PBR, S, C	Salespeople. Education level not reported PBR amount (%) reported.
Olafsen et al. (2015)	BS, S, C	Bank employees. Approx. 62% had completed a higher education degree.
Ren et al. (2017)	PBR, S, C	Employees of a privately owned Chinese company in the beauty industry. Junior college or below. Employee tasks were not disclosed.
Reychav & Sharkie (2010)	TCR, S, C	Employees of five local government authorities in Australia.
Salamin (2000)	BS, PBR, S, C	Bank employees, education undisclosed.
Thibault Landry et al. (2017a) Study 1	PBR, S, C	A heterogeneous sample of workers.
Thibault Landry et al. (2017a) Study 2	PBR, S, L	Technology company employees. Time-lag design.
Thibault Landry et al. (2017a) Study 3	PBR, S, L	Financial advisors (time-lag design / multi-wave design).
Thibault Landry et al. (2017b) Study 1	PBR, S, C	A heterogeneous sample of workers. Over 70% had completed a bachelor's degree or higher.
Thibault Landry et al. (2017b) Study 2	PBR, S, C	A heterogeneous sample of workers. Over 90% had completed two or more years of college.
Thibault Landry et al. (2019) Sample 1	PBR, S, C	A heterogeneous sample of workers. Almost 85% had completed a bachelor's degree or higher.
Thibault Landry et al. (2019) Sample 2	PBR, S, C	A heterogeneous sample of workers. Over 83% had completed a bachelor's degree or higher.
Thibault Landry et al. (2019) Sample 3	PBR, S, C	A heterogeneous sample of workers. Almost 71% had completed a bachelor's degree or higher.

Van der Hauawert & Bruggeman (2015)	PBR, S, C	Middle- and top-level managers from the industries of production, development, logistics, and shared service centers.
Van Herpen et al. (2005)	PBR, S, C	Publishing company employees (e.g., editorial staff, salespeople, marketing). Educational level undisclosed.
Wenzel et al. (2019)	PBR, S, C	A heterogeneous sample of public service employees. Educational level undisclosed.
Wilkesmann & Schmid (2014)	PBR, S, C	Professors
Yoon et al. (2015)	PBR, S, C	Financial planners working at an insurance company
Zhang et al. (2015) Study 1	PBR, S, C	Employees in technical positions, multiple different firms.
Zhang et al. (2015) Study 2	PBR, S, C	Middle-level hospital employees, multiple hospitals.

Abbreviations. PBR = performance-based rewards, BS = base salary, TCR = task-contingent rewards, S = self-reported (subjective) pay/reward measure, O = objective reward measure, O/S = both objective and subjective measures of rewards, C = cross-sectional study, L = longitudinal study

[a] The study did not measure the independent (i.e., reward) variable but reported a change in intrinsic motivation between two measurement points for those whose reward was contingent on performance and those whose pay remained fixed.

[b] The study did not measure the independent (i.e., reward) variable. Instead, the study reported a change in intrinsic motivation between two measurement points, and the change was attributed to extrinsic rewards.

Appendix 4 Funnel plots – experimental studies.

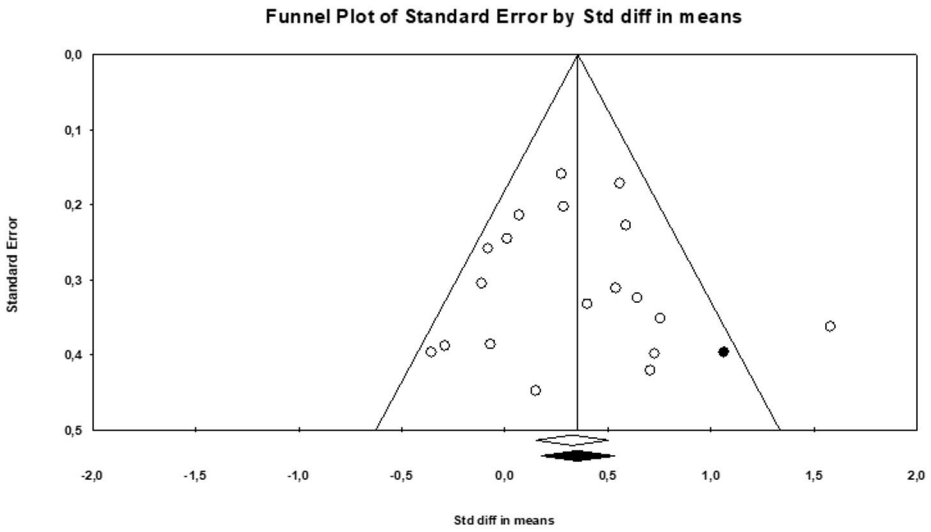

Figure 23 Funnel plot for the effects of positive feedback on free-choice intrinsic motivation (with imputed studies).

