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We Know This Much is (Meta-Analytically) True:**A Meta-Review of Meta-Analytic Findings Evaluating Self-Determination Theory**

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Transparency and Openness: The complete data that underpin this narrative synthesis of meta-analyses is included in Online Supplementary Materials Table S1. This review of meta-analyses was not preregistered.

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Abstract

Self-determination theory (SDT) is a theoretical framework for addressing human motivation and wellness that has been actively and increasingly researched over four decades. As a cumulative knowledge base, many of SDT's fundamental tenets have been repeatedly examined. We identified 60 meta-analyses that tested many of the propositions of SDT's six mini-theories, other theory-based hypotheses, and SDT's utility in applied domains. In this review we examine what these meta-analyses establish, highlighting the support they lend to the validity of SDT's motivational taxonomy and its hypotheses regarding the respective effects of basic psychological need satisfaction and frustration on well-being and ill-being. Meta-analytic evidence also strongly supports the relevance of SDT for organizations, health care, parenting, and education among other domains, with identifiable gaps in the meta-analytic literature. We conclude by discussing the importance of broad theory and the use of meta-analytic knowledge as scaffolding for further theory and research, albeit with its own methodological limitations.

Keywords: self-determination theory, meta-analysis, basic psychological needs, autonomy, intrinsic motivation

Public significance statement: This systematic review includes a comprehensive narrative synthesis of sixty meta-analyses, each of which tests various principles from Self-Determination Theory (SDT). Such a review is of broad public significance because SDT has become one of the most widely applied approaches to human motivation and is the basis for interventions in many domains including work and organizations, healthcare, education, physical activity, and sport, among others.

Self-determination theory (SDT; Ryan & Deci, 2017) is a broad theory of human motivation, personality development, and well-being that has emerged as among the most researched and applied in psychology today. In part, this strong interest in SDT stems from the theory's relatively unique focus on the important issues of human autonomy and volition, and how support for people's basic psychological needs for autonomy, competence, and relatedness can enhance learning, personality and identity growth, and sustained behavior change. SDT is therefore relevant not only to the basic science of motivation and development, but also to applied fields as diverse as parenting, education, organizations, sport, healthcare, and technology (Ryan, Soenens, & Vansteenkiste, 2019). In all these areas of life, SDT assumes that the extent to which people undertake tasks and activities with a sense of choice, ownership, and agency is linked with higher quality performance, greater persistence, and higher well-being when compared to more controlled forms of motivation.

SDT began in the 1970s with studies on the facilitation and undermining of *intrinsic motivation*—or activities done for inherent enjoyment (Deci & Ryan, 1980). From there, the theory expanded to *extrinsic motivation* and to model the drivers of extrinsic or instrumental behaviors as they vary in their relative autonomy (Ryan & Connell, 1989). Based on repeated empirical findings that social and intra-personal supports for autonomy, competence, and relatedness enhanced not only high-quality motivation but also individual's reports of wellness and vitality, SDT expanded to address well-being and life goals (Ryan & Deci, 2000; 2017), establishing it as a fuller framework for the study of personality (Sheldon & Prentice, 2019).

Among major theories of human motivation, SDT's emphasis on autonomy and basic need satisfaction early on stood in contrast to behavioral theories that largely focused on external causation of actions (e.g., Skinner, 1971), and to cognitive theories which focused on the mediation of such external causation (Bem, 1972). It also contrasts with Bandura's social-

cognitive theory (SCT; Bandura, 1989). Although both SDT and SCT view experiences of competence as essential to self-motivation, Bandura explicitly denied the importance of autonomy and more generally eschewed the concept of psychological needs. In contrast, more recent “third wave” behaviorists have taken interest in issues of basic psychological needs and the importance of autonomy and relatedness, including *acceptance and commitment therapy* (e.g., Hayes, 2019) and *motivational interviewing* (e.g., Markland et al., 2005; 2007) among other contemporary approaches to behavior change.

Because SDT’s organismic approach focuses on basic psychological needs as essential foundations of growth and wellness, it interfaces with theoretical work by Doyal and Gough on basic needs (see Dover, 2016; Doyal & Gough, 1991; Gough, 2019). SDT constructs have also been applied within *Personality Systems Integration* (PSI) theory (Kuhl & Bauman, 2021; Kuhl, Quirin & Koole, 2015), especially regarding measurement and hypotheses concerning autonomy (Bauman & Kuhl, 2005; Koole, et al 2019). SDT overlaps with Leary and Baumeister’s (2000) *sociometer theory* in focusing on the psychological need for belonging or relatedness as central to healthy self-functioning, using similar criteria in defining relatedness as a basic need. SDT has also been integrated with the theory of planned behavior (TPB; Ajzen, 1985), with autonomous motivation as defined in SDT being positively and significantly associated with TPB factors, behavioral intentions, and adherence (e.g., see Wan, Hagger et al., 2022). Finally, because SDT is a broad framework, it has inspired related theories such as Vallerand’s (2015) theory of harmonious and obsessive passion and Sheldon and Elliot’s (1999) self-concordance theory, among others.

An important and guiding focus of SDT is providing an evidence-based framework for real-world practice and interventions. As a general theory, SDT expresses broad principles expected to generalize across domains of activity, so examining SDT’s propositions and hypotheses in distinct contexts is important both for basic theory testing and

differentiations and refinements, as each domain of application involves its own unique embodiments of SDT variables and challenges to the theory's implementation. Thus, coaches' autonomy support and control on the sports field differs from autonomy and control in the clinic in both content and social context. Secondly, the effects of SDT interventions can also be meta-analytically reviewed, as has been done with other behavior change approaches such as "nudge" (Mertens et al., 2022; Maier et al., 2022) or mindset (Yeager & Dweck, 2020) interventions.

Recently, Ryan and Deci (2019) described the development of SDT over a four-decade period as a "brick by brick" (p. 111) process of conservatively building upon an open and convergent evidence base. One advantage of a slow-maturing theory is that it can generate sufficient research to allow for meta-analyses. In this article we take stock of 60 meta-analyses that have tested various hypotheses and propositions derived from SDT, discussing their significance, overlap, and meaning, as well as identifying gaps in the literature where more data is needed. Determining what is meta-analytically supported within and between parts of SDT can reveal the relative solidity of its current theoretical propositions, applications, and interventions, as well as foundations that remain in need of further testing.

Why Meta-Analyses?

Meta-analyses are reviews that combine empirical results from multiple studies with the typical purpose of estimating the reliability and magnitude of effect sizes and research findings testing specific hypotheses. Data across studies are systematically gathered from the literature, analyzed, and evaluated. In contrast to narrative reviews, meta-analyses provide a statistically focused evaluation of collective findings, potentially reducing interpretive biases. Meta-analyses also enhance understanding of effect sizes and their heterogeneity, which can

help identify potential sources of measurement error, moderating variables (or the need to look for them), and limiting conditions.

As a widely engaged theory of motivation and wellness and the conditions that facilitate them, SDT has forwarded many empirical claims that have been widely tested. Some of these claims are in the form of formal theoretical propositions (see Supplemental Material, Table S2), and others are hypotheses following from or extending elements of the theory or its principles of application. Many arguments central to SDT entail universal claims or principles that are argued to apply across genders, age groups, countries, cultures, and contexts. Meta-analysis is an apt method for assessing such claims of universality because it allows group-level variables (e.g., age, cultural membership) to be included as possible moderators of a specific pooled effect. Depending upon the availability of sufficient data, if a group-level variable does not substantially moderate the main effect, it can be considered common across groups. Noting that occasional anomalous results could be a function of Type I or Type II errors, sample characteristics rather than population characteristics, or various method effects, pooling effect sizes and assessing moderators meta-analytically thus contributes to greater rigor when estimating the “true” effects across studies.

Meta-analyses are also valuable because they facilitate the identification of gaps and guide maturing fields of research toward addressing unanswered questions. At a certain point, additional studies of the same variables in similar contexts using identical outcomes contribute little new knowledge. Therefore, meta-analyses facilitate the identification of effects both for which there is little data or support, and those with more robust standing. Meta-analyses also can be used to identify variation in effect sizes beyond sampling error, or *heterogeneity* (Higgins & Thompson, 2002), which can suggest the presence of potential moderators and measurement variations, and thus areas in need of further research.

Finally, meta-analyses are also instrumental in quantifying the strength of relations between constructs. Meta-analyses allow for the calculation of average effect sizes and the comparison of these values against other known effects and established thresholds.

Historically, the import and utility of statistical effects have been interpreted according to the effect size thresholds proposed by Cohen (1988). Cohen (1988) recommended interpreting $r = .10$, $r = .30$, and $r = .50$ as small, medium, and large effects, respectively. Yet more recent research has indicated that Cohen's (1988) interpretations may be too stringent (Gignac & Szodorai, 2016). In their review of 708 meta-analytic effects, Gignac and Szodorai (2016) reported that $r = .11$, $r = .19$, and $r = .29$ represented the 25%, 50%, and 75% percentiles of the observed effects, respectively. In a similar vein, Funder and Ozer's (2019) review of effect size benchmarks and the "concrete consequences" (p. 156) associated with them reported that $r = .05$ is a very small effect, $r = .10$ is a small effect that has more potential to be consequential, $r = .20$ is a medium-sized effect that could be meaningful in the short- and long-term, and $r = .30$ is a large effect that is likely substantially consequential in the short- and long-term.

Gignac and Szodorai's (2016) and Funder and Ozer's (2019) conclusions are just two examples of a growing consensus (e.g., Brydges, 2019; Hemphill, 2003) that Cohen's (1988) threshold "overestimate effect sizes" (Brydges, 2019, p. 1). These more recent studies of effect sizes (Brydges, 2019; Funder & Ozer, 2019; Gignac & Szodorai, 2016; Hemphill, 2003) refocus the interpretation on representativeness and probable utility. As a result, the field has an updated yardstick for the evaluation of effect sizes, particularly meta-analytic effects. Instead of the average effect size in psychology ($r = .21$; Richard et al., 2003) being a small effect (according to Cohen's (1988) guidelines), evidence increasingly suggests that such effects are medium-sized, or "typical" (Gignac & Szodorai, 2016, p. 75), and possibly of explanatory and practical utility in both the short- and long-term. That said, one also expects

variations in effect size, both because in SDT the strength of relations is predicted to vary for substantive reasons (e.g., as a function of relative autonomy), and because effect sizes vary in magnitude because of factors such as shared method variance or overlaps in content. Thus, effect sizes must always be interpreted in both theoretical and methodological context. In this review we hope to capture what meta-analytic studies have identified with respect to the constructs and assumptions underpinning SDT.

Self-Determination Theory in Brief

SDT is an *organismic psychology*, concerned with the active organization and development of the self (Ryan & Deci, 2017). As an organismic approach, SDT assumes humans are inherently prone toward active assimilation and integration when under nurturing or supportive conditions (Ryan, 1995). Conversely, it proposes that deprivations in psychological nurturance and supports can lead to passivity, defensiveness, integrative blocks, and compromised functioning (Ryan et al., 2016; Vansteenkiste & Ryan, 2013). In understanding the effects of contexts on psychological development and wellness, SDT focuses on three *basic psychological needs*, those for autonomy, competence, and relatedness, of which the satisfactions are seen as essential nutriments to healthy motivation, integrative functioning and striving, and ultimately, wellness. Social environments strongly influence the satisfaction and frustration of these needs, leading to optimized versus compromised psychological functioning. Over the years, specific claims following from this “broad strokes” description of SDT have been organized as six mini-theories.

SDT’s Six Mini-Theories

SDT is currently built around six overlapping mini-theories (Vansteenkiste, Ryan, & Soenens, 2020). Each of these formal mini-theories contains a set of formal hypotheses, stated as *propositions*, which are related to numerous hypotheses. SDT’s propositions have historically been articulated after assembling convergent evidence, so as not to make errors of

commission in formal theory building (Ryan & Deci, 2019). The mini-theories also emerged individually over time in response to a widening evidence base.

SDT's first mini-theory, *cognitive evaluation theory* (CET; Deci & Ryan, 1980; 1985b) was concerned exclusively with how social and intrapersonal events and contexts affect intrinsic motivation—especially the roles of autonomy and competence satisfactions in sustaining intrinsic motivation. Subsequently, expanding from the study of intrinsic motivation, *organismic integration theory* (OIT; Ryan & Connell, 1989) was introduced to address extrinsically motivated behaviors and their internalization. It specifies a taxonomy of distinct motives or regulatory styles that systematically vary in their relative autonomy and their consequences for quality of motivation, performance, and wellness. Having developed a fuller view of motivation, a third mini-theory, *causality orientation theory* (COT; Deci & Ryan, 1985a) was proposed to address individual differences in motivational orientations and their correlates.

A turning point toward a broader theory of wellness emerged with the development of the fourth mini-theory, *basic psychological needs theory* (BPNT; Ryan, 1995; Vansteenkiste, Soenens, & Ryan, 2022). Having examined conditions supporting optimal motivation, BPNT proposes the universal importance of autonomy, competence, and relatedness satisfactions for human flourishing, and the robust role of psychological need satisfactions and frustrations in outcomes from wellness and vitality, on the positive side, to violence and psychopathology, on the negative side. *Goal contents theory* (GCT; Bradshaw, 2023; Vansteenkiste et al., 2010) built on BPNT by specifying the differing effects that intrinsic and extrinsic aspirations and life goals have on people's wellness through their impact on fundamental psychological needs. Finally, the most recent mini-theory, *relationships motivation theory* (RMT; Ryan & Deci, 2017), focuses on the motivational underpinnings of close social relationships and attachments. RMT is concerned with basic psychological need satisfactions in relationships,

in particular the mutuality of autonomy support and the positive associations between autonomy and relatedness satisfactions.

Experimental and correlational studies have empirically examined many of the hypotheses central to SDT's mini-theories. In addition, SDT-based hypotheses have proven testable and useful in a variety of specific and applied domains. In fact, many of the most important claims forwarded by SDT concern its applied value and practical import in various domains. Although the earliest applied studies occurred mainly in educational and work contexts (see Deci & Ryan, 1985b), over time research and intervention studies have accumulated, especially in the areas of health care, parenting, sport, and physical activity.

We accordingly organized this review into two parts. In *Results Part I: Meta-Analyses Related to SDT Mini-Theories* we focus on basic research testing both formal propositions and hypotheses stemming from SDT's six mini-theories. In *Results Part II: SDT Meta-Analyses in Applied Areas* we focus on meta-analyses examining SDT's utility in practical domains. We conclude with an overarching discussion about what the collective meta-analyses to date suggest about SDT's framework, its empirical supports, and areas of either weakness or insufficient knowledge.

Method

Search Strategy

As an initial step, records were readily identified within the personal databases of the paper's authors, each of whom is conversant in SDT, and from the Center for Self-Determination Theory website (www.selfdeterminationtheory.org), where research papers and findings are listed. Additionally, a systematic search was conducted in February 2021 using the databases APA PsycInfo, CINAHL, SPORTdiscus, ERIC, and SCOPUS; this search was later repeated at the end of July 2021. Both searches included keywords of Self-Determination Theory ("SDT" OR "Self-Determination Theory"), or Basic Psychological

Needs ("Basic Psychological Need*"), or Autonomy Support ("Autonom* Support"), and Meta-analysis (meta-analys*).

Study Selection

Studies were considered eligible for inclusion when they 1) were identified as meta-analysis or systematic review, 2) completed studies (not protocols of ongoing studies), 3) included relevant SDT variables (e.g., basic psychological need support, intrinsic/extrinsic aspirations, motivational regulation), 4) tested SDT hypotheses, and 5) were published in English. All studies suitable for screening were gathered in an Endnote library and duplicate papers were removed. Two independent reviewers then assessed the title and abstract of each study. Studies that were excluded by both reviewers were removed from the screening. Studies that were included by both reviewers proceeded to the full-text round of review. Studies for which there was rater disagreement were discussed and negotiated by the two raters. The same two reviewers then independently screened the full-texts of the remaining articles for eligibility. Any discrepancies regarding eligibility were discussed to reach consensus. When consensus was not reached, a third independent reviewer was consulted. Supplemental Material, Table S3 presents the 33 articles that were excluded at the full text review stage, along with the specific reason for exclusion.