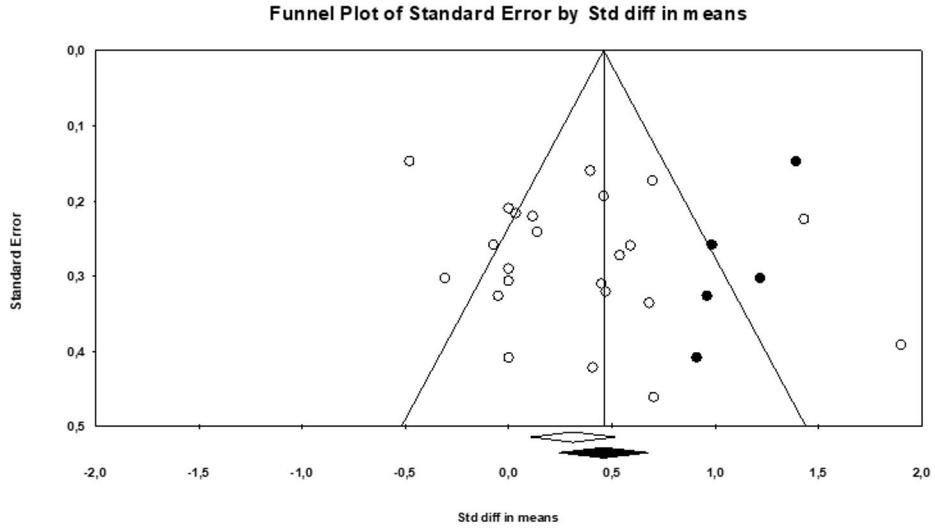

Figure 24 Funnel plot for the effects of positive feedback on self-reported interest (with imputed studies).

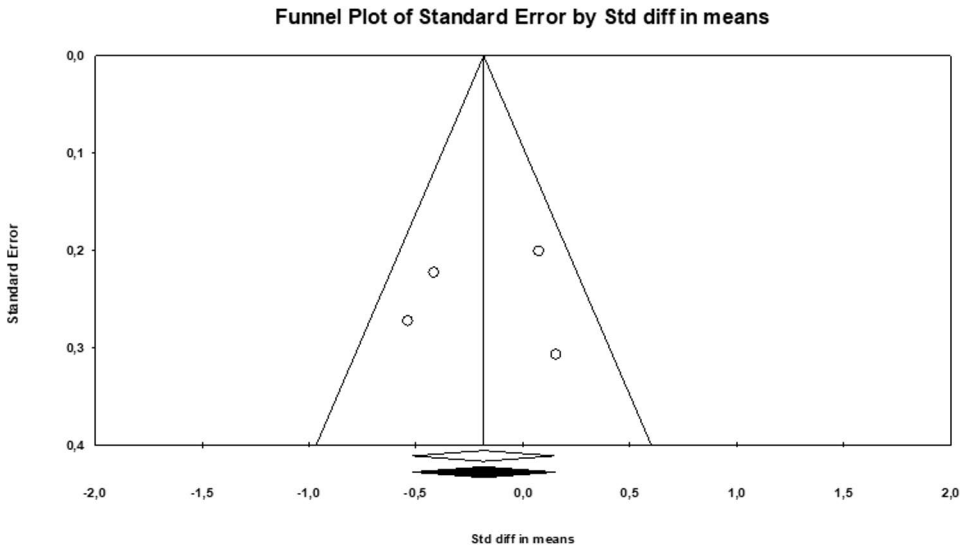

Figure 25 Funnel plot for the effects of negative feedback on self-reported interest (no imputed studies)[79,80].

[79] The trim-and-fill analysis suggested that no studies were missing from the analysis.

[80] As only two studies were available for the analysis of the effects of negative feedback on free-choice intrinsic motivation, examining the effect of publication bias or presenting a funnel plot was not possible.

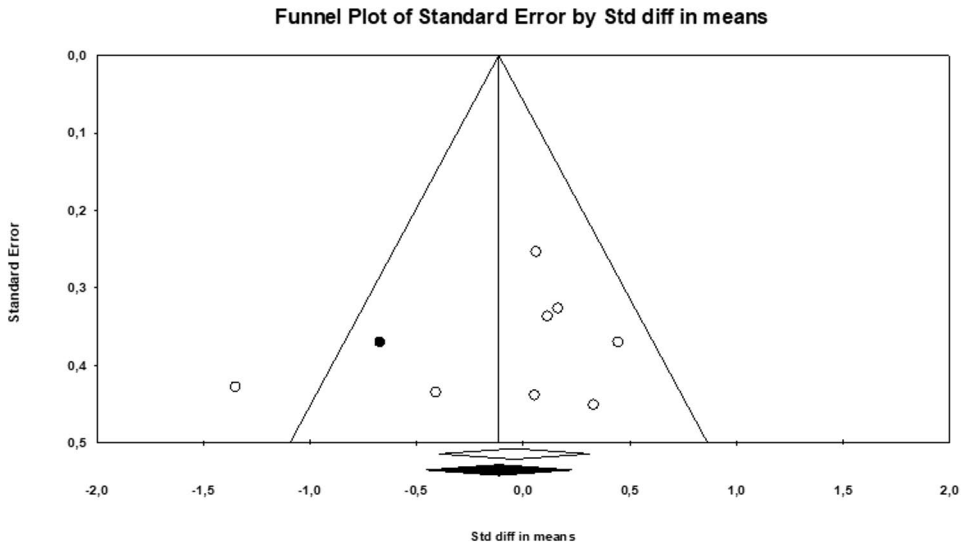

Figure 26 Funnel plot for the effects of unexpected rewards on free-choice intrinsic motivation.

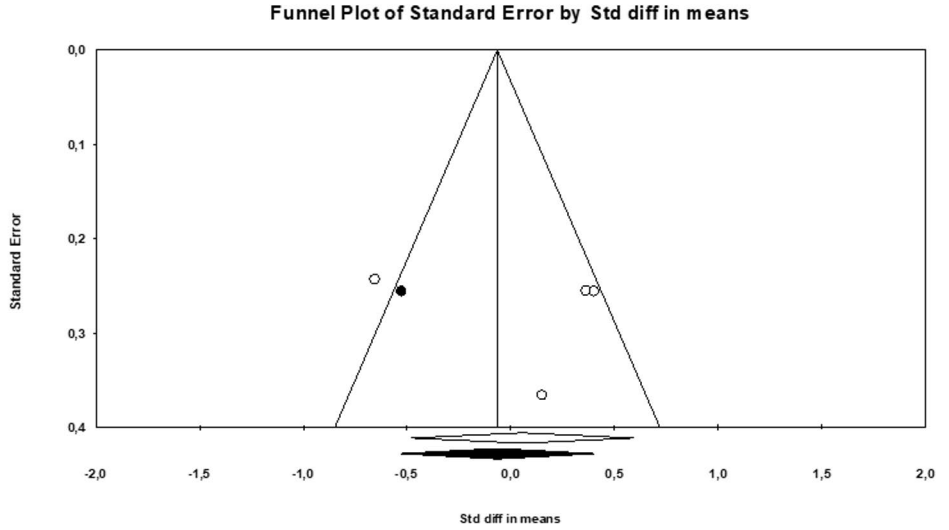

Figure 27 Funnel plot for the effects of unexpected rewards on self-reported interest (with imputed studies).

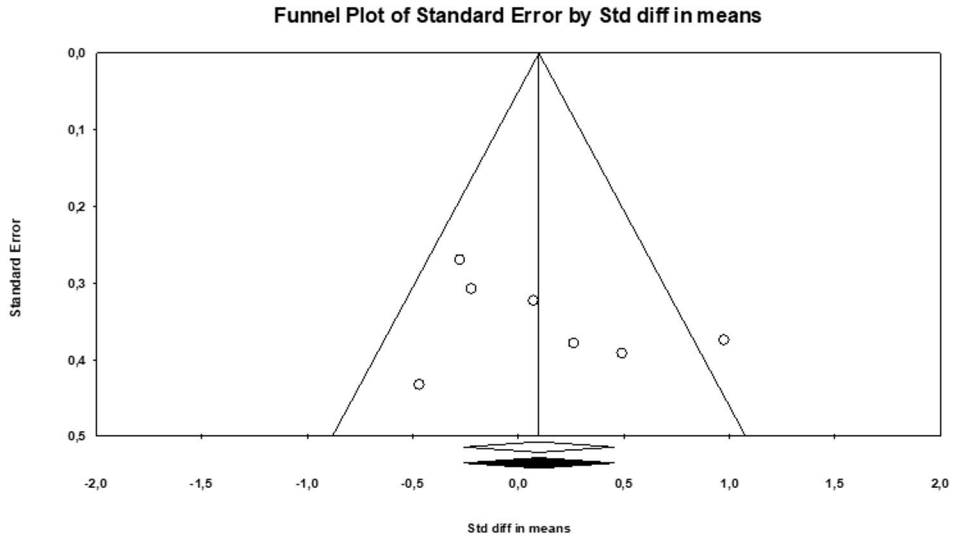

Figure 28 Funnel plot for the effects of task-noncontingent rewards on free-choice intrinsic motivation (no imputed studies)[81].