The search and selection process ultimately resulted in 60 articles eligible for this review. Inspection of publication dates reveals that the vast majority of these reports appeared within the last 10 years (> 75%), suggesting a point at which a critical mass of studies had emerged for many SDT hypotheses to be meta-analytically examined. Of the 60 included articles, 58 were published. Although journal quality of these published articles is varied, many have appeared in top tier outlets within the field, both basic (e.g., *Psychological Bulletin*, *Journal of Personality and Social Psychology*) and applied (e.g., *Educational Psychology Review*; *Journal of Consulting and Clinical Psychology*). Noteworthy as well is

that more recent meta-analyses are better documented, typically applying methods to detect bias and outliers (e.g., funnel plots) and providing estimates of heterogeneity in effects, consistent with trends reported by Appelbaum et al., 2018).

Figure 1 provides a flow diagram of the search results and study selection steps, including the number of articles screened and excluded. Table 1 lists SDT's six mini-theories and the meta-analyses most directly related to each. We note that one mini-theory, RMT, which is the most recent in SDT's formal framework (Ryan & Deci, 2017), has no entry in its column within Table 1, already suggesting a gap in meta-analytic knowledge. Table 2 lists the applied domains and the relevant meta-analyses. There is some overlap between entries in Tables 1 and 2 because some of the primary meta-analytic tests of SDT mini-theory hypotheses and propositions have been carried out within applied domains (e.g., Fong, et al., 2019; Slemp et al., 2018).

Data Collection

We extracted the effect sizes from the eligible articles. Our goal was to describe the magnitude of the relevant effect sizes and their alignment with the hypotheses stemming from each SDT mini-theory. A secondary aim was to provide readers with a ready summary of previous meta-analytic results. A summary of all extracted effect sizes can be found in Supplemental Material, Table S1. Extracted data included the effect size, the type of effect size (e.g., Cohen's d , Pearson's r , Hedge's g , Spearman's ρ), whether the mean effect size was statistically corrected for unreliability, the mini-theory to which the effect size pertained, the topic to which the effect size pertained, and the pair of variables to which the effect size was related. To increase comparability of effect sizes across studies, we transformed all effect sizes to Pearson's r . To convert from a standardized mean difference (d) to a correlation (r) we used the formula $r = \frac{d}{\sqrt{d^2 + a}}$ where $a = 4$ as specified by Borenstein et al. (2009). In addition to meta-analytic effect sizes, Supplemental Material, Table S1 lists the number of

studies in each meta-analysis (k), the total sample size of each meta-analysis (N). Table S1 also includes Higgins' and Thompson's (2002) I^2 measure of heterogeneity, τ^2 measure of heterogeneity variance, as well as Cochran's (1954) Q statistic for each meta-analysis where these were available, to represent the percentage of variation not attributable to sampling error.

Transparency and Openness

This review was not preregistered. The complete data that underpin this narrative synthesis of meta-analyses is included in online Supplementary Materials, Table S1. To help readers locate the meta-analyses focused on testing formal propositions within each of SDT's mini-theories, we provide a listing of each of the propositions and the relevant meta-analyses and statistics (see Supplemental Material, Table S2). Note that these tests of propositions represent only a subset of the effects listed in Table S1, which reflect a broader set of questions examined meta-analytically with respect to SDT and its assumptions.

Results Part I: Meta-Analyses Related to SDT Mini-Theories

Cognitive Evaluation Theory

Cognitive Evaluation Theory (CET) developed from early experimental studies within SDT that examined the factors influencing people's intrinsic motivation for activities. Intrinsic motivation was typically assessed during behavioral "free choice" periods, operationalized as time engaged in an activity in the absence of external regulators such as rewards or interpersonal directives (Deci, 1975). These experiments primarily focused on exposing people to conditions expected to affect perceptions of *autonomy* (the sense of willing versus feeling controlled in doing something) and *competence* (one's sense of being able to effectively perform a task) (Deci & Ryan, 1980).

This SDT conceptualization of autonomy grew out of de Charms' (1968) theory of *personal causation* and the idea that intentional behaviors can vary in their *perceived locus of*

causality (PLOC). An internal PLOC refers to experiencing oneself as willingly engaged in an act, or being an “origin” (de Charms, 1968, p.272) whereas an external PLOC refers to experiencing one’s behavior as being brought about by forces external to the self, an experience that de Charms described as feeling like a “pawn” (p. 274). SDT’s conception of competence was drawn from White’s (1959) concept of effectance motivation—the desire to experience mastery and effectiveness in acting. Three central propositions concerning the main effects of situational conditions affecting intrinsic motivation emerged based on these two central constructs:

1. *Events that enhance an internal perceived internal locus of causality—or the relative autonomy of motivation—will sustain or enhance intrinsic motivation; those that foster an external perceived locus of causality—or heteronomous control over behavior—will or undermine intrinsic motivation.*
2. *Events that enhance perceived competence sustain or enhance intrinsic motivation, whereas those that diminish perceived competence decrease intrinsic motivation.*
3. *Events vary in their functional significance or meaning to the recipient. Events perceived as ‘informational’ support an internal PLOC and feelings of competence; those perceived as ‘controlling’ conduce an external PLOC and undermine intrinsic motivation; those perceived as ‘amotivating’ conduce incompetence or absence of value. Whereas events experienced as informational support intrinsic motivation, those experienced as controlling or amotivating undermine intrinsic motivation.*

This third proposition regarding functional significance suggests that experiences of autonomy versus control, and of competence versus lack of it, mediate the relations between external events and their positive, neutral, or negative effects on intrinsic motivation. This proposition is important in part because it suggests that an external pressure, such as a deadline, demand, or a constraining rule can have a less controlling meaning if, for example,

it is accompanied by autonomy-supportive elements such as a rationale (Jang, 2008), choice (Bao & Lam, 2008) or expression of acknowledgment or empathy (Koestner et al., 1984), factors that can ameliorate its controlling functional significance and thus its negative effects on intrinsic motivation. This proposition therefore further suggests that perceived competence alone is not enough to yield intrinsic motivation, as autonomy is a necessary condition.

A fourth proposition adds that general interpersonal contexts that support people's satisfaction of basic psychological needs, lend a more informational functional significance to events, whereas generally controlling relational contexts have an opposing impact, with associated positive and negative effects on intrinsic motivation respectively.

A final, fifth, proposition of CET concerns the fact that *intrapersonal* factors can also have varied functional significance, with effects paralleling those for external events (Ryan, 1982). Thus, *internally controlling* processes such as ego-involvement, evaluative self-comparisons, and contingent self-esteem, representing controlling pressures, tend to undermine intrinsic motivation, relative to more self-supporting and task-focused orientations. Excessive self-criticism, and maladaptive perfectionism can similarly undermine perceived competence and be amotivating.

As noted, these propositions have typically been tested by experimentally manipulating factors affecting autonomy and competence or by measuring variations in their experience between different social conditions. Regarding autonomy, factors such as external rewards, deadlines, and pressures toward specific outcomes have been used to induce an external PLOC and a sense of being controlled, whereas factors such as choice and rationale are used to foster an internal PLOC and sense of autonomy. Studies also often contrast autonomy supportive versus controlling general climates (e.g., in a workplace or classroom) through survey or observational methods (Ryan & Grolnick, 1986; Baard et al., 2004). Similarly, on the competence side, some experiments manipulate the presence and valence of

feedback, level of difficulty, and other factors (Grouzet et al., 2004; Mouratidis et al, 2008). Still other studies look at variations in experiences of competence under different challenges (e.g., Peng et al., 2012). CET argues that negative or critical feedback tends to undermine perceived competence, as do persistent negative outcomes. CET also holds that a lack of feedback undermines competence satisfaction, and thus intrinsic motivation because it represents an absence of informational inputs. In contrast, constructive, *effectance-relevant* inputs, even when critical, can be experienced as informational, supporting perceived competence and thus intrinsic motivation (Niemiec & Ryan, 2009).

What is important in such hypotheses is that they allow researchers and practitioners to vary conditions in the environment to facilitate autonomy and competence. Events such as shifts in specific features of reward contingencies, styles of communicating deadlines or rules, the perceived intent of external evaluations, or the locution used in external directives, can be studied in terms of their expected functional significance, and impact on intrinsically motivated behavior and its associated phenomenology. Traditional narrative reviews of this literature are available elsewhere (e.g., Ryan & Deci, 2017, 2019) but herein we focus more narrowly on how CET's general propositions and hypotheses linked to them have been tested via meta-analyses.

Meta-Analyses within CET

Choice and Intrinsic Motivation. The first meta-analysis we consider is by Patall et al. (2008), which tested a very basic CET proposition, namely that events that support an internal PLOC or sense of autonomy will tend to maintain or enhance intrinsic motivation. Patall et al. specifically tested the role of *choice*, a factor argued in SDT to generally (i.e., under many conditions) enhance autonomy, and thus intrinsic motivation and related outcomes. Patall et al.'s (2008) literature search spanned three decades (1974-2004),

identifying 41 studies on the effect of choice on intrinsic motivation, comprised of 46 total samples, yielding 290 separate effect sizes.

Using both fixed- and random-effects modeling, Patall and colleagues (2008) found that choice was generally associated with greater intrinsic motivation as expected within CET ($r = .15$). Choice was also associated with more effort ($r = .11$), and strongly linked with greater preference for challenge ($r = .33$), though the latter effect is based on few studies ($k = 3$). Choice was also found to yield a positive effect on subsequent learning, although this effect size was small ($r = .05$). Results for creativity were not statistically significant ($r = .08$), though a limited number of studies ($k = 2$) have examined the effects of choice on creativity.

Patall et al.'s (2008) analysis of heterogeneity suggested important moderating variables. First, smaller effect sizes emerged from studies where the choices were highly effortful, such as those associated with important consequences. It is likely that when it comes to important choices, how intrinsically motivated a person feels may have other determinants. They also found that more choices may be better than fewer, but only up to a point, where again choices may become too effortful or tiring. Finally, and again in line with CET, Patall et al. (2008) found that the positive effects of choice on intrinsic motivation may be reduced when rewards external to the choice are provided, as rewards may lead people to experience an external PLOC.

In an interesting moderator analysis, Patall et al. (2008) coded for different types of choice manipulations and found that “instructionally irrelevant” choices were most strongly associated with intrinsic motivation. In contrast to other types of choice manipulations in the studies reviewed by Patall et al. (2008)—choices between activities, choices between versions of an activity, choices between rewards, and instructionally relevant choices that could affect participants’ learning—instructionally irrelevant choices had no direct bearing

on the activity that participants were asked to perform. Examples of instructionally irrelevant choices included allowing participants to choose what color pen to use and what music to play to when exercising. Patall et al. (2008) speculated that such choices offered participants meaningful ways to express their personal identities. Like Patall et al. (2008), we surmise that these instructionally irrelevant choices increased participants' autonomy and, accordingly, their intrinsic motivation. Yet, CET does not offer a more specific explanation for this moderator effect and future research is needed to understand the functional significance of instructionally irrelevant choices. With interest, we observe that one of the benefits of meta-analytic moderator analyses, like Patall et al.'s (2008), is their potential to identify new targets for research, even for topics that have long been studied.

Positive and Negative Feedback. Whereas choice would be considered a facilitator of perceived autonomy, positive feedback would be considered a facilitator of competence, the other essential psychological need satisfaction for intrinsic motivation. CET suggests that conditions where there is little or no feedback also undermine intrinsic motivation because they supply no effectance-relevant input.

Meta-analyses by Fong et al. (2019) examined this CET proposition, specifically looking at the effects of negative feedback, positive feedback, and no feedback or neutral feedback (collapsed together) on intrinsic motivation. These authors located 78 relevant studies testing these effects, made up of 102 samples, from which 431 effect sizes were extracted. Meta-analytic results, using both fixed- and random-error models, showed that negative feedback was, as expected, moderately associated with decreased intrinsic motivation relative to positive feedback ($r = -.18$). There were no statistically significant differences in the effect of negative versus no feedback. Fitting with CET, results also showed that the effects of negative feedback (compared to positive) on intrinsic motivation was less negative, or even positive, if the feedback was effectance relevant—that is, when it

could help guide the person to improve performance (Ryan & Deci, 2017). Similarly, the negative effect of negative feedback (compared to positive) on intrinsic motivation was reduced when feedback was not based on social comparison (normative feedback) but on specific criteria or standards, as the latter presumably makes it more informational.

Additional moderation effects suggested that negative feedback could be less undermining when delivered in person compared to technologically mediated delivery. Generally, then, these results supported the competence-relevant propositions of CET, as well as the more general notion that when feedback is informational and competence supportive it can enhance intrinsic motivation.

Fong et al. (2019) also include in their meta-analysis a comparison of negative feedback and no feedback or neutral feedback (collapsed together) on intrinsic motivation. Interestingly, there was no statistically significant difference in the effects of negative versus no or neutral feedback. Although it seems odd at first glance that across studies getting negative feedback would not be more undermining of motivation than getting neutral or no feedback,

wide confidence intervals suggest that data were highly heterogeneous reflecting wide variation in effects across studies. This could be for a variety of reasons including differences in the type of neutral feedback provided. Depending on expectations/context participants may have interpreted neutral feedback as negative (Holroyd, Hajcak, & Larsen, 2006). Given that people tend to see themselves as above average (Alicke & Sedikides, 2009), getting neutral feedback may conflict with this assessment of self. As well, depending on context, receiving no feedback could feel like neglect (competence thwarting) or a trust in one's ability (competence enhancing). Such findings are not inconsistent with SDT, which would focus on the functional significance of the neutral or no feedback on competence and autonomy. These heterogeneous effects indicate significant variance left to explain and thus represents an area

for future work. Indeed, of the 45 studies included in the negative versus neutral/no feedback comparison, only 15 have been published, again suggesting this as an emerging research question.

Fong et al. (2019) began to answer this question by examining several possible moderators of null effect of negative vs. neutral/no feedback on intrinsic motivation. First, across studies where feedback was delivered in person, negative feedback had a small, but positive effect on intrinsic motivation (compared to neutral or no feedback). Yet, when feedback delivery was not in person, the effect was moderate and negative. This finding again highlights the importance of considering context when seeking to understand the motivational impact of negative compared to neutral or no feedback. Thus, neutral feedback may be interpreted differently depending on its mechanism of delivery.

Considering the feedback standard (criterion-based or normative), significant moderation emerged with effects changing direction. In this case, negative feedback (compared to neutral/no feedback) had a negative effect on intrinsic motivation, but only when that feedback was normative. When criterion-based feedback was given a small but positive effect of negative (compared to neutral/no feedback) emerged. This suggests that informational feedback, even when negative, may be more beneficial to intrinsic motivation than no or neutral feedback, supporting CET principles.

Examining age as a moderator, the authors found that for college students negative feedback was worse for intrinsic motivation than neutral feedback whereas for K-12 students the opposite pattern emerged, with negative feedback being associated with greater intrinsic motivation compared to no or neutral feedback. Future research could examine the developmental and contextual influences driving this difference.

Perhaps most curiously, looking at publication status, Fong and colleagues (2019) found that across the 15 published studies comparing negative feedback to no/neutral

feedback a positive effect of negative feedback on intrinsic motivation emerged, whereas this effect was negative in the 30 unpublished studies included in this analysis. Although it is always concerning to see a significant moderating effect of publication status, the wide confidence intervals around these effects (especially the unpublished ones) and their significance under fixed effects models only, suggests that there may be other differences between these comparison groups that more directly explain these disparate effects. It is worth noting that for the effect about which SDT does make strong claims (negative compared to positive feedback), effects are stronger in unpublished compared to published studies, providing evidence against a more systematic publication bias.