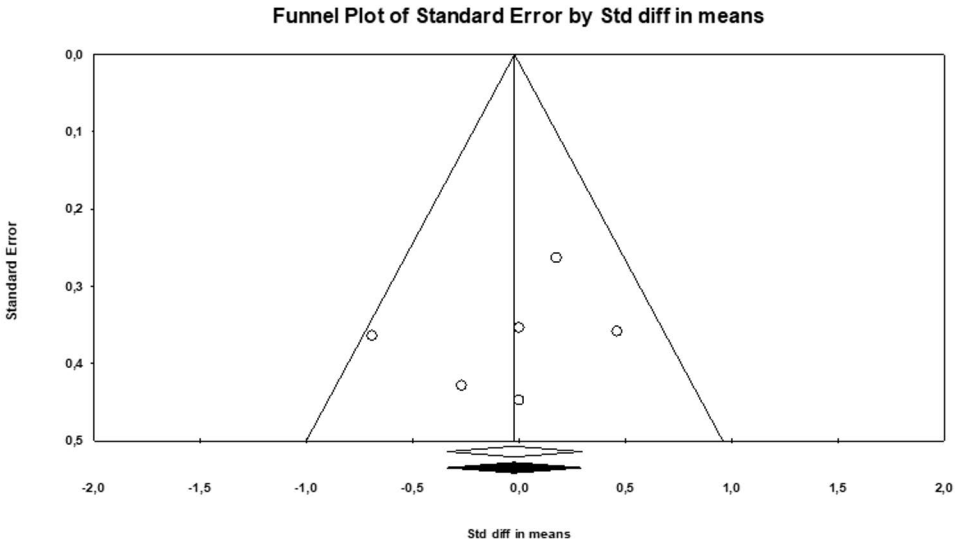

Figure 29 Funnel plot for the effects of task-noncontingent rewards on self-reported interest (no imputed studies)[82].

81 The trim-and-fill analysis suggested that no studies were missing from the analysis.
82 The trim-and-fill analysis suggested that no studies were missing from the analysis.

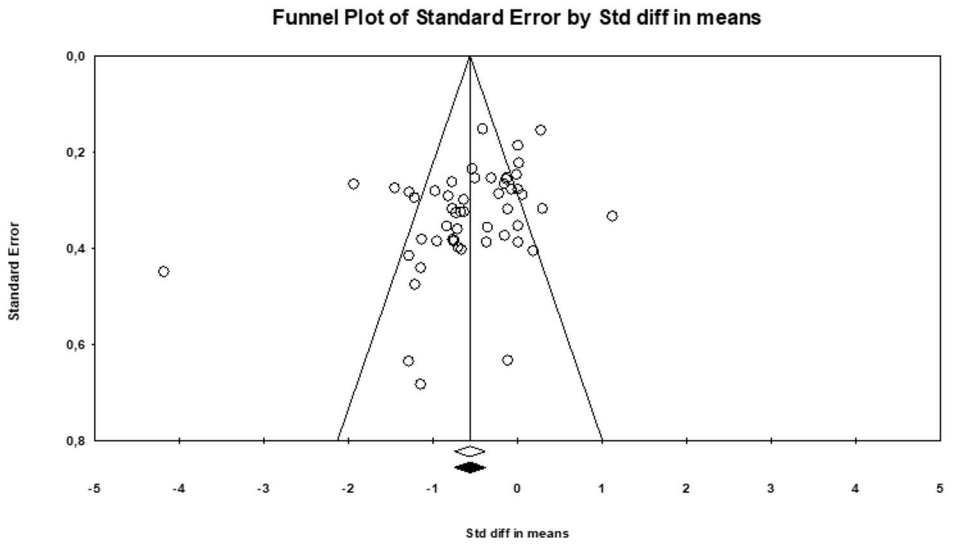

Figure 30 Funnel plot for the effects of engagement-contingent rewards on free-choice intrinsic motivation (no imputed studies)[83].

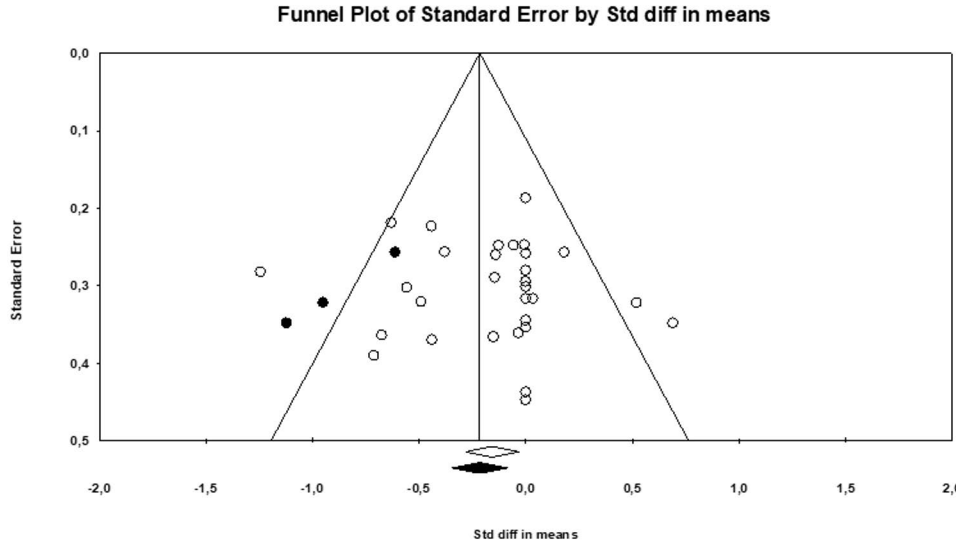

Figure 31 Funnel plot for the effects of engagement-contingent rewards on self-reported interest (with imputed studies).

[83] The trim-and-fill analysis suggested that no studies were missing from the analysis.