CET and Reward Effects: A Tale of Five Meta-Analyses. Among the most controversial aspects of CET, especially in its early years, were findings that controlling rewards could have negative effects on intrinsic motivation. To be clear, CET has never claimed that all rewards negatively impact intrinsic motivation (see Deci, 1972; Deci & Ryan, 1980a; Ryan & Deci, 2017). CET does claim, however, that when rewards are used to externally pressure or induce people to behave a certain way or to reach a specific outcome, they tend to foster an external PLOC and thus undermine a sense of autonomy and intrinsic motivation. CET also proposes that rewards can, when well-structured, be informational, supplying acknowledgement or positive feedback that enhances perceived competence and does not undermine intrinsic motivation.

Ryan et al. (1983) presented and empirically tested a CET-based taxonomy of different types of reward contingencies theorized to have more informational or more controlling functional significance to the recipient, and therefore differentially affect intrinsic motivation. For example, task-non-contingent rewards and unexpected rewards (because they are not typically experienced as controlling one's behavior) were expected and found to not undermine motivation, whereas task contingent and many types of performance-contingent

rewards (because they typically convey a sense of behavior being externally controlled) were undermining.

Yet this formulation was, and to some extent remains, highly controversial especially for some behaviorists, who view the idea that rewards can diminish subsequent motivation as anathema (e.g., Catania, 2013). Nonetheless, in the 1970s and early 1980s, evidence relevant to the undermining effect of contingent rewards on intrinsic motivation was sustained by studies both within CET (Deci & Ryan, 1980) and by attribution theorists such as Lepper et al. (1973) who dubbed such results the “overjustification effect” (p. 130).

Three early meta-analyses in the area of rewards and intrinsic motivation, listed in Table 1, helped to clarify the literature. Rummel and Feinberg’s (1988) meta-analysis included 45 studies and showed, across reward conditions, a substantial undermining effect. Subsequently, Wiersma (1992) also conducted a meta-analysis of 16 experimental studies in which tangible rewards were examined for their effects on free choice behavioral measures. Here too, meta-analytic results supported an undermining effect. Finally, Tang and Hall (1995) presented a meta-analysis of 50 studies. Rather than focusing on overall effects, and more in line with CET’s differentiated formulations, they found that both task-contingent rewards and performance-contingent rewards undermined intrinsic motivation.

Around the same time as Tang and Hall (1995) presented their analysis, however, Cameron and Pierce (1994) presented a separate meta-analysis contradicting the three prior ones and reporting no meaningful undermining effects of rewards. Cameron and Pierce (1994) strongly concluded that the time had come for “abandoning cognitive evaluation theory” (p. 396). This highly contrasting set of findings and formulations was disputed by Ryan and Deci (1996) in a narrative review. Nonetheless, Cameron and Pierce’s (1994) meta-analysis with only minor changes was presented by Eisenberger and Cameron (1996) in *American Psychologist*, where it received great attention after claiming, even in its title, that

the undermining effect was a “myth” (p. 1154). Eisenberger and Cameron’s (1996) meta-analysis found no evidence for the undermining effects of completion-contingent or performance-contingent rewards and their paper appeared to vindicate long-standing behaviorist critiques in this area.

Disputing the accuracy of Eisenberger and Cameron’s (1996) analyses, Deci et al. (1999) performed a new meta-analysis of the same data presented by Eisenberger and Cameron (1996), also including (at reviewers’ requests) all available additional unpublished and omitted studies. More importantly, Deci et al. (1999) documented how the data as extracted by Eisenberger and Cameron was compromised by omissions of results, misclassifications of conditions, and even numerical recording errors. With such issues corrected, the findings looked quite different. First, although CET does not propose that all rewards have negative effects on intrinsic motivation, across all types of rewards—both verbal and tangible—there was a negative effect on behaviorally measured intrinsic motivation ($r = -.12$). Within that overall effect, however, and in accord with CET, “verbal rewards” (Eisenberger & Cameron, 1996, p. 1157)—which CET would call positive feedback—yielded a positive effect on intrinsic motivation ($r = .16$), whereas tangible rewards yielded a negative effect ($r = -.17$).

As emphasized above, CET further argues that the effect of tangible rewards depends on their functional significance, and thus Deci et al. (1999) broke down tangible rewards further, with results showing, in line with Ryan et al. (1983), no negative effect of unexpected tangible rewards on intrinsic motivation ($r = .00$), but a statistically significant undermining effect for expected rewards ($r = -.18$). Finally, the effect of expected rewards was further differentiated in line with CET’s taxonomy. Again, supporting CET’s differentiated predictions, task noncontingent rewards did not undermine intrinsic motivation to a statistically significant degree ($r = -.07$), whereas engagement-contingent ($r = -.20$),

completion-contingent ($r = -.18$), and performance-contingent ($r = -.14$) rewards all showed small-to-moderate statistically significant negative impacts on intrinsic motivation.

Eisenberger et al. (1999) were invited to comment on these results in the same *Psychological Bulletin* issue in which Deci et al. (1999) presented their findings, and notably, although still disagreeing with CET, Eisenberger et al. (1999) did not dispute the errors discovered within their prior analyses. As we shall see, these findings concerning rewards and incentives on intrinsic motivation have implications for applied fields such as organizational psychology where rewards are often used to motivate performance (e.g., Cerasoli et al., 2016)

This set of disputes also tells an important story about meta-analysis generally, namely that although the term often carries with it an air of definitiveness, all meta-analytic studies need to be critically reviewed and can themselves be biased in terms of the studies included and the tabulation of effects. Even how studies are classified within a meta-analysis is often not just a matter of data, but of the quality of conceptual frameworks and transparency in methods (Polanin et al., 2020), a point to which we shall later return. Before turning to such issues, we next review one last meta-analysis on this question of incentives, intrinsic motivation, and performance.

Intrinsic Motivation and Performance. Previous studies suggest that intrinsic motivation enhances performance, especially for activities that are complex, involve learning and problem-solving, and benefit from deeper engagement. External incentives, on the other hand, can enhance performance on tasks that are algorithmic in nature, but insofar as they undermine intrinsic motivation or autonomy, they may compromise performance on more complex or creative tasks (Ryan & Deci, 2017). Though not a formal proposition of CET, the link between intrinsic motivation and performance has been a topic of many empirical reports. Cerasoli et al. (2014) conducted a set of meta-analyses examining the relationship between intrinsic motivation and performance across the workplace, classroom, and sports

field. Their meta-analytic review included studies in which external incentives were present and examined the nature of incentive contingencies (directly performance-salient versus indirectly performance-salient) as a possible moderator of the link between intrinsic motivation and performance.

Using random-effects meta-analytic methods with a large number of included studies ($k = 183$), Cerasoli et al. (2014) found that intrinsic motivation was a medium-to-strong predictor of performance overall ($r = .21$), a finding that held regardless of whether incentives were present ($r = .27, k = 40$) or absent ($r = .21, k = 34$). Cerasoli et al. (2014) also found that intrinsic motivation was less important to performance when incentives were directly tied to performance ($r = .21$) than when incentives were indirectly tied to performance outcomes ($r = .34$) because the latter are presumed to have a more controlling functional significance (Deci et al., 1999). These results indicate that intrinsic motivation is a robust predictor of performance, even when external incentives are strong, but that type of reward contingency matters.

In another set of moderator analyses, Cerasoli et al. (2014) distinguished between performance quality and performance quantity. Performance outcomes were coded as quality criteria when some evaluative standard could be used to judge the performed work (e.g., works requiring creativity). Quantity criteria were performance outcomes that could be summarized as discrete units of output (e.g., a number of tasks completed). Criteria that did not explicitly fall into either category or had elements of both (e.g., academic performance) constituted the third set of performance outcomes. Cerasoli et al. (2014) found that intrinsic motivation was associated with performance quality ($r = .28$), performance quantity ($r = .20$), and outcomes encompassing both quality and quantity ($r = .25$).

Cerasoli et al. (2014) further specified meta-analytic regression models in which external incentives and intrinsic motivation were entered as simultaneous predictors of

performance. Results indicated that whereas intrinsic motivation predicted more unique variance in performance quality than external incentives ($\beta = .35$ and $\beta = .06$, respectively), external incentives were a better predictor of performance quantity than intrinsic motivation ($\beta = .33$ and $\beta = .24$, respectively). These results accord well with previous arguments in SDT that the use of external incentives to motivate performance on interesting or cognitively complex activities may narrow people's focus on attaining extrinsic outcomes and may detract from fuller engagement (Ryan & Deci, 2017). We hope to see this hypothesis further tested in future studies. Finally, Cerasoli et al. (2014) found that intrinsic motivation and external incentives were similarly associated with performance in tasks coded for both quality and quantity ($\beta = .29$ and $\beta = .29$, respectively). Consistent with SDT, from these results we can infer that intrinsic motivation is especially relevant for performance on complex or heuristic tasks, whereas incentives can promote performance on more algorithmic endeavors that do not typically require interested engagement (Deci & Ryan, 1985b).

Summary

Consistent with CET, meta-analyses indicate that choice is associated with greater intrinsic motivation, effort, and preference for challenge; that negative feedback is associated with decreased intrinsic motivation; and that tangible rewards can undermine intrinsic motivation. Intrinsic motivation is also associated with enhanced quality of performance, which can be compromised by the controlling use of rewards.

Organismic Integration Theory

Expanding on the idea that humans are inclined toward assimilation and integration, OIT suggests that people are not only prone to intrinsic motivation, but also toward the internalization and integration of the values and practices endorsed by significant others in their social contexts. Indeed, the first proposition of OIT is that people are prone to internalize ambient behavioral regulations to different degrees, with some regulations

retaining an external PLOC and others being more fully assimilated to self and thus having an internal PLOC.

Accordingly, OIT specifies a taxonomy of regulatory styles, or types of motivation, that are theorized to systematically vary in their relative autonomy. Figure 1 depicts these varied motives or regulatory styles. *Amotivation* is the lack of motivation, where there is an absence of intentional regulation of behavior, typically involving either a lack of value and/or a lack of perceived competence. *External regulation* is a controlled form of motivation, in which behavior is experienced as being regulated by external rewards and punishments. Somewhat less controlled is *introjected regulation*, in which behavior is regulated by internal contingencies of self-esteem and self-regard, representing *intrapersonal* rewards and punishments that motivate action and performance efforts. Relatively more internalized and therefore autonomous is *identified regulation*, in which behaviors are assimilated by the self and experienced as worthwhile and personally valued. Finally, and even more autonomous, is *integrated regulation*, when that with which one identifies is fully self-endorsed and congruent with one's other values, as well as flexibly open to information and revision.

Testing the Simplex Model

These regulatory styles differ in their antecedents, experience, neuropsychology, and consequences, and yet relate to each other in a pattern consistent with their theoretically specified positions on a continuum of autonomy. OIT argues that extrinsic motivations can be described as lying along a “continuum that spans from relatively heteronomous or controlled regulation to relatively autonomous self-regulation” (OIT Proposition II, Ryan & Deci, 2017, p. 191).

The specification of this continuum of motives that differ in character but nonetheless systematically align along a continuum of autonomy has clear statistical implications. Specifically, Ryan and Connell (1989) argued that such motives will be interrelated in a

quasi-simplex pattern, or as ordered correlations such that those adjacent on the continuum will be most highly correlated and those more separated on this hypothetical continuum will be less positively correlated. Since the introduction of OIT, many studies have assessed each of these motivation types and their interrelations. This literature has in turn generated two meta-analyses focused on the claim that these motives array in a simplex fashion or represent a continuum.

The first of these was a meta-analytic review of the OIT continuum in the domains of sport, exercise, and physical education by Chatzisarantis et al. (2003). They identified 21 published articles and their meta-analytic results supported the existence of a simplex-type pattern reflecting a continuum. They also did an overarching path analysis to show that PLOC (relative autonomy) mediated the positive associations between perceived competence and intentions to act.

Subsequently, a broader meta-analysis of the theorized continuum of motivation was undertaken by Howard et al. (2017). They examined the relations between OIT's motivation categories to determine if they reliably conformed to a continuum-like pattern across multiple domains. They gathered data from 486 samples ($N > 200,000$) using varied OIT-based scales. Howard et al.'s (2017) results largely supported a continuum-like structure of motivational regulations. However, due in part to both too few studies measuring integration and its high correlation with identified regulation, results did not support the differentiation of integrated regulation from identified regulation. In addition, some SDT-based research scales (e.g., Vallerand et al., 1992) have attempted to differentiate intrinsic motivation into three subtypes (i.e., intrinsic motivation to know, to experience stimulation, and to achieve) but Howard et al.'s (2017) meta-analysis provided no support for those distinctions. Overall, the meta-analysis provided strong support for a continuum of self-determination as specified with OIT.

Basic Needs and Internalization

Although OIT establishes a taxonomy of motives arrayed along a continuum of relative autonomy, it also argues (Proposition III) that conditions that support basic psychological needs facilitate greater internalization and thus more autonomous forms of motivation. Furthermore, OIT states that motivations characterized by greater autonomy will tend to foster better behavioral outcomes such as sustained motivation and quality of performance (Proposition IV), as well as greater subjective well-being, positive experiences, and psychological health (Proposition V). We now turn to meta-analyses that have examined these propositions either separately or jointly, as well as hypotheses linked to them.

A first relevant piece is a meta-analysis by Slemp et al. (2018) that was aimed at identifying the positive effects of manager's autonomy support in the workplace as providing support for all three needs, in turn promoting more autonomous forms of motivation as described in OIT. They assembled a database of 754 correlations drawn from 72 studies, involving samples from nine countries of varied cultural types. Slemp et al. (2018) showed that leaders' support for autonomy was moderately-to-strongly, positively associated with more autonomous forms of work motivation such as identification ($r = .26$) and intrinsic motivation ($r = .34$). Indeed, the more internalized the type of work motivation the more positive its relations with leadership autonomy support, as predicted by Proposition IV. A meta-analytic path analysis more specifically supported the idea that autonomy support was positively associated with all three basic need satisfactions, and these in turn were associated with more autonomous forms of motivation, and less correlated with the more controlled or amotivated regulatory styles. Notably, these relations were not moderated by the country from which data were drawn, supporting OIT's universality claims.

Subsequently, Slemp et al. (2020) performed a similar meta-analysis that was more narrowly focused on teachers as employees, and how their motivation and wellness is associated with motivational climate. They found that a supportive workplace climate was

related to more autonomous and less controlled motivations to teach. In turn, more autonomous motivation was positively associated with teacher well-being outcomes, as well as higher job satisfaction ($r = .56$) and autonomy-supportive teaching ($r = .31$), and lower teacher distress ($r = -.40$) and burnout ($r = -.45$). Findings for controlled teacher motivation were generally in the opposite direction. These results were generally not moderated by educational settings or culture. Taking a further step, Slemp et al. (2020) presented a meta-analytic path analysis, which demonstrated that teachers' basic psychological need satisfaction was associated with greater well-being ($r = .49$), lower distress ($r = -.42$), and more autonomy-supportive teaching ($r = .32$) indirectly through autonomous motivation as a mediator. In sum, Slemp et al.'s (2020) meta-analysis broadly tested and supported the OIT model.

Lochbaum and Jean-Noel (2016) looked within the literature of physical education at the impact of autonomy-supportive teaching on need satisfactions and the array of motivational constructs from OIT's taxonomy, as well as varied outcome measures. Most relevant to OIT is that, as would be predicted by SDT more broadly, autonomy-supportive teaching is associated with the autonomy continuum in a graded way, with very strong associations with autonomous motives (intrinsic motivation, $r = .54$; identified motivation, $r = .50$), weaker relations with introjection ($r = .20$), and negative links with external regulation ($r = -.15$) and amotivation ($r = -.19$). The link between autonomy-supportive teaching and the relative autonomy index was large ($r = .42$), as were those for satisfactions of autonomy ($r = .57$), competence ($r = .41$), and relatedness ($r = .46$) needs. These relations support OIT's proposition that autonomy support enhances processes associated with internalization.

Greater Internalization, Better Outcomes

Recently, Howard et al. (2021) supplied a meta-analysis that specifically looked at whether more autonomous forms of motivation show relations with positive and negative

behavioral and well-being outcomes. Drawing on 344 samples ($N = 223,209$) in the education domain, Howard et al. (2021) related measures of the OIT taxonomy to 26 different performance, well-being, goal-orientation, and persistence-related outcomes. As predicted, findings revealed that both intrinsic and identified motivations were related to higher student performance and greater student well-being. Identified regulation was particularly important for persistence-related variables. Also as predicted by OIT, introjected motivation was only weakly predictive of persistence and performance goals, and it was negatively associated with a number of well-being outcomes. External regulation was generally unrelated to performance or persistence and showed negative relations with indicators of well-being. Finally, the category of amotivation was the most strongly associated with poor outcomes in both performance and well-being areas.

One meta-analysis reported null results for OIT categories in predicting environmental behaviors. In this unpublished dissertation, Osbaldiston (2005) rated pro-environmental interventions in terms of whether they emphasized incentives (which they classified as external regulation) guilt (which was classified as introjection) and value or importance (classified as identification). These ratings did not predict outcomes.

Mindfulness and the OIT Continuum

SDT specifically argues that mindfulness conduces to greater autonomy (Ryan et al., 2021). Mindfulness, which represents an open and receptive stance with respect to inner and outer events, allows for a more reflective perspective and more informed choice. Brown and Ryan (2003) addressed the proposed link between mindfulness and autonomy, arguing that open and receptive awareness conduces to a greater sense of choice and congruence in action—that is, greater autonomy, and to lower defensiveness (e.g., Niemiec et al., 2010). Thus, when mindful, people are more able to formulate and enact what is authentic.

Donald et al. (2020) meta-analytically examined how mindfulness is related to the varied types of motivation specified within SDT, and more specifically the continuum of motives detailed in OIT. The authors presented a theoretical model for how mindfulness supports different forms of motivation, with greater mindfulness relating in a graded manner to the varied types of motivation along SDT's relative autonomy continuum. They identified 89 papers ($N = 25,176$), comprising 104 independent data sets and 200 effect sizes. Using a three-level modeling approach to meta-analyze these data they found consistent support for mindfulness predicting more autonomous forms of motivation, across both correlational and intervention studies. Among correlational studies only, mindfulness moderately predicted less external motivation ($r = -.19$) and amotivation ($r = -.23$).

Autonomy, Control, and Prosociality

SDT further suggests that, when people are more autonomous, they act with more integrity, and are more in touch with abiding values and interest. In a recent narrative review, Ryan and Deci (2017) argued that when acting autonomously people are more likely to behave in prosocial ways, as such actions are more often experienced as volitional and congruent (Weinstein & Ryan, 2010). In contrast, Ryan and Deci (2017) suggested that anti-social actions are typically experienced as controlled, more as something a person 'had to do' rather than 'wanted to do'. Thus, SDT predicts a positive relation between controlled motivations and anti-social behaviors and a positive link between experiences of autonomy and prosocial behaviors. This, however, does not mean that prosocial behavior is always experienced as autonomous. SDT research shows that when prosocial behavior is heteronomous (e.g., feelings of guilt), it does not provide the same benefits as prosocial behavior that is experienced as autonomous (e.g., Weinstein & Ryan, 2010).

Donald and colleagues (2021) recently presented a meta-analysis that specifically explored if experiences of autonomy support, autonomy satisfaction, and autonomous

motivation conduce to prosocial behavior, and more controlled motives or conditions lead to more anti-social outcomes. Searching for studies linking measures of autonomy or control and indicators of prosocial and antisocial attitudes and behaviors, they identified 138 studies yielding 1,077 relevant effect sizes. Using a two-stage multi-level structural equation modeling approach, and segregating correlational, longitudinal, and experimental study designs, Donald et al. (2021) found multi-method support for several of the key predictions. As expected, experiences of autonomy were moderately positively associated with prosocial outcomes ($r = .28$), whereas controlled motivation had a small positive association with antisocial outcomes ($r = .16$). However, the longitudinal effect of control on antisociality was non-different from zero, and there appeared to be too few intervention studies ($k = 1$) to evaluate the causal effect. Moderator analyses assessed the generalizability of the correlational results, showing that the hypothesized relations were consistent across cultures and genders, albeit with some moderation by age.

Summary

Meta-analyses support OIT's proposition that different motivational regulations are arrayed along a continuum of relative autonomy, though additional work is necessary to clarify the relative positions of integrated regulation and intrinsic motivation within this continuum. Meta-analyses also support the proposition that autonomy support and basic psychological need satisfactions are differentially associated with the quality of people's motivations, and that more autonomous forms of motivation are associated with better performance and wellness outcomes whereas controlled motivations and amotivation are associated with poorer outcomes. Mindfulness is positively associated with autonomous motivations. Finally, more autonomous forms of motivation are also positively associated with pro-sociality, and more controlled motives with anti-sociality.

Causality Orientations Theory

SDT's taxonomy of motives encompasses three general and broad categories of motivation, namely those that are autonomous (such as intrinsic motivation and identified regulation), those that are controlled (such as external regulation and introjection), and those representing forms of amotivation (lack of value or felt competence). Early on in SDT research, individual differences in people's general tendencies to react to external events in autonomous, controlled, or amotivated ways was recognized and formulated in COT, which proposes three different motivation sets or orientations called *causality orientations* that represent individual differences in propensities to focus on certain aspects of environments and inner capacities when initiating behavior. COT specifies how these three dispositions relate to each other, and to behavioral and well-being outcomes.

When *autonomy-oriented*, the tendency is to interpret events in the environment as informational, and thus to take interest in events and emotions, and feel choice with respect to actions and reactions. A *controlled orientation* describes the tendency to primarily orient to external or introjected controls, contingencies, pressures, and rewards. Whether compliant or defiant, when in a controlled orientation what is salient is what others are thinking, rewarding, or sanctioning. Finally, an *impersonal orientation* is characterized by feeling an absence of control, and involves the tendency to readily see obstacles, hazards, and to anticipate anxiety when facing challenges. SDT sees the orientations as propensities that develop over time, in large part as a function of the autonomy-supportive, controlled, and amotivating influences people have experienced. Autonomy orientations in particular are expected to predict fuller, more adaptive functioning (Deci & Ryan, 1985a). SDT also argues that any of the three causality orientations can be primed, and thus have more salience in a given situation (e.g., Murphy & Taylor, 2020; Weinstein et al., 2010).

To date, there have been only two meta-analyses examining COT and its implications of which we are aware. The most comprehensive study is by Hagger and Hamilton (2021) who performed a meta-analysis on aspects of COT, including testing a process model in which the relations between general causality orientations and behavioral outcomes were mediated by autonomous and controlled motivations. They identified 69 studies entailing 83 independent samples reporting correlations between causality orientations, autonomous and controlled forms of motivation, and behavioral outcomes. Data were analyzed using both fixed- and random-effects meta-analysis methods and meta-analytic structural equation modeling.

Meta-analyzed correlations revealed a theoretically consistent pattern of relations between autonomy, control, and impersonal causality orientations, both with each other and with the forms of motivation specified within OIT. Noteworthy was the large positive correlation between impersonal and controlled orientations ($r = .27$), which suggests shared variance possibly because both are lacking a sense of personal endorsement and volition.

Hagger and Hamilton (2021) also examined the relations between causality orientations and OIT's motivational regulations. As expected, results revealed larger correlations between autonomy orientation and intrinsic and identified regulations, and weaker associations with more controlled forms of motivation such as introjection and external regulation. An opposing graduated pattern was observed for controlled orientation, which had larger correlations with the external and introjected regulations and smaller associations with identified regulation and intrinsic motivation. Finally, the impersonal orientation was positively related only with external regulation and was negatively related to identified and intrinsic motivations. Hagger and Hamilton summarized these patterns in a SDT-based meta-analytic process model, which revealed theoretically consistent relations with motivational and behavioral outcomes (Deci & Ryan, 1985a; Ryan & Deci, 2017). In

Hagger and Hamilton's (2021) model, autonomy orientation showed the most reliable ties with behavior. Correlations between causality orientations and outcomes were, however, small-to-medium in size, with considerable room for situational influences.

Recently a specific meta-analysis was performed by Murphy and Steel (2021) to examine studies within SDT that use priming to alter motivational orientations, and specifically whether studies in this area were subject to *p*-hacking, which would compromise their scientific value. The authors identified 30 experiments using autonomy or control priming yielding 33 effects. In their focused meta-analysis, results showed that even after removing especially large effects, the effects of these SDT-based primes had solid evidential value. This result is important in a priming literature that often leaves reliability of results in question.

Summary

COT proposes three causality orientations that are differentially associated with people's regulatory styles. Only one meta-analysis has thus far examined this proposition. As predicted by COT, the autonomy orientation was positively associated with autonomous forms of motivation, and the controlled and impersonal orientations were negatively associated with autonomous regulations and positively associated with controlled motivation and amotivation. Priming of autonomy and controlled orientations also appears to yield reliable effects in hypothesized directions.

Basic Psychological Needs Theory

The issue of how basic psychological needs support wellness and vitality brings us to BPNT, which concerns the cross-developmental, contextual, and cultural assumption that all three basic psychological need satisfactions are associated with greater flourishing and that all three basic need frustrations are detrimental. BPNT entails several specific propositions

(Ryan & Deci, 2017), but for the sake of brevity we include only the central ones, summarized as follows:

1. *Three basic psychological needs, those for autonomy, competence and relatedness, are essential to wellness and thriving; frustration of these needs leads to greater ill-being and impoverished functioning.*

1a. *This proposition holds across development (age) and cultural variations (e.g., collectivist, individualist), and will be evident despite people's values or desires for these needs.*

2. *Events and contexts lead to variations in psychological need satisfactions and frustrations, with corresponding changes in well-being. This mediational model is thus expected at both between- and within-person levels of analysis.*

3. *Autonomy support is expected to facilitate all three basic need satisfactions, whereas controlling contexts frustrate needs, with consequent enhanced or diminished wellness, respectively.*

Additional propositions and hypotheses in BPNT (Ryan & Deci, 2017) concern issues such as vitality versus depletion, exposure to nature, mindfulness, deficit needs, and other matters. We will not review these topics here because meta-analyses have yet to be directed at these specific propositions.

Needs and Well-Being

We begin with perhaps the most recent meta-analysis concerning BPNT because it tests one simple and main hypothesis of this mini-theory—that there should be positive associations between need satisfactions for autonomy, competence, and relatedness and indicators of wellness and thriving. Stanley et al. (2021) focused on positive and negative emotions and their relations with need satisfaction, as well as potential moderators of these relationships. Stanley et al. (2021) identified 16 studies examining these relations. Across

studies, higher positive affect was strongly associated with greater autonomy ($r = .39$), competence ($r = .45$), and relatedness ($r = .39$) satisfaction. To examine how basic psychological need satisfaction predicted negative affect, the authors identified 11 samples containing measures of autonomy, 13 containing competence, and 11 containing relatedness. Across studies, lower negative affect was strongly associated with higher autonomy ($r = -.30$), competence ($r = -.33$), and relatedness ($r = -.30$) satisfaction. Additional analyses suggested that gender, sample type (employee versus student), and the basic psychological need satisfaction measure used, moderated the strength of associations, with relations being stronger for females versus males, students versus employees, and more recently developed versus older SDT measures. Unfortunately, this meta-analysis did not examine the emotional consequences of need frustration.

Tang et al. (2020) performed a meta-analysis to examine the role of SDT's basic psychological needs and autonomous motivation to well-being among elderly persons. Aggregating across 17 studies they found that autonomy need satisfaction was negatively related to depression ($r = -.27$) as was competence ($r = -.37$) and relatedness ($r = -.17$). Autonomy satisfaction also predicted subjective health ($r = .21$) whereas relatedness satisfaction was negatively associated ($r = -.07$), which was an unexpected result. Finally global need satisfaction (all three needs combined) was associated with both depression ($r = -.48$) and general life satisfaction (.37) in expected directions. There were several other effects reported in the manuscript supporting the hypothesis that basic psychological need satisfaction is positively related to well-being (e.g., life satisfaction, positive affect, vitality, etc., r 's ranging from $.21$ to $.49$), and negatively with negative indicators of well-being (depression, apathy, etc., $r = -.55$ to $-.27$). The authors concluded that there was general support for the importance of basic need satisfactions and autonomous motives among the elderly.

Recently Serie et al. (2021) reported a meta-analysis of constructs they labeled *primary goods*, which are associated with the *Good Lives Model* of wellness (GLM; Ward & Fortune, 2013). The GLM suggests 11 primary goods necessary for a good life and in this meta-analysis proxy measures for each were assembled. Connecting with SDT, Serie et al. argued that each of SDT's basic needs were reflected in specific GLM primary goods variables and these should each be associated with an overall well-being index. Their findings supported this view showing that *excellence in agency*, corresponding to autonomy, was correlated with overall well-being at $r = .35$; *relatedness*, corresponding to SDT's relatedness at $r = .37$, and *excellence in work*, reflecting SDT's competence need, at $r = .28$.

Testing Universality. An important element in BPNT is the notion that basic needs, including autonomy, are universally positive variables in their relations with wellness. Yet many authors have disputed their universal importance, some arguing that autonomy, in particular, is not essential especially in collectivistic nations in East Asia. To directly examine this issue, Yu et al. (2018) meta-analytically examined how measures of autonomous motivation or autonomy need satisfaction, as measured within SDT, are associated with subjective well-being in both East Asian and Western countries. Random-effects analyses using 36 independent samples and involving almost 13,000 participants showed a large, positive correlation between autonomy and subjective well-being ($r = .46$). The positive association was not moderated by the type of culture from which the sample was drawn, suggesting that in both collectivist and individualist cultures, autonomy is positively related to wellness.

Earlier in discussing OIT we reviewed a meta-analysis by Slemp et al. (2018) on data from work settings from around the globe that also tested some central hypotheses within BPNT. Again, Slemp et al. (2018) drew from a database of 83 unique samples with over 32,000 participants. As predicted within BPNT, autonomy-supportive leadership was

strongly and positively associated with autonomy ($r = .46$), competence ($r = .34$), and relatedness ($r = .38$) satisfactions. Each of the three basic psychological needs were associated with more autonomous work motivation, greater well-being, more positive work behaviors, and less distress. Important for BPNT (see Proposition 1a) these relations were not moderated by the collectivist or individualist backdrop of the country from which the samples were drawn, suggesting invariant relations across cultural contexts. The authors also provided a meta-analytic path analysis testing the central propositions of BPNT. The path model specified autonomy support being associated with all three need satisfactions, in turn predicting more autonomous forms of work motivation, and resulting in job-related and wellness outcomes. Presented in *Figure 3*, the Slemp et al. (2018) model strongly supported the basic propositions of BPNT and shows the importance of autonomy-supportive leadership for employees' optimal functioning at work and their more general psychological wellness.

We present the full figure from Slemp et al. (2018) in part because this meta-analytic path model captures multiple aspects of BPNT's propositions—namely that autonomy-supportive environments lead to all three need satisfactions, which in turn fosters more volitional motivations and greater flourishing. Although this is limited to the organizational domain, Slemp et al. (2020) more recently replicated this basic model in the domain of education in a meta-analysis of the SDT literature on teacher motivation and wellness, which we shall also later review in Part II. Important in these models is the support for the mediational processes important to SDT's psychological theorizing in which need-related experiences proximally predict outcomes (Ryan, Deci, Vansteenkiste, & Soenens, 2021).

Summary

BPNT maintains that autonomy, competence, and relatedness satisfactions are essential for wellness and the available meta-analytic evidence supports this proposition. The proposition that frustration of these needs is associated with ill-being has yet to be meta-

analytically investigated. The positive associations between need satisfactions and wellness are not moderated by culture in the several meta-analyses that included it as a moderator (e.g., Slemp et al., 2018; 2020; Yu et al., 2018). However the meta-analysis by Stanley et al. (2021) suggests possible moderation by gender, sample characteristics, and measurement instruments. Finally, meta-analyses of studies conducted in work settings support the BPNT proposition that autonomy supports fosters greater need satisfaction and that need satisfaction is associated with autonomous motivation and enhanced functioning.