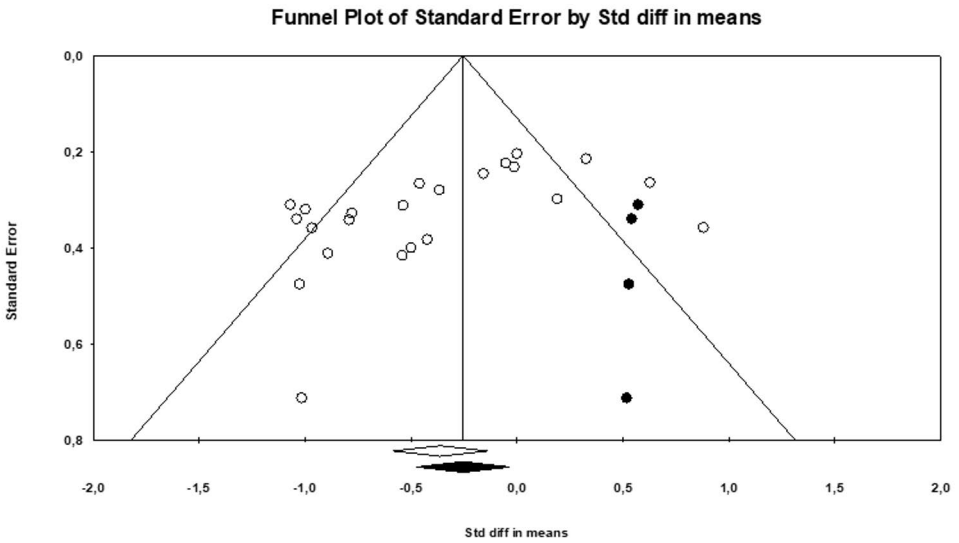

Figure 32 Funnel plot for the effects of completion-contingent rewards on free-choice intrinsic motivation (with imputed studies).

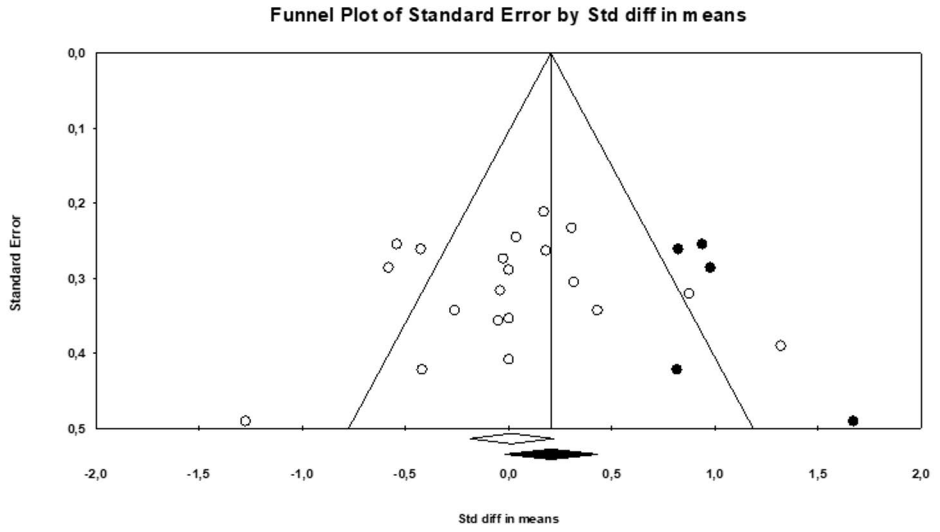

Figure 33 Funnel plot for the effects of completion-contingent rewards on self-reported interest (with imputed studies).

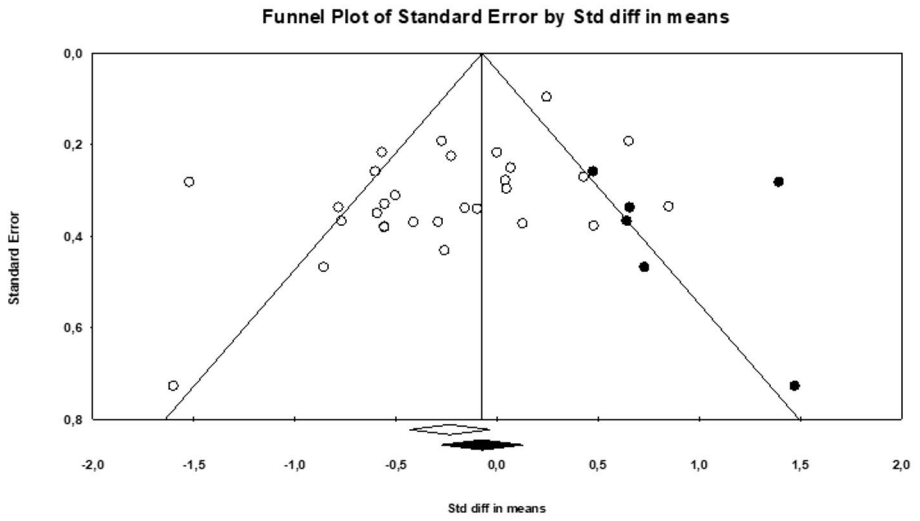

Figure 34 Funnel plot for the effects of performance-contingent rewards on free-choice intrinsic motivation (with imputed studies).