Goal Contents Theory

The fifth of SDT's mini-theories, GCT, diverges from preceding SDT mini-theories by focusing less on *why* people do things, and instead studies *what* they do. GCT specifies that the prioritization of extrinsically-oriented life goals—such as those for wealth, fame, beauty, and power—will not directly satisfy basic psychological needs, thereby failing to optimally support wellness. In contrast, more intrinsic goals that emphasize personal growth and self-expression, close relationships, contributing to the community, and maintaining physical health, directly bolster psychological need satisfactions and thus wellness (Kasser & Ryan, 1993, 1996, 2001; Martela et al., 2019).

Goal Contents and Wellness

A central proposition of GCT is that intrinsic and extrinsic aspirations link differentially with indices of well-being and ill-being. Bradshaw et al. (2022) examined this key proposition by meta-analyzing 92 studies containing correlations between intrinsic and extrinsic aspirations with well-being and ill-being, together comprising 1,808 effect sizes and 70,110 participants from 27 countries. Using multi-level meta-analytic multilevel structural equation modeling, Bradshaw et al.'s (2022) results found that intrinsic aspirations linked moderately and positively with indices of well-being ($r = .24$), and negatively with ill-being ($r = -.11$). Meanwhile, extrinsic aspirations were not associated with well-being ($r = .02$).

A core tenet of GCT is that extrinsic aspirations are not ‘bad’ *per se*, but that they have the potential to be detrimental the more they predominate relative to intrinsic aspirations. In this regard, Bradshaw et al.’s (2022) meta-analysis was decisive. When the effect sizes on extrinsic aspirations were analyzed according to whether extrinsic aspirations were calculated as a ‘simple score’ (i.e., the mean across all extrinsic aspirations) or a ‘relative centrality score’ (i.e., the mean across extrinsic aspirations minus, or controlling for, the mean across all aspirations), the effect sizes diverged both in terms of magnitude and direction. The meta-analytic link between well-being and extrinsic aspirations as simple scores was very small and positive ($r = .07$) because these scores capture a ‘general striving’ component. Striving for anything, it seems, is better for wellness than not striving. However, when extrinsic aspirations were calculated as a relative centrality score, the link with well-being became moderately negative ($r = -.22$). A similarly divergent pattern emerged for the link between extrinsic aspirations and ill-being. When extrinsic aspirations were calculated as a simple score their link to well-being was positive but very small ($r = .07$). When calculated as a relative centrality score, however, the effect of extrinsic aspiring on ill-being was positive ($r = .23$). Taken together, the results of Bradshaw et al.’s (2022) meta-analysis indicated that to the extent that extrinsic aspirations dominate in the overall pattern of aspiring, the more they both hinder well-being and conduce to ill-being. The effects associated with the relative centrality of extrinsic aspirations were not moderated by gender, age, region, or socioeconomic status, suggesting that the negative consequences of prioritizing extrinsic aspirations appear universal. Bradshaw et al.’s (2022) results could be interpreted as contradicting evidence that national (Hagerty & Veenhoven, 2003) and personal wealth (Tan et al., 2020) are associated with gains in individuals’ well-being, but such a conclusion would be a misinterpretation. As Bradshaw et al. (2022) outlines, extrinsic goals can serve positive functions; money can provide security and safety, maintaining a

positive image can support feelings of esteem and confidence. However, regardless of the underlying motivation, Bradshaw et al.'s (2022) results suggest that if extrinsic pursuits are allowed to predominate the overall pattern of aspiring any possible gains will be undermined to some extent.

Materialism, Wellness, and Need Satisfaction. Dittmar et al. (2014) used a meta-analysis to examine the effects of materialism on well-being, defining materialism as “individual differences in people’s long-term endorsement of values, goals, and associated beliefs that center on the importance of acquiring money and possessions that convey status” (p. 886). Recognizing the close relation of this definition to some aspects of SDT’s conception of extrinsic goals, Dittmar et al. (2014) explicitly tested several hypotheses from GCT. They identified 259 independent samples examining materialism and wellness, comprising 753 effect sizes. Their meta-analyses showed that materialism was associated with decrements across a variety of well-being indices, although the effect sizes varied as a function of how materialism was measured. Materialism measures that were multifaceted (e.g., tapping both materialist values and beliefs), and those assessing the relative importance of materialist goals, fared better in predicting wellness (negatively) than measures focused on money-seeking alone, or those that did not assess the relative strength of materialism vis-à-vis other values. The predictive strength of materialism also depended on the type of well-being outcome. Small-to-moderate negative correlations were observed between materialism measures and well-being outcomes including life satisfaction ($r = -.13$), positive ($r = -.23$) and negative affect ($r = -.15$), positive self-appraisal ($r = -.17$), anxiety ($r = -.17$), depression ($r = -.19$), and self-reported physical health ($r = -.15$). Larger effects emerged for negative self-appraisal ($r = -.28$), health risk behaviors ($r = -.29$), and especially compulsive buying ($r = -.44$).

Importantly, Dittmar et al. (2014) also included a mediation analysis to test the third GCT proposition, which is that the detrimental link between extrinsic aspirations and well-being is mediated by decrements in basic psychological need satisfaction. Results supported the proposition, suggesting that the negative link can be explained by diminished need satisfaction.

It's important to note that GCT does not argue that having wealth or attaining a higher income hurts people's wellness; on the contrary several SDT research papers confirm that greater wealth is correlated with greater wellness, and moreover, that this result is mediated by greater basic psychological need satisfaction (e.g., see Di Domenico & Fournier, 2014; Martela et al., 2022). Instead, what GCT argues is that a strong focus on wealth, fame, or appearances relative to a focus on growth, intimacy, and community is harmful to wellness, regardless of one's attainments.

Summary

Meta-analyses support the main proposition of GCT. Whereas intrinsic aspirations are positively associated with wellness and negatively associated with ill-being, extrinsic aspirations have opposite effects. These relationships most clearly emerge when people's overall levels of goal striving are statistically controlled. Notably, these effects have not been found to be moderated by demographic characteristics. Meta-analyses also confer support for the proposition that the negative associations between relatively strong extrinsic aspirations and wellness are mediated by diminished need satisfaction. Still, the mediational effect of need satisfactions has yet to be meta-analytically established for intrinsic aspirations.

Results Part II: SDT Meta-Analyses in Applied Areas

An important reason why interest in SDT has grown is because of its applied value. Specifically, SDT targets aspects of the environment that facilitate or undermine optimal

qualities of motivation, and thus has utility in areas such as education, sport, health care and work, where practitioners are looking for ways to optimize engagement and productivity.

Education

Some of the earliest applied work in SDT was in education and how classroom climate affects the motivation of students (e.g., Deci et al., 1981). Since then, hundreds of applied studies across the globe have used SDT in the areas of both learning and formal education (see Ryan & Deci, 2020). Surprisingly, we could not find meta-analyses summarizing some of the basic SDT ideas in this domain, such as whether classroom need satisfaction predicts greater engagement and flourishing, even though that has been demonstrated in numerous individual studies.

Taylor et al. (2014) did, however, present a meta-analysis of SDT's motivational constructs in the prediction of school achievement over time. In fact, the meta-analysis was the first in a series of four studies in their paper, which Taylor et al. (2014) described as a systematic attempt to use both meta-analysis and controlled, longitudinal investigations to examine how SDT's specific types of motivation, and particularly intrinsic motivation, related to academic achievement. Regarding the Taylor et al. (2014) meta-analysis itself, however, the literature search was focused exclusively on papers that: (a) used the *Academic Motivation Scale* (AMS; Vallerand et al., 1992), a commonly used SDT measure of academic motivation at that time, and (b) a measure of academic achievement (e.g., test score, self-reported GPA, report card grade). Taylor et al. (2014) found 18 such studies, spanning elementary, high school, and college samples, most of which were cross-sectional in design. Their meta-analysis showed that, in general, academic achievement had positive links with intrinsic motivation ($r = .13$) and identified regulation ($r = .17$) and that introjection ($r = -.06$) and external regulation ($r = -.11$) both had negative relations to achievement. Finally, also consistent with expectations, amotivation was strongly negatively related to achievement ($r =$

-29). Thus, the Taylor et al. (2014) meta-analysis supported SDT's expectations concerning the relations of more autonomous forms of motivation and achievement, but also highlighted how such findings are heavily based on cross-sectional work that, however reliable, cannot untangle the causal relations. We thus note that the next three studies in the Taylor et al. (2014) series were longitudinal designs done in French Canadian and Swedish schools, all showing the importance of intrinsic motivation in predicting higher academic achievement over time.

Autonomy Support and Motivation

Bureau et al. (2022) recently presented a meta-analysis of 144 studies involving more than 79,000 students that examined relations between parent and teacher autonomy supports, basic need satisfactions, and variations in student motivation. First, in line with BPN, basic need satisfactions were highly related across studies (all r 's $> .63$). All three basic needs related to the motivational continuum in the expected graded pattern, with greater need satisfactions predicting more autonomous forms of motivation and lower amotivation. The evidence pointed to teacher autonomy support as more strongly related to motivational outcomes than parental autonomy support. Teacher autonomy support was related to intrinsic ($r = .48$), identified ($r = .44$), introjected ($r = .17$), external ($r = -.10$), and amotivation ($r = -.32$) whereas the corresponding r 's for parent autonomy support were .23, .28, .15, .05, and -.23 respectively. The meta-analysis also presented a path model in which autonomy support predicted more autonomous forms of motivation via mediation by needs in which autonomy and competence needs proved to be the significant mediators.

Rationale Provision. According to OIT, the provision of a meaningful rationale is an important aspect of autonomy support and thus contributes to more autonomous internalization. When a reason for acting is understandable and coherent, a person is more able to volitionally 'get on board.' Thus, a rationale can support autonomy and facilitate

internalization. Testing this idea was a meta-analysis of 23 experimental studies by Steingut et al. (2017) that examined the effect of rationale provision (versus control) on an array of relevant variables including subjective task value, autonomous motivation, engagement, performance, perceived autonomy, perceived competence, perceived relatedness, and controlled motivation. The findings suggested that providing a rationale was, as expected within OIT, positively associated with enhanced task value ($r = .16$), engagement ($r = .10$), performance ($r = .08$), and perceived autonomy ($r = .20$). Interestingly, the findings also indicated that rationale provision had a small *negative* effect on perceived competence ($r = -.10$). Additionally, rationale provision appeared to also have more positive effects in samples with more females. Based on their review of the existing data, Steingut et al. (2017) suggested that rationales were most effective when their delivery is prosocial or autonomous in nature rather than controlling and when they are provided for uninteresting tasks for which volition becomes especially relevant to initiation.

The impact of perceived autonomy support has also been studied in higher education contexts, as recently reviewed by Okada (2022). As part of the review Okada meta-analyzed the relations of perceived instructor autonomy support with the OIT taxonomy of motivation, finding that autonomy support was related to autonomous ($r = .37$) but not to controlled ($r = .03$) forms of motivation, and to both cognitive ($r = .31$) and emotional ($r = .40$) academic engagement. Autonomy support, which SDT expects to facilitate all three need satisfactions, was accordingly associated with satisfactions for autonomy ($r = .50$), competence ($r = .45$), and relatedness ($r = .39$). This meta-analysis thus helps establish the generalizability of these constructs to college and university students.

Teacher Motivation

Slemp et al. (2020) presented an analysis (briefly discussed earlier) on the antecedents and consequences of autonomous and controlled teacher motivation by drawing on a database

of 1,117 correlations derived from 102 independent samples. Findings indicated that workplace autonomy ($r = .48$), competence ($r = .53$), and relatedness ($r = .38$) satisfactions predicted more autonomous motivation to teach. Teachers' autonomous motivation was strongly and positively associated with their job satisfaction ($r = .56$), work commitment ($r = .51$), work engagement ($r = .69$), and general well-being ($r = .46$), whereas teachers' controlled motivation was weakly positively associated with distress ($r = .16$), burnout ($r = .18$), and stress ($r = .19$). Perhaps most important, Slemp et al.'s findings indicated that autonomously motivated teachers are more competence and autonomy supportive in their practices, which in turn may foster students' basic need satisfactions and lead to better student-related outcomes (Pelletier et al., 2002). These results were generally not moderated by educational setting or the type of teaching, but some associations were moderated by teacher age and time in career.

Intervention Studies in Education

Su and Reeve (2011) performed a meta-analysis to determine the effectiveness of interventions designed to support autonomy in others. They presented a meta-analysis of findings from 19 studies (20 effect sizes) showing that the training programs focused on increasing autonomy support were, overall, effective at doing so ($r = .30$).

Moderator analyses revealed, among other findings, that the more effective programs were those focused on training for multiple elements of autonomy support, a finding later supported by Gillison et al.'s (2019) meta-analysis of health-care interventions. Also, programs were more effective when offered to teachers (rather than to other professionals) and for individuals with an autonomy (rather than a control) causality orientation. In fact, several conditions appeared to impact program effectiveness that require some deeper analyses. Still, the overall results suggested that training in autonomy support, which is a crucial component of all SDT interventions, can be designed to be highly effective.

Burke et al. (2020) argued that interventions fostering self-determination in persons with disabilities are critical to enabling their educational success, community participation, and overall quality of life. To look at effectiveness, Burke et al. (2020) conducted a meta-analysis of interventions to promote self-determination and associated skills in samples of students with disabilities. As with Su and Reeve's (2011) findings, they found that interventions to promote self-determination are effective across age and grade, disability types, and school settings (average $r = .41$). They suggested that training in self-regulatory skills such as choice-making, problem-solving, planning and goal setting, self-management, self-advocacy, and self-knowledge can help prepare students to make more autonomous and adaptive purposeful decisions and choices. Nonetheless, there remains a need for an increased focus on promoting self-determination within education settings for both students with and without disabilities.

Summary

A number of meta-analyses support the applied significance of SDT in educational settings. Higher autonomous motivation among students is associated with greater academic achievement and students who are provided with meaningful rationales for their school activities perform more optimally, and report enhanced experiences. More autonomously motivated teachers experience a host of positive workplace outcomes, including greater job satisfaction and commitment. They are also more likely to adopt an autonomy-supportive approach in their teaching. Intervention studies have established the effectiveness of SDT principles within educational contexts, including among students with disabilities.

Work and Organizations

The SDT Motivational Taxonomy in the Workplace

Van den Broeck and colleagues (2021) performed a meta-analysis of SDT's taxonomy of motivation specified within the OIT mini-theory. The meta-analysis was

comprehensive in that it examined the findings from 124 samples from several analytic perspectives. However, among the summary findings was that progressively autonomous forms of motivation related increasingly positively with beneficial work outcomes and negatively with undesired work outcomes. Intrinsic motivation was found to be the most robust predictor of job satisfaction ($r = .57$), and engagement ($r = .67$). Identified motivation was a somewhat better predictor of performance ($r = .43$) than intrinsic motivation ($r = .36$). Van den Broeck et al. (2021) also found that external regulation did not predict performance ($r = .04$) and that amotivation was negatively related to performance ($r = -.28$), job satisfaction ($r = -.32$), and work engagement ($r = -.27$). Indeed, patterns across measures of work attitudes, employee well-being, and work behaviors were aligned with SDT's hypotheses. One final highlight was that these investigators found that the category of integrated regulation was rarely measured in workplace studies, and where it was measured it did not show differentiation from identified motivation.

Modeling SDT in Organizations

We previously described a meta-analysis by Slemp et al. (2018) that examined, using meta-analytic path analysis, several elements of SDT's approach to organizations. The model (Figure 2) examined the effects of managers' autonomy support on employee outcomes across a fairly large database drawn from 83 samples ($N = 32,870$). Among their findings was that leader or manager autonomy support was strongly and positively associated with more autonomous forms of work motivation in employees but was unrelated to their levels of more controlled forms of motivation. As the type of motivation became more relatively autonomous, the correlations with leader autonomy support became increasingly positive. Thus there were stronger associations between autonomy support and each type of motivation moving left to right in Figure 2. Leader autonomy support was also positively associated with basic psychological need satisfactions, well-being, and positive work behaviors, and

negatively linked with work distress. Important to SDT's assumptions about needs, these relations were not moderated by the country from which the samples were drawn.