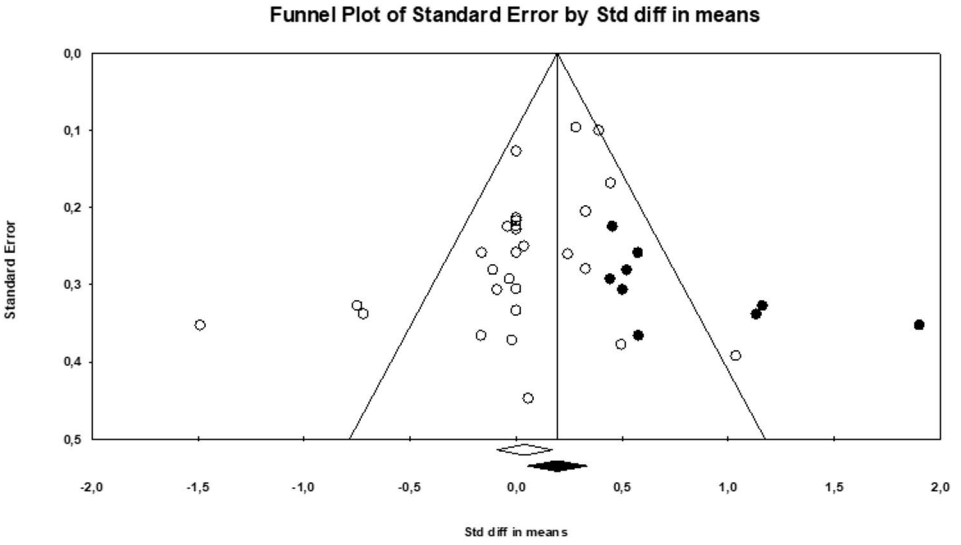

Figure 35 Funnel plot for the effects of performance-contingent rewards of self-reported interest (with imputed studies).

Appendix 5 Funnel plots for observational studies.

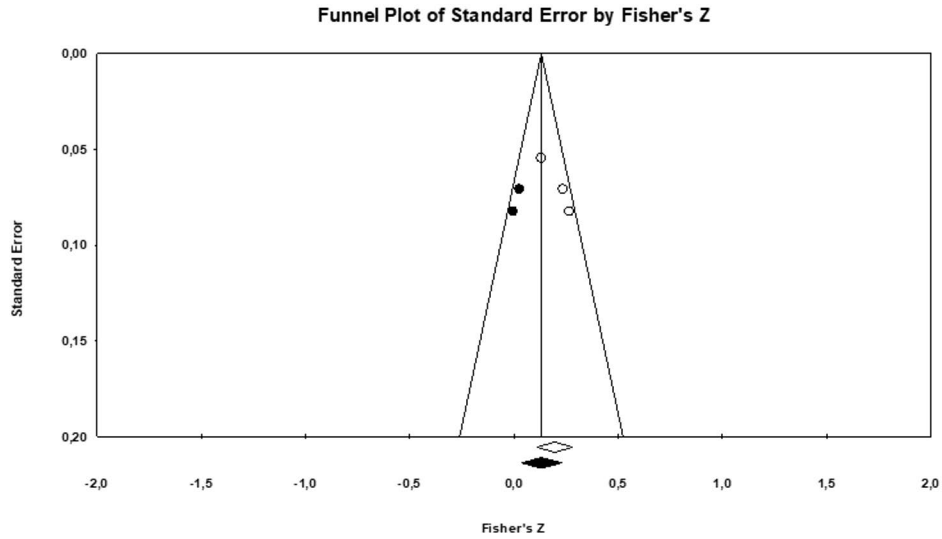

Figure 36 Funnel plot for the relationship between self-reported positive feedback and self-reported intrinsic work motivation (with imputed studies).