Basic Needs, Work Wellness, and Motivation

In a test of BPNT and OIT applications to organizations, Van den Broeck et al. (2016) assembled 99 studies with 119 samples to assess antecedents and consequences of SDT's basic psychological need satisfaction at work. Their meta-analytic findings largely supported SDT, in that all three needs contributed to a variety of wellness outcomes, and were related negatively to role stressors, work-family conflict, and job insecurity. However, because basic needs more robustly predicted positive than negative outcomes, the authors questioned if they should be considered truly *basic* needs, which might show more bi-directional effects (Vansteenkiste & Ryan, 2013; Vansteenkiste et al, 2022). It is noteworthy that Van den Broeck et al.'s (2016) meta-analysis appeared just as SDT's emphasis on also measuring need frustration in addition to measuring need satisfaction (e.g., Bartholomew et al., 2011) was having an impact. Today there is a fuller account of why *satisfaction* items are less predictive of negative outcomes, whereas *frustration* ratings are less apt at predicting positive ones (Ryan et al., 2016). Returning to Van den Broeck et al. (2016), they also found that basic psychological need satisfactions generally demonstrated positive relations with positive leader and organizational variables, fairness perceptions, and person-environment fit, and negative relations with perceived mistreatment.

Basic Needs, Incentives, and Performance at Work. Earlier we reviewed a meta-analysis by Cerasoli et al. (2014) concerning intrinsic motivation. Cerasoli et al. (2016) presented a separate meta-analysis concerning how needs for autonomy, competence, and relatedness, when placed alongside incentives, relate to performance. For this meta-analysis, they obtained 108 samples ($N = 30,648$). As expected within SDT, each of the three basic psychological need satisfactions predicted performance, with moderate-to-large effects for

relatedness ($r = .20$), autonomy ($r = .22$), and competence ($r = .30$). Incentives *per se* had little impact on need satisfaction. Instead, the need-satisfaction-to-performance relation was moderated by incentive salience. Consistent with the ‘crowding-out’ hypothesis, Cerasoli et al. (2016) found that need satisfaction mattered less to performance when incentives were directly salient ($r = .19$) but mattered more when incentives were indirectly salient ($r = .37$). Direct salience typically translates into a more controlling functional significance—which means that under such systems, SDT expects need satisfaction would be both less evident and less predictive of performance. In contrast, indirectly salient incentives would tend to have a less controlling functional significance and thus not decrease the salience and positive effects of need satisfaction. Cerasoli et al.’s (2016) results supplied support for these relatively nuanced expectations of SDT in performance contexts.

Bauer et al. (2016) performed a meta-analysis that examined motivational factors in reactions to, and outcomes of, business training and development settings. They did not use the full SDT motivational model, however, instead only assessing measures of intrinsic motivation, which may not be the only relevant subtype, especially given the mandated nature and content of many corporate training interventions. Nonetheless, intrinsic motivation had an expectably large effect on employee satisfaction and enjoyment reactions ($r = .70$), but small effects on declarative knowledge ($r = .12$) and no reliable effect on initial skill acquisition ($r = .02$).

Good et al. (2022) analyzed results from 127 studies comprised of 293 effect sizes ($N = 77,560$) to assess the relations of intrinsic and extrinsic motivation to performance in salespersons. The findings showed first that motivation in general is meaningfully related to sales performance ($r = .25$). Findings further indicated that intrinsic motivation was more strongly associated with performance ($r = .30$) than extrinsic motivation ($r = .18$), a

difference effect that remained when controlling for age, gender, and job tenure. Results thus suggested attending to intrinsic as well as extrinsic motivators for salespeople.

Summary

In the workplace, more autonomously motivated employees report greater job satisfaction and evince better workplace performance. Leader or manager autonomy support is positively associated with more autonomous qualities of motivation, basic need satisfactions, and wellness among employees. Basic psychological need satisfactions at work are robustly related to well-being and workplace outcomes, including perceptions of fairness and leadership. Consistent with CET, need satisfactions are particularly strong predictors of performance when external incentives are less salient. Thus, as SDT argues both intrinsic motivation and extrinsic motivations appear to be important for work performance and sustained engagement, with basic need satisfactions being a key to workplace wellness.

Health and Health Care

Practitioner Autonomy Support

As a theory of motivation and behavior change, SDT has spawned considerable research in healthcare settings. This led to an early meta-analysis by Ng et al. (2012) focused on SDT's utility in healthcare contexts. Specifically, they examined the relations between the SDT-based constructs of practitioner autonomy support and patients' experiences of psychological need satisfaction and indices of mental and physical health. They extracted data from 184 independent published and unpublished studies focused on health behaviors such as weight change, physical activity, diabetes care, and smoking. Research in related areas such as sport and physical education were excluded.

Ng et al.'s (2012) results showed the expected positive relations between basic psychological need satisfactions and autonomous motivation to a host of beneficial health outcomes. Ng et al. (2012) also used path analyses of the meta-analyzed correlations to test

the interrelations of SDT's healthcare model as specified in Ryan et al. (2008). Results were generally consistent with Ryan et al.'s (2008) model, albeit showing generally small effect sizes for the direct paths from autonomous motivation to health outcomes, and stronger indirect paths such that autonomous motivation was associated with increases in perceived competence, which in turn was associated with health outcomes (e.g., see Williams et al., 2006). This finding resonates with practice, where so often finding strategies to alter difficult-to-change health behaviors is a key to maintaining volition. Overall, the authors suggested that SDT constructs appear useful both in predicting health-related behaviors and helping describe the conditions that facilitate them.

SDT-based Interventions

Gillison et al. (2019) conducted a comprehensive meta-analysis of the techniques used within SDT-based interventions to facilitate motivation for health behavior. They began with a systematic review, followed by meta-analysis of the techniques and strategies used to enhance basic psychological need satisfaction and motivation within health interventions based on SDT. Databases were searched from 1970-2017 for studies with either children or adults that minimally included a control group and pre- and post-intervention ratings of SDT-related psychosocial mediators (namely perceived autonomy support, basic psychological need satisfaction, and motivation). A total of 74 studies met these inclusion criteria, 80% of which were RCTs or cluster RCTs. Gillison et al. (2019) applied two established taxonomies for the coding of techniques to enhance basic psychological need satisfaction, as well drawing from a list of 21 SDT-specific techniques, grouped into 18 SDT-based strategies. Results showed strong positive effects for perceived autonomy support ($r = .39$), autonomy satisfaction ($r = .38$), and competence satisfaction ($r = .30$), as well as small-to-moderate effects for relatedness satisfaction ($r = .14$), and autonomous motivation ($r = .20$). One-to-one interventions ($r = .43$) resulted in more competence satisfaction than group-based

interventions ($r = .14$), and competence satisfaction was greater for adults ($r = .43$) than for children ($r = .06$). Meta-analytic regression showed that individual strategies had limited independent impact on outcomes, suggesting that a need-supportive environment entails the combination of multiple co-acting techniques, as also found by Su and Reeve (2011) in educational interventions.

Sheeran et al. (2020) conducted another meta-analysis focused on randomized, controlled trials using health behavior change interventions based on SDT and testing theoretically specified mediation processes, and potential moderators. The authors identified 56 articles that included 65 independent tests of SDT interventions. Random effects meta-analysis and meta-regressions showed a sample-weighted average effect size for SDT interventions was $r = .11$. There were small but statistically significant intervention effects on physical activity ($r = .12$), sedentary behavior ($r = .11$), diet ($r = .10$), screen time ($r = .09$), alcohol consumption ($r = .13$), and smoking cessation ($r = .08$). A meta-analytic structural equation model suggested that autonomous motivation and perceived competence mediated intervention effects on behavior.

Ntoumanis et al. (2021) recently did yet another meta-analysis of SDT-based health promotion and disease management intervention results and follow-up results. Their aim was to meta-analyze such interventions if they: (a) used an experimental design, (b) tested an intervention that was clearly based on SDT, and (c) measured at least one SDT-based motivational construct, and at least one indicator of health behavior, or physical- or psychological health. Seventy-three studies met these criteria. Results using a random-effects meta-analytic model showed that SDT-based interventions produced small-to-medium changes in most health behaviors at the end of the intervention period and at the follow-up. Small positive changes in physical and psychological health outcomes were also observed at the end of the interventions. Increases in need support and autonomous motivation (but not

controlled motivation or amotivation) were associated with positive changes in health behavior. The authors concluded that SDT-based interventions positively affect health outcomes, with effects that are typically modest in size.

SDT and Theory of Planned Behavior

Hagger and Chatzisarantis (2009) used meta-analysis toward showing a potential integration of theory of planned behavior (TPB; Ajzen, 1991) and SDT in the realm of health behavior. Specifically, Hagger and Chatzisarantis (2009) sought to derive empirical support for a proposed model combining TPB and SDT through a motivational sequence in which autonomous motivation (as assessed in SDT) predicts the proximal predictors of intentions and behavior (as assessed within TPB). Hagger and Chatzisarantis (2009) identified 34 studies testing the relations between SDT and TPB constructs, including perceived autonomy support and autonomous motivation constructs from SDT, and the attitude, subjective norms, perceived behavioral control, intention, and behavior constructs from the TPB. A path-analysis using meta-analytically derived correlations revealed direct effects of autonomous motivation on intentions and behavior, as well showing these relations being partially mediated by some, though not all, of proximal predictors from the TPB. Thus, evidence supported the proposed motivational sequence, especially links between autonomous motivation and intention. These meta-analytic results suggest that TPB and SDT can be simultaneously modeled, given there is relative independence of constructs, and both perspectives have been used to address a broad range of health behaviors. Yet, as our focus here is only on SDT-based hypotheses independent of TPB, regarding which several relations were examined. Specifically, the relation of autonomy support to self-determined motivation was found to be strong and positive ($r = .38$) as was the relation of self-determined motivation to behavior ($r = .37$). Perceived autonomy support was moderately linked to behavior ($r = .25$).

Subsequently, Hagger and Chatzisarantis (2016) reported a separate meta-analysis, this time investigating their *trans-contextual model* of how motivation in physical education may transfer to out-of-school motivation for physical activity. Again, their analysis finds support for the trans-contextual model, which involves the mediation by TPB variables. Of the multiple analyses performed only one, however, directly tested an SDT-specific hypothesis, finding, as the theory predicts, that instructor autonomy support strongly and positively predicted students' motivation for physical activity in school ($r = .42$).

Summary

A relatively large body of meta-analytic work supports the application of SDT in healthcare settings. More autonomous qualities of motivation and basic psychological need satisfactions are positively associated with a variety of health-related behaviors (e.g., weight management, physical activity, diabetes care). SDT-based interventions for improving motivation have proven effective for positively affecting health behaviors. SDT-based interventions have also shown themselves to complement those based on the TPB, another longstanding model for positive behavioral change.

Sport, Physical Education, and Physical Activity

Testing OIT's Simplex Model in Sport

Chatzisarantis et al. (2003) did a meta-analysis of perceived locus of causality in exercise, sport, and physical education contexts. They focused their literature search on three main areas: (a) research using instruments that assessed perceived locus of causality or OIT's taxonomy, (b) research bearing on the construct validity of perceived locus of causality including its antecedents and outcomes, and (c) integration of Nicholls' (1984) concepts of task- and ego-orientation with perceived locus of causality. A meta-analysis using 21 published articles supported the existence of a self-determination continuum from external regulation to introjection and identification. In addition, path analysis of corrected effect sizes

supported the mediating effects of perceived locus of causality on the relationship between perceived competence and intentions.

Autonomous Motivation and Physical Activity

Data such as that presented by Chatzisarantis et al. (2003) suggest the importance of autonomous motivation for intentions to be physically active. Owen et al. (2014) also explored the relations of autonomous motivation and physical activity but in children and adolescents using the SDT framework. Forty-six studies ($N = 15,984$ participants) met their inclusion criteria. Consistent with SDT the meta-analysis showed that more autonomous motivation had small-to-moderate positive associations with physical activity. Specifically, autonomous forms of motivation (i.e., intrinsic motivation and identified regulation) had moderate, positive associations with physical activity ($r = .27$ to $.38$), whereas controlled forms of motivation (i.e., introjection and external regulation) had weak, negative associations with physical activity ($r = -.03$ to $-.17$). Amotivation was also negatively related to activity ($r = -.11$ to $-.21$). Owen et al. (2014) concluded that the evidence provided some support for SDT, but also pointed to the fact that there was substantial heterogeneity in most of the associations. Such heterogeneity likely reflects the diverse contexts and types of PA, as well as the fact that PA is itself a multiply determined outcome in which motivation plays a part. The authors also argued that many of the studies included in their analyses had methodological shortcomings.

Another meta-analysis by Sierra-Díaz et al. (2019) examined psychosocial factors thought to affect physical activity and sport engagement, in educational and extracurricular settings. They found, in line with SDT, that sustained physical activities and sport practice engagement are strongly positively related to self-determined motivation ($r = .40$).

A meta-analysis by Teixeira et al. (2018) examined the relations between SDT's basic psychological needs and positive and negative affect in exercise contexts. They identified 10

studies in which basic psychological need satisfaction variables and affect were measured in an exercise setting. Positive affect was related very strongly and positively with competence ($r = .52$), and moderately positively with autonomy ($r = .25$) and relatedness ($r = .20$). Results for the effects on negative affect were more mixed. Competence satisfaction was strongly negatively associated with negative affect ($r = -.27$), autonomy was not related to negative affect ($r = .03$), and relatedness was unexpectedly strongly positively correlated with negative affect ($r = .41$). Noteworthy was the considerable heterogeneity identified across the studies, which reflects both varied methods and exercise settings. It is also likely, from SDT's dual-process view, that measures of need frustration would better predict negative affect than would low need satisfaction scores. The authors suggested that, nonetheless, results support the view that basic need satisfactions are important for positive affect in exercise contexts.

Autonomy Support, Basic Needs, and Physical Activity. A recent and comprehensive meta-analysis by Mossman et al. (2022) focused on the role of coach autonomy support in sport and exercise settings. The review encompassed both sport coaching and coaching in PE settings. Drawing from 1,320 correlations extracted from 131 independent samples ($N=38,844$), their findings showed that coach autonomy support was positively related to athletes' motivation and wellness.

Regarding motivation, meta-analyzed correlations were strongest for autonomous forms of athlete motivation (intrinsic, $r = .32$; integrated, $r = .37$; identified, $r = .31$) and weaker for controlled forms of motivation (introjected regulation, $r = .13$; external regulation, $r = .00$), and negative with amotivation ($r = -.16$). Positively associated regarding athletes' general well-being ($r = .41$), vitality ($r = .30$), self-esteem ($r = .23$) among other indicators of wellness. Coach autonomy support was further predictably negatively associated with general ill-being ($r = -.15$), burnout ($r = -.24$), and depression ($r = -.25$) among other signs of distress (see Supplemental Material, Table S1 for all meta-analyzed outcomes). Finally, in 15 studies

performance or achievement outcomes were reported, and were positively related to coach autonomy support ($r = .18$).

There were also strong associations between autonomy support and athletes' basic autonomy ($r = .46$), competence ($r = .28$), and relatedness ($r = .39$) need satisfactions. Autonomy support was further associated with other measured behavioral supports for basic psychological needs such as relatedness support, structure, involvement, and task-involving climates, adding to convergent validity. Finally, and important for SDT's universality claims, these effects of autonomy support were not moderated by culture.

Burnout and Dropout in Sport. Li et al. (2013) provided a systematic review and meta-analysis on the relations of burnout to basic psychological needs and motivation among athletes. There were eighteen studies that met inclusion criteria, and these were described as highly varied in terms of study characteristics such as type of participants, study design, and measures used. Despite such variations, results revealed that autonomy ($r = -.50$), competence ($r = -.52$), and relatedness ($r = -.43$) satisfactions, intrinsic motivation ($r = -.46$), extrinsic autonomous regulation ($r = -.27$), controlled regulation ($r = .48$), and amotivation ($r = .68$) had large and theoretically-congruent effects on global burnout across studies.

Li et al.'s findings were complemented by another recent meta-analysis by Zhang et al. (2022) on sport persistence. They examined factors such as enjoyment, and coach, peer, and parent supports, all of which had positive relations with persistence, but which were not assessed in an SDT specific manner. Included however, was a meta-analysis of three studies, together showing positive effects of SDT basic need satisfaction on athletes' persistence intentions ($r = .41$).

Back et al. (2022) also presented a systematic review and metanalysis on dropout in team sports, with a focus on adolescents in team sports. Twelve studies met their criteria, the results of which appeared heterogeneous, bespeaking multiple determinants of dropout during

this developmental period. Nonetheless, the overall findings indicated that not dropping out from team sports was associated with lower controlled motivation ($r = -.11$) and amotivation ($r = -.37$), and higher self-determined motivation ($r = .13$). They also reported a positive relation of need satisfaction to not dropping out ($r = .21$). Again, the small number of studies in these analyses suggest caution, as does the variability in the study methods summarized.

Motivation in Physical Education

Lochbaum and Jean-Noel (2016) examined the direct effects of instructor autonomy support on outcomes stemming from physical education. Their review focused on both outcomes in-class, as well as out-of-school or leisure-time physical activities. They identified 39 papers that met their inclusion criteria, comprising samples from 15 countries totaling over 23,000 participants, of which 46.5% were female. Regarding in-class effects, autonomy support from physical education teachers was very strongly and positively associated with students' autonomy ($r = .57$), competence ($r = .41$), and relatedness ($r = .46$) satisfactions, as well as their intrinsic ($r = .54$) and identified ($r = .50$) motivation. Large effects on effort ($r = .33$) and small effects on physical activity ($r = .10$) were also detected. In terms of the transfer effects from autonomy support from physical education instructor to leisure time outcomes, the effects were moderate to large in magnitude, though they were smaller than they were for effects in class, underscoring the difficulty of creating trans-contextual change.

Subsequently, Vasconcellos et al. (2020) provided a thorough systematic review and meta-analysis of SDT within the context of school physical education programs.

Vasconcellos et al. (2020) utilized a multilevel structural equation modeling approach to meta-analyze data from 265 studies identified as meeting their criteria. In line with SDT, the meta-analytic results showed that autonomous motivation was strongly, positively associated with adaptive outcomes ($r = .54$) and moderately, negatively linked with maladaptive ones ($r = -.25$) in school physical education programs. Introjected regulation was positively

correlated with both adaptive ($r = .26$) and maladaptive ($r = .13$) outcomes, again as SDT would expect. External regulation was strongly positively linked to maladaptive outcomes ($r = .25$), and very weakly, negatively linked with adaptive ones ($r = -.07$). Finally, amotivation was both very strongly positively associated with maladaptive outcomes ($r = .45$), as well as negatively associated with adaptive ones ($r = -.37$). Also supporting SDT, autonomy ($r = .57$), competence ($r = .60$), and relatedness ($r = .51$) satisfactions were very strongly positively related with students' autonomous student motivation, and less strongly, but still positively, correlated with introjected regulation ($r = .35$, $r = .27$, $r = .27$, for autonomy, competence, and relatedness, respectively). Small to very small negative correlations were found between autonomy ($r = -.13$), competence ($r = -.10$), and relatedness ($r = -.07$) and external regulation. Amotivation had strong negative correlations with autonomy ($r = -.29$), competence ($r = -.42$), and relatedness ($r = -.30$). Vasconcellos et al.'s (2020) findings further revealed that teachers more greatly impact classroom experiences of autonomy and competence, whereas relatedness in physical education is associated with both peer and teacher influences.

Whereas the prior meta-analyses looked at how motivational variables and satisfactions impacted physical education outcomes, Kelso et al. (2020) provided a meta-analysis of how school-based interventions that are meant to increase physical activity affected motivational outcomes and experiences. Because the physical activity interventions were both varied and multi-component, Kelso et al.'s (2020) meta-analysis, which included a large array of SDT variables as outcomes, does not specifically test any SDT propositions. Nonetheless, the findings show that physical activity interventions generally had small to moderate positive effects on perceived autonomy, identified regulation, intrinsic motivation, and motivational climate. Significant moderate to large effects were also identified for the

relative autonomy index (RAI or SDI) used in many studies (see Supplemental Material, Table S1).

Gender Differences in Exercise Motivation

Guérin et al. (2012) examined differences between men and women on SDT's motivational regulations for exercise. The meta-analysis was restricted, however, to a single measure, namely the *Behavioral Regulations in Exercise Questionnaire* (BREQ; Mullan et al., 1997). With this focus, 27 studies were identified that reported gender differences for each of the basic SDT forms of regulation assessed with the BREQ, as well as for a composite self-determination score. Overall, results reflected the expected relations between forms of regulation, but negligible differences between men and women on each of the regulations. The findings were interpreted as supporting the applicability across genders of autonomy-related constructs within OIT and reflected in the Mullan et al. (1997) measure.

Summary

Meta-analyses support SDT's motivational continuum within the sporting domain. Autonomous motivation is positively associated with physical activity, sport practice, and engagement. Basic psychological need satisfactions are associated with more positive affective experiences, and both need satisfactions and autonomous qualities of motivation are negatively associated with burnout. Instructor autonomy support is positively associated with students' need satisfaction, effort, and level of activity within physical education. SDT's motivational constructs have proven applicable for both men and women within the exercise domain.

Parenting

Parental Autonomy Support

Rosenzweig (2000), in an unpublished dissertation, provided a meta-analytic review of parenting practices and their effects on student achievement. The practices examined were

drawn from multiple theories and focused on broad constructs such as emotional support as well as theory-specific constructs such as parental autonomy support. Rosenzweig (2000) identified 12 studies including autonomy support, with findings revealing a small, positive correlation between parental autonomy support and student achievement ($r = .16$). The use of external rewards, a parenting behavior that SDT has criticized as too often controlling, was negatively associated with student achievement ($r = -.28$). More generally looking across both positive and negative parenting styles, Rosenzweig (2000) concluded that autonomy support and authoritative parenting styles positively promoted children's school success, whereas controlling, uninvolved or critical parental behavior, which in SDT would be seen as need thwarting, negatively predicted student success.

Subsequently, Vasquez et al. (2016) presented a more extensive and SDT-focused look at parent autonomy support and its effects on school achievement, motivation, and positive functioning in a meta-analysis of 36 studies. Parent autonomy support was related to greater academic achievement ($r = .11$) and indicators of adaptive psychosocial functioning, including greater autonomous motivation ($r = .19$), greater extrinsic motivation ($r = .22$), higher perceived competence ($r = .21$), more engagement ($r = .12$), and more positive school-related attitudes ($r = .22$). However, the strongest relation was found between parent autonomy support and child psychological health ($r = .38$). Vasquez et al.'s (2016) results also suggested that the parent autonomy support relation was stronger when both parents were autonomy supportive. Moderator analyses also suggested that the relations between parent autonomy support and psychosocial outcomes may vary by grade level.

Valcan et al. (2017) examined the impact of parental behaviors on children's executive functioning. SDT holds that particularly autonomy support and competence scaffolding enhance executive functioning in development (e.g., Bindman et al., 2015). Valcan et al. included autonomy support, responsiveness and scaffolding in a variable called

positive parenting, which was positively associated with executive functioning ($r = .25$), whereas negative parent behaviors, which included control, rejection, negative regard, power assertion and intrusiveness were negatively related ($r = -.22$).

Finally, a meta-analysis under review by Bradshaw and colleagues (2021) provides perhaps the most comprehensive review of the effects of parental autonomy support and control on child well-being. The review included 211 eligible reports, spanning 49 years, and including $N=92,634$ participants. Using meta-analytic multilevel structural equation modelling, Bradshaw et al. (2021) demonstrated that parental autonomy support was moderately, positively associated with child well-being ($r = .28$), and moderately, negatively associated with child ill-being ($r = -.22$). Controlling parenting was moderately, positively associated with child ill-being ($r = .19$), and weakly, negatively linked with child well-being ($r = -.12$). The ‘cross-path’ effects observed in the review are further evidence of SDT’s so-called dual-process model. Parent autonomy support does more to support wellness than it does to protect against ill-being, and similarly, controlling parenting conduces to harm more than it undermines existing wellness. Moderator analyses further indicated that psychological control (as compared to behavioral control) may be particularly detrimental to child wellness, whereas the negative effects of behavioral control are weaker, perhaps reflecting their role as a structural or boundary-setting component of parenting. Importantly, child age, child gender, and the region from which the sample was drawn did not moderate the effects of parent autonomy support or parent control, suggesting they are largely universal.

Bradshaw et al. (2021) also sought to settle debate within the literature concerning autonomy versus independence. Early in SDT’s development, disagreements arose about whether people genuinely need autonomy. Most often, such debate was based on a definition of autonomy as ‘independence from others’ rather than autonomy as ‘agency and volition’, the latter of which is what SDT specifies. In their review, Bradshaw et al. (2021) separated

studies that measured parenting practices consistent with SDT's definition of autonomy from those that conflated autonomy support with independence-oriented parenting. They used the resulting binary variable as a moderator of the links between autonomy support and child well-being and ill-being. While 'conflation' was not a statistically significant moderator of the pooled effects, compared to the studies of 'pure' autonomy, the confidence intervals for studies in which autonomy and independence were conflated were much wider. This suggests that although there may be an average positive effect of conflating autonomy-supportive with independence-supportive parenting, the effect is associated with greater uncertainty, meaning the degree to which it will be beneficial to a specific child is harder to predict. As compared to autonomy support, for which the confidence intervals were tight, suggesting the effect is reliably beneficial across children. These results further emphasize SDT's longstanding distinction between autonomy and independence (Ryan & Lynch, 1989), and its importance in the domain of parenting.

Are Autonomy Support and Control Opposites?

Duineveld, et al. (2018) did a meta-analysis of the relations between autonomy supportive and psychologically controlling parenting across developmental stages. Autonomy support and psychological control are two of the most highly researched parenting dimensions, yet research is inconsistent about how these parenting approaches relate to each other: are they polar opposites or separate parenting dimensions? Suspecting heterogeneity, Duineveld et al. (2018) conducted a meta-analysis of the link between autonomous and psychologically controlling parenting, and whether this link was moderated by age, an important issue given varied beliefs about younger children's rights to and capacities for autonomy. A meta-analytic structural equation model was conducted on findings from 51 studies, involving 88 separate data points. A large negative relationship was found between autonomy support and psychological control ($r = -.50$), but this relation was moderated by

developmental stage, which explained almost 50% of the heterogeneity in effect sizes. In fact, starting from early childhood, there was a general monotonic increase in the relationship, while autonomy support and psychological control were strongly negatively associated in measures of parenting of emerging adults ($r = -.72$), these dimensions are distinct in studies of parenting in early childhood ($r = .10$).

Koehn and Kerns (2018) applied meta-analysis to examine the relations between parenting strategies and child attachment styles in children 5 to 18 years of age. Neither the variables nor the hypotheses were restricted to or framed using SDT, but SDT authors have clearly argued that one important component of secure attachments is parental autonomy support (La Guardia et al., 2000; Ryan et al., 2016). Koehn and Kerns (2018) identified 10 studies testing this relation, revealing a small-to-moderate, positive effect ($r = .18$), indicating that autonomy-supportive parents had children with more secure attachments. Fourteen studies also examined the relations of attachment security to harsh control from parents, a relation that from an SDT view should clearly be negative. Results showed such a negative effect ($r = -.20$). No statistically significant results were found for other attachment styles, likely due to the small number of studies tracking those relations.

Although also not couched in SDT, Crandell et al. (2018) did a meta-analysis of parenting styles related to children's mental health outcomes using Skinner et al.'s (2005) six-dimensional model which draws from and strongly parallels SDT's model of parental autonomy support, structure, and positive involvement as the nutrients for development (Grolnick & Ryan, 1989). Skinner et al. (2005) instead assess autonomy support and coercion, structure and chaos, and warmth versus rejection, as six dimensions. SDT would predict positive effects from autonomy support, structure, and warmth, and opposite effects from coercion, chaos, and rejection. Across outcomes including anxiety, depression, quality of life, and internalizing and externalizing symptoms this pattern was generally true, although

not all variables predicted outcomes. Autonomy support, for example, was associated with less anxiety ($r = -.22$), higher quality of life ($r = .24$), and fewer externalizing symptoms ($r = -.27$). Autonomy support's opposing dimension, coercion, predicted higher anxiety ($r = .22$), depression ($r = .33$), internalizing symptoms ($r = .17$), and lower quality of life ($r = -.20$).

Summary

Parental autonomy support is related to a host of positive child outcomes, including greater academic achievement, adaptive psychosocial functioning, and more positive school-related attitudes. Whereas autonomy-supportive parenting is particularly predictive of children's well-being, controlling parenting is predictive of children's ill-being. The association between autonomy-supportive and controlling parenting changes over the course of development: in early childhood, these constructs are distinct, but by emerging adulthood these constructs are strongly negatively correlated. Autonomy-supportive parents have children with more secure attachments, and harsh parental controls are associated with insecure child attachments.

Summary and Conclusions

SDT is a broad and multi-aspect framework that has developed slowly over time. At this point a sufficient pool of meta-analyses has started to distinguish the broad outlines of what is reliably known, at least meta-analytically speaking. In these conclusions, we summarize some of those 'truths'. However, we should begin with a comment about the nature of meta-analyses and the strengths and limitations of the evidence they can provide.

The most striking feature of these meta-analyses, when examined collectively, is their typical (though not invariant) reliance on cross-sectional datasets. Even in areas where multiple longitudinal studies and intervention data exist, for methodological reasons often only one time point is included from each dataset so as not to bias the overall meta-analysis. In an era of psychological science that focuses on causal rather than associative links, the

knowledge revealed by aggregations of cross-sectional data can be unsatisfying. Helping to ameliorate that, a few meta-analyses of intervention effects (e.g., Gillison et al., 2019; Su & Reeve, 2011) and experimental studies (e.g., Deci et al., 1999), both of which have causal implications, provided supportive evidence for SDT propositions and hypotheses.

Additionally, several recent meta-analyses took strides to examine longitudinal effects or change (e.g., Ntoumanis et al., 2021; Sheeran et al., 2020). Nonetheless, the main body of meta-analyses here is focused on establishing the reliability of hypothesized relations between SDT's constructs, and between those constructs and various predicted antecedents and consequences.

Yet, from the standpoint of theory construction, these meta-analytic demonstrations of hypothesized associations between constructs, and predictive relations between constructs and outcomes, provide an important scaffolding for continuing science. As just one example, within SDT a central issue is the role of basic psychological need satisfaction and frustration as mediators between environments and outcomes. Evidence of mediation by basic needs points toward important points for leverage in applied work—particularly because on the environmental side, interventions can enhance autonomy and basic need supports and, on the individual side, changes in awareness, emotion regulation, and motivation can also alter these mediators. In addition, mapping out existing meta-analytic knowledge highlights what has not yet been reliably established, and what relations are heterogeneous and perhaps strongly moderated. Thus, in what follows we highlight findings that appear to be ‘meta-analytically true’ as well as some gaps in knowledge and needed future directions for research.

First, there is support for CET in the evidence for multiple factors that can enhance (e.g., choice, positive feedback) or diminish (e.g., negative feedback, controlling rewards) intrinsic motivation as the theory proposes. Regarding OIT, there does seem to be a clear relative autonomy continuum structure to motives, and a generally graded set of relations

between motives and outcomes such as burnout, job satisfaction, academic performance (Howard et al., 2017; Van den Broeck et al., 2021), and mindfulness (Donald et al., 2020) such that the more autonomous the type of motive, the better the outcome, and the more mindful the person, the more likely they are acting with autonomy. Moreover, need-supportive environments appear to enhance autonomous motivation, and its associated positive consequences, including prosociality (e.g., Donald et al., 2021). Third, SDT's basic psychological needs are reliably related to wellness outcomes with effect sizes typically in the medium to large range (e.g., Stanley et al., 2021).