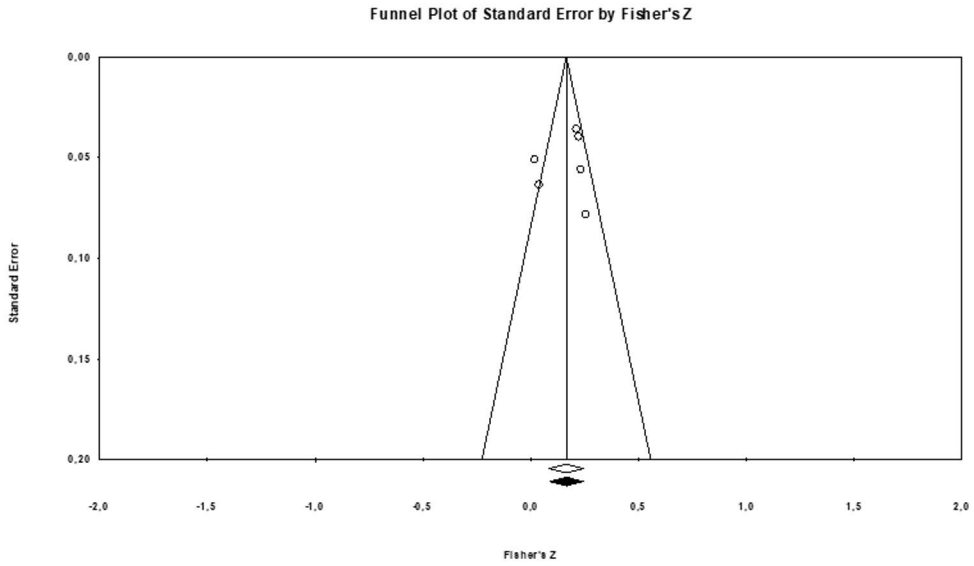

Figure 37 Funnel plot for the relationship between base salary and self-reported intrinsic work motivation (no imputed studies)[84].

[84] The trim-and-fill analysis suggested that no studies were missing from the analysis.

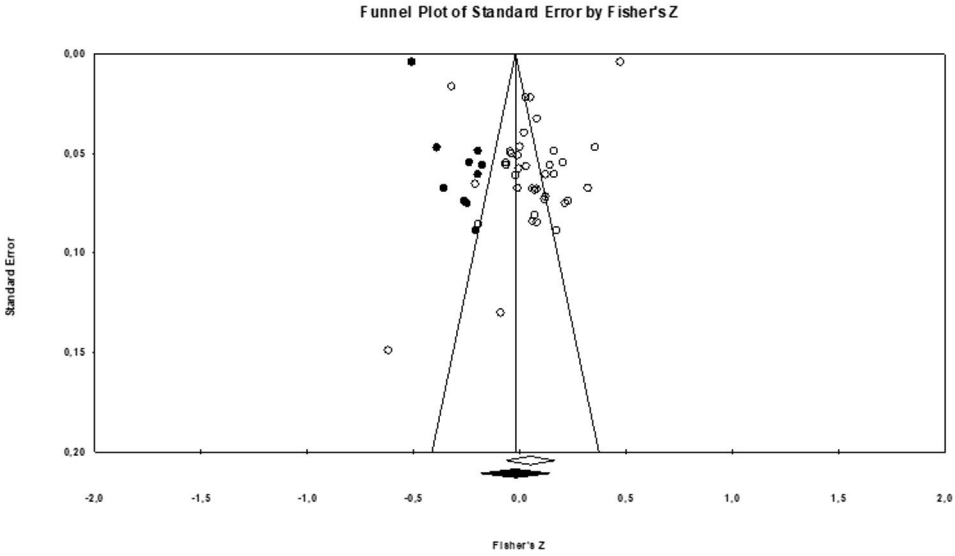

Figure 38 Funnel plot for the relationship between performance-based rewards and self-reported intrinsic work motivation (with imputed studies).

Appendix 6 An example of the utilized search terms and phrases.

Database	Search terms and phrases
PsycINFO	"intrinsic motivation" AND "ext* rewar*" AND effect*
	“intrinsic motivation" AND "ext* rewar*" AND affect*
	reinforce* AND “intrinsic motivation”
	underm* AND “intrinsic motivation”
	overjustific* AND “intrinsic motivation”
	"intrinsic motivation" AND pay for per*
	“intrinsic motivation” AND AND "performance-contingent rewa*"
	“intrinsic motivation” AND incentive*
	"intrinsic motivation" AND "ext* rewar*" AND effect*
	"intrinsic motivation" AND "ext* rewar*" AND affect*
	”verbal reward*” AND ”intrinsic motivation”
	Feedback AND “intrinsic motivation”
	prais* AND "intrinsic motivation
	"intrinsic motivation" AND "performance-based pay"
	"intrinsic motivation" AND "performance-based pay*"
	"intrinsic motivation" AND "pay for performance"
	"intrinsic motivation" AND "performance-related pay"
	"intrinsic motivation" AND "merit pay"
	"Bonus*" AND "intrinsic* motivat*"
	"Pay*" AND "intrinsic* motivat*"
	"performance-related pay*" AND "intrinsic* motivat*"
SocINDEX	"intrinsic motivation" AND ext* rewar* AND effect
	"intrinsic motivation" AND ext* rewar* AND affect
	Reinforc* AND “intrinsic motivation”
	Underm* AND “intrinsic motivation”
	Overjustific* AND “intrinsic motivation”
	“intrinsic motivation” AND “pay for per*”
	"intrinsic motivation" AND "performance-contingent rewa*"
	“Intrinsic motivation” AND incentive*
	"intrinsic motivation" AND ext* rewar* AND effect*
	"intrinsic motivation" AND ext* rewar* AND affect*
	“verbal reward*” AND “intrinsic motivation”
	Feedback AND “intrinsic motivation”
	Prais* AND "intrinsic motivation"
Wiley Online Library	"intrinsic motivation" AND ext* rewar* AND effect
	"intrinsic motivation" AND ext* rewar* AND affect
	Reinforcement AND “intrinsic motivation”
	Undermining AND “intrinsic motivation”
	Overjustific* AND “intrinsic motivation”
	"intrinsic motivation" AND pay for per*
	"intrinsic motivation" AND performance-contingent rewa*
	"intrinsic motivation" AND incentive*
	“intrinsic motivation" AND ext* rewar* AND effect *