Whereas CET, OIT, and BPNT mini-theories have received strong meta-analytic support, support is much thinner where COT and GCT are concerned. In each case, only one primary meta-analysis exists, and though they each provided promising results, more research is needed, especially to unravel moderators and more detail on causal relationships. Indeed, one general observation from the review is that while many findings support SDT formulations, many central propositions remain to be meta-analytically confirmed. In this regard, the science of SDT remains incomplete and, hopefully, this meta-analytic skeleton of knowledge can continue to be fleshed out by a much more nuanced and complex surrounding literature.

Heterogeneity in Effect Sizes

Another common finding across these meta-analyses is a high degree of heterogeneity in many study findings (see Supplemental Material, Table S1). Thus, even though meta-analyses have generally supported SDT hypotheses in terms of both direction and significance, there is substantial variation in effect sizes between individual studies. Such heterogeneity suggests the potential presence of moderators and/or variations or unreliability in measures and methods. To date, accounts of heterogeneity have been far from comprehensive.

Several meta-analyses examined moderation by age. Duineveld (2018) found important age differences in the relations between perceived autonomy support and perceived control, reflecting a developmental effect. However, other meta-analyses have found little effect of age (e.g., Donald et al., 2021; Bradshaw, 2022). Gender has also been examined but has not emerged as a significant moderator (with an exception being Stanley et al., 2021).

The most common focus of moderation testing has been on the theoretically relevant dimensions of individualism and collectivism. These dimensions have been especially salient because some authors have suggested that autonomy is more valued and relevant in individualistic cultures than in collectivist contexts (Chirkov et al., 2003). Accordingly, and especially in recent reports, the issue of moderation by individualism and collectivism has been examined (e.g., Bradshaw et al., 2021; Slemp et al., 2018, Slemp et al., 2020; Yu et al., 2018). These analyses have consistently shown no moderation effects for this cultural dimension, providing support for this aspect of SDT's universality assumption. Several meta-analyses also examined moderation by country, which has also not emerged as significant (e.g., Bradshaw et al., 2022; Slemp 2018). Yet, specific dimensions of culture such as vertical-versus-horizontal (Singelis et al., 1995) or tight-versus-loose (Gelfand, 2019) distinctions have yet to be explored as moderators.. Also, although Bradshaw et al. (2022) found no effects for socioeconomic status, we note that economic factors have not been widely examined at a meta-analytic level. Future research should address these and other underexplored possibilities. From an inductive standpoint, a universality assumption can never be thoroughly enough tested.

Heterogeneity in meta-analyses can also reflect variations in methods and measures employed across studies. Variance of this nature is likely within SDT research, as a variety of instruments have been used to measure outcomes such as wellness, engagement, or performance. In addition, key theoretical constructs such as autonomy and intrinsic

motivation are often measured in a variety of different—though related—ways across studies. Meta-analytic results reveal, for example, that differing scoring systems can moderate effects, (e.g., Bradshaw, 2022; Howard, 2021). Finally, many SDT variables are broad, and can be intervened upon in myriad ways, as shown in intervention meta-analyses (e.g., Gillison et al., 2019; Ntoumanis et al., 2021). This multi-determination in predicted effects is yet another factor that may contribute to heterogeneity within this literature.

In sum, there have been efforts to account for heterogeneity in effect sizes within SDT meta-analyses, but much remains to be understood. The substantial variation documented for many of the effects listed in Supplemental Material, Table S1 suggests the importance of both further refinements in terms of both measurement reliabilities and identification of moderators.

Additional Limitations

Our review focused on English language publications and papers, which can contribute to a mono-language bias. This limitation also applies to many of the meta-analyses we reviewed within this paper. Especially where hypotheses may potentially be moderated by regional or cultural contexts, global publications may have particular importance and future reviews should seek out non-English meta-analytic studies. Also as noted above, several meta-analyses have included samples from multiple countries and examined for moderation effects. Nonetheless, the preponderance of studies comprising these meta-analyses are based on North American, European, Australian, and Asian samples with many fewer studies stemming from African or South American nations. This limitation in the extant literature lends caution to statements of generalizability. Because SDT claims many of its principles to be universal in nature, more research in underrepresented regions is needed.

Another salient limitation is our focus in this review only on clearly SDT-based meta-analyses. As we noted in the introduction, other contemporary theories focus on some

questions and issues overlapping with the content of SDT, and we did not attempt to synthesize those into the current review.

Conclusions

Within behavioral sciences attitudes toward broad theory vary, but recently many have suggested that there is a theory crisis within psychology (e.g., see Muthukrishna & Henrich, 2019). The claim is that broad theories have not taken root or been sustained over time, resulting in an absence of cumulative and actionable knowledge. Eronen and Bringmann (2021) argue that theory building in psychology suffers, in part, because “not enough attention is paid to defining and validating constructs...” (p. 785), which they see as essential to solid theory construction. McPhetres et al. (2021) add that much if not most of the published research in psychology is not theory driven. Finally, Berkman and Wilson (2021) suggest that contemporary theories rarely pass a practicality criterion—too often they are simply not useful and have meaning only within academia.

These are all problems with which SDT researchers have been contending by carefully validating constructs, testing explicit propositions and hypotheses, and focusing on practicality and translational value. SDT’s “brick by brick” approach (Ryan & Deci, 2019, p. 111) layers newer SDT constructs upon already well-validated constructs and corroborates findings, leading to an ever-widening scope of research and utility. In this way the theory has grown from a narrow theory of the dynamics of intrinsic motivation, to the wider spheres of both intrinsic and extrinsic motivations, and then further to the study of personality development and the psychological and social supports necessary for wellness and flourishing. The progress and the limitations of that growth are hopefully brought into greater clarity by this review of what we meta-analytically know about SDT.

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Table 1*Meta-analytic Studies Testing SDT Mini-theories and Their Propositions*

Cognitive Evaluation Theory <i>CET</i>	Organismic Integration Theory <i>OIT</i>	Causality Orientations Theory <i>COT</i>	Basic Psychological Needs Theory <i>BPNT</i>	Goal Contents Theory <i>GCT</i>	Relationships Motivation Theory <i>RMT</i>
Ceresoli et al., 2014	Bureau et al., 2022	Hagger & Hamilton, 2021	Cerasoli et al., 2016	Bradshaw et al., 2022	
Deci et al., 1999	Chatzisarantis et al., 2003	Murphy & Steel, 2021	Serie et al., 2021	Dittmar et al., 2014	
Eisenberger & Cameron, 1996	Donald et al., 2020		Stanley et al., 2021		
Fong et al., 2019	Guerin et al., 2012		Tang et al., 2020		
Howard et al., 2021	Howard et al., 2017		Vasquez, 2016		
Patall et al., 2008	Howard et al., 2021		Yu et al., 2018		
Rummell & Feinberg, 1988	Lochbaum & Jean-Noel, 2016				
Tang & Hall, 1995	Slemp et al., 2018				
Wiersma, 1992	Steingut et al., 2017				

Table 2*Meta-analytic Studies Testing SDT Within Applied Domains*

Organizations	Health	PA/PE/Sport	Education	Parenting
Bauer et al., 2016	Gillison et al., 2018	Back et al., 2022	Bureau et al., 2022	Bradshaw et al., 2021
Cerasoli et al., 2014	Hagger & Chatzisarantis, 2009	Guerin et al., 2012	Burke et al., 2020	Crandell et al., 2018
Cerasoli et al., 2016	Ng et al., 2012	Hagger & Chatzisarantis, 2016	Howard & Howard, 2020	Duineveld, 2018
Good et al., 2022	Ntoumanis et al., 2021	Li et al., 2013	Okada et al., 2022	Koehn and Kerns, 2018
Slemp et al., 2018	Sheeran et al., 2017	Lochbaum and Jean-Noel, 2016	Slemp et al., 2020	Rosenzweig, 2000
Van den Broeck et al., 2016		Mossman et al., 2022	Su & Reeve, 2011	Valcan et al., 2018
Van den Broeck et al., 2021		Owen et al., 2014	Taylor et al., 2014	Vasquez, 2016
		Sierra-Díaz, 2019		
		Teixeira et al., 2018		
		Vasconcellos et al., 2020		
		Zhang et al., 2022		

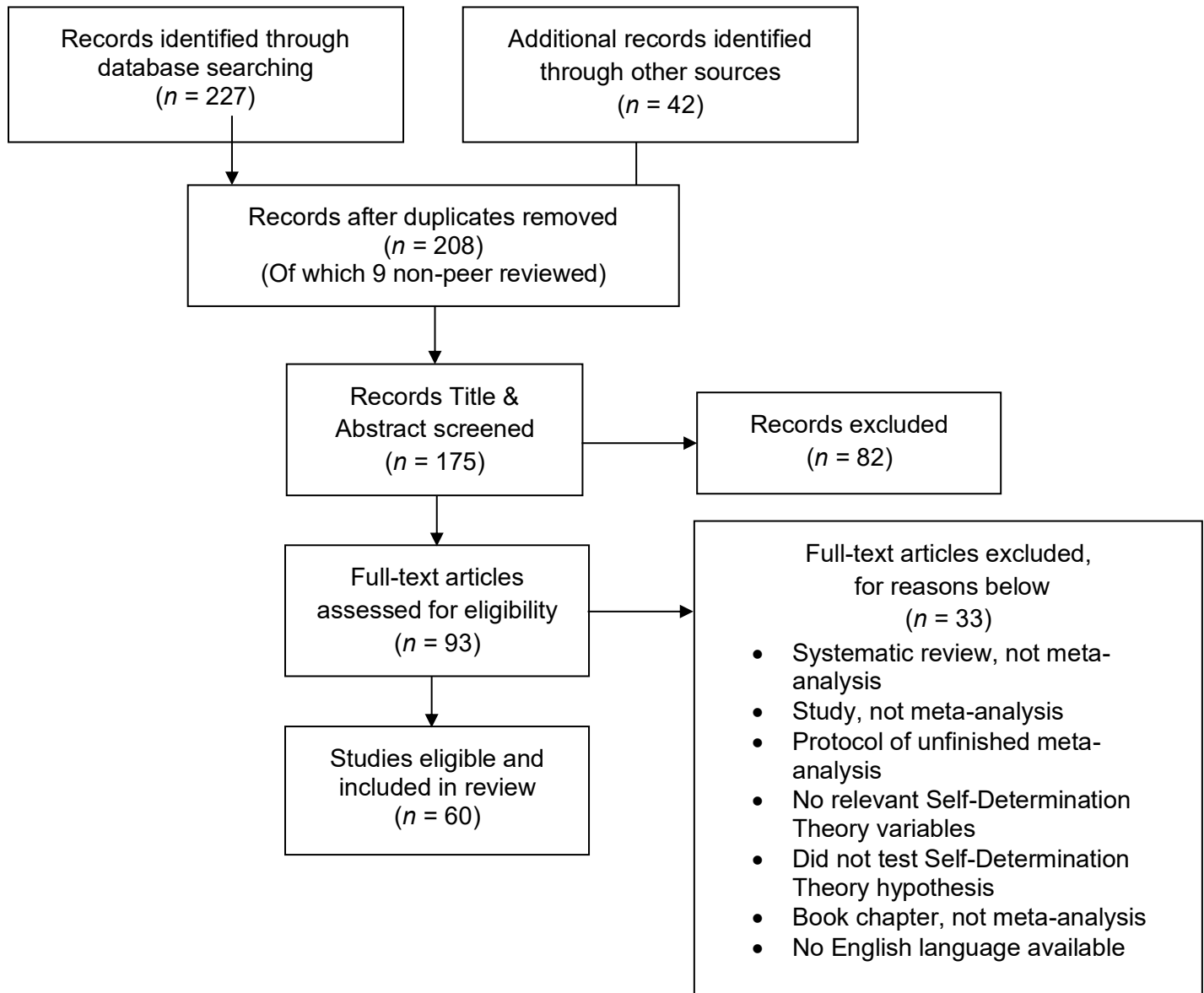
Figure 1*Flow Diagram of Search Results and Article Screening*

Figure 2

The Organismic Integration Theory (OIT) Taxonomy of Regulatory Styles

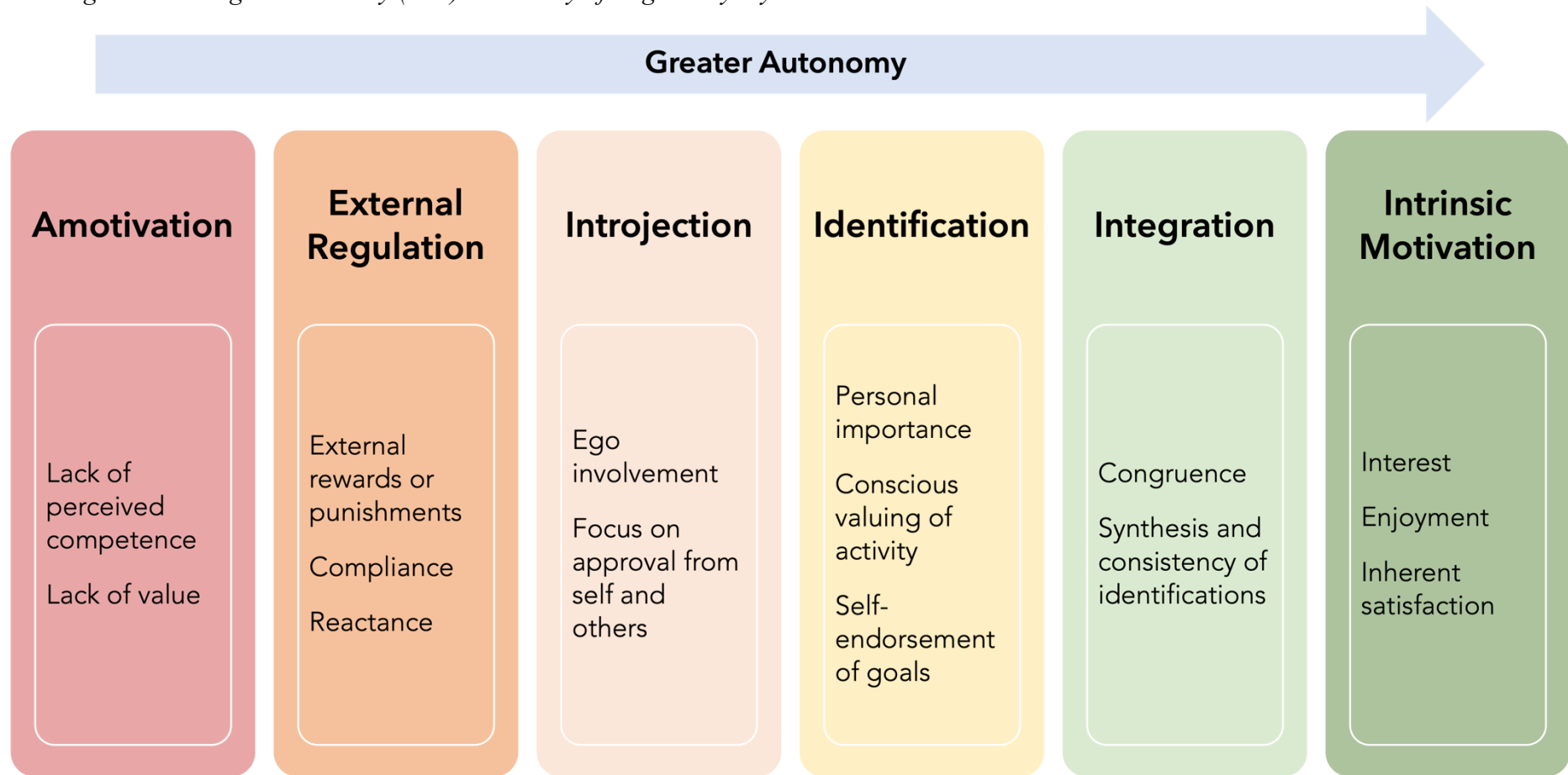


Figure 3*Leadership Autonomy Support Path Diagram*

Adapted material from: Slemp, Kern, Patrick, & Ryan, *Leader autonomy support in the workplace: A meta-analytic review*, *Motivation & Emotion*, 2018, Springer, <https://creativecommons.org/licenses/by/4.0/>