	“intrinsic motivation" AND ext* rewar* AND affect*
	“Verbal reward” AND “intrinsic motivation”
	Feedback AND “intrinsic motivation”
	Prais* AND “intrinsic motivation
	Pay AND “intrinsic motivation”
	“Pay for performance” AND “intrinsic motivation”
	“Performance-based pay” AND “intrinsic motivation”
	Bonus AND “intrinsic motivation”
	“performance-related pay” AND “intrinsic motivation”
	merit pay AND
ABI/INFORM Collection	"intrinsic motivation" AND "ext* rewar*" AND effect
	"intrinsic motivation" AND "ext* rewar*" AND affect
	reinforcement AND " intrinsic motivation "
	underm*AND "intrinsic motivation"
	overjustificat* AND “intrinsic motivation”
	“intrinsic motivation" AND pay for performance (Note: "pay for performacen" was also used)
	"intrinsic motivation" AND "performance-contingent rewa*"
	"intrinsic motivation" AND incentive*
	“intrinsic motivation" AND "ext* rewar*" AND effect*
	intrinsic motivation" AND "ext* rewar*" AND affects*
	“verbal reward*” AND “intrinsic motivation”
	Feedback AND “intrinsic motivation”
	Prais* AND “intrinsic motivation”
	"Pay*" AND "intrinsic* motivat*"
	"performance-based pay*" AND "intrinsic* motivat*"
	"Bonus*" AND "intrinsic* motivat*"
	"performance-related pay*" AND "intrinsic* motivat*"
Science Direct[a]	"intrinsic motivation" AND extrinsic reward AND effect
	"intrinsic motivation" AND reward AND effect
	"intrinsic motivation" AND extrinsic reward AND affect
	"intrinsic motivation" AND reward AND affect
	reinforcement AND "intrinsic motivation"
	undermining AND "intrinsic motivation"
	overjustification AND “intrinsic motivation”
	“intrinsic motivation" AND pay for performance (search term “pay for performance” was also included)
	“Intrinsic motivation” AND “performance-contingent reward”
	"intrinsic motivation" AND incentive
	“verbal reward” AND “intrinsic motivation”
	Feedback AND “intrinsic motivation”
	Praise AND “intrinsic motivation”
	Pay AND “intrinsic motivation”
	"performance-based pay" AND "intrinsic motivation”
	“Pay for performance” AND “intrinsic motivation"
	"Bonus" AND "intrinsic* motivation"
	“performance-related pay” AND “intrinsic motivation”

Emerald Journals (Emerald)	intrinsic motivation" AND ext* rewar* AND effect* "intrinsic motivation" AND "ext* rewar*" AND affect* Reinfor* AND “intrinsic motivation Underm* AND ”intrinsic motivation” overjustific* AND "intrinsic motivation" "intrinsic motivation" AND pay for per* "intrinsic motivation" AND "performance-contingent rewa* "intrinsic motivation" AND incentive* "verbal reward" AND "intrinsic motivation" feedback AND "intrinsic motivation" Prais* AND "intrinsic motivation"
Business Source complete (EBSCO)	"intrinsic motivation" AND ext* rewar* AND effect* "intrinsic motivation" AND ext* rewar* AND affect* reinforc* AND “intrinsic motivation” underm* AND “intrinsic motivation” overjustific* AND “intrinsic motivation” "intrinsic motivation" AND pay for per* "intrinsic motivation" AND performance-contingent rewa* "intrinsic motivation" AND incentive* “verbal reward*” AND “intrinsic motivation” feedback AND "intrinsic motivation" Prais* AND "intrinsic motivation" "Pay*" AND "intrinsic* motivat*" "performance-based pay*" AND "intrinsic* motivat*" "Bonus*" AND "intrinsic* motivat*" "performance-related pay*" AND "intrinsic* motivat*"

[a] Wildcard symbols not supported
* = wildcard symbol
“ – “ = apostrophes were used

[i] An exploratory examination of Quattrone’s (1985) postulate was conducted by comparing the mean effect sizes of those studies using both intrinsic motivation measures to those using only self-report measures. The analysis was limited to engagement-contingent rewards and completion-contingent rewards to reduce unnecessary variation in effect sizes. Statistical results showed the composite effect for self-reported interest did not differ between studies in which self-reported interest was the only measure of intrinsic motivation (d = –0.03, 95% CI = –0.24, 0.17; k = 36 studies) or in which self-reported interest was measured after free-choice persistence (d = –0.12, 95% CI = –0.25, 0.02; k = 36 studies), $Q_b(1) = 0.45$, p = 0.50. Interestingly, the trend of effects is opposite of what Quattrone (1985) suggested. Moreover, the latter composite effect size (d = –0.12, p = 0.086) was marginally significant. However, it must be emphasized that more research is needed before drawing any generalizable conclusion about Quattrone’s (1985) suggestion in this research context.

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