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A Meta-Analysis of the Effectiveness of Implementation Intentions for Sustainable Behavior Adoption

Abstract

Many studies have indicated the difficulties that motivated consumers encounter to effectively carry out their intentions to behave sustainably. Goal planning, such as the formulation of implementation intentions, may be effective in facilitating the performance of sustainable actions. However, because past studies have produced mixed results, we do not know under which conditions goal planning is more effective for sustainable behavior adoption. Drawing from goal planning theories, we propose a comprehensive conceptual framework to explain the plausible moderators of the effectiveness of implementation intentions. We test this framework with a random-effects meta-analysis of the existing evidence (k=31; N=10,466) to estimate the overall effect of implementation intentions on the adoption of sustainable behavior. The findings show that implementation intentions have an overall large effect (d=0.781), and moderate when only experimental studies are considered (d=0.473). Implementation intentions are more effective for sustainable behaviors that require more effort, time or money and when individuals can adapt their plans to their circumstances. The conclusions of this study are

relevant for improving both future research and the application of implementation intentions to scale up sustainable behavior adoption.

Keywords: sustainable behavior; implementation intentions; meta-analysis; sustainability

Nomenclature

d	Standardized mean difference
I^2	Percentage of total variation in effect sizes that is due to heterogeneity
k	Number (count) of studies=number of measures=number of effect sizes included in the meta-analysis
N	Sample size (sum of sample size of all the studies included in the meta-analysis)
n	Number (count) of articles included in the meta-analysis
Q	Q statistic
r	Correlation coefficient
V_d	Variance of standardized mean difference
V_r	Variance of correlation coefficient

1. Introduction

The adoption of sustainable behavior (SB), defined as consumer behaviors which are less damaging to the environment than alternatives (Thøgersen and Olander, 2002: 606), is a fundamental objective in view of the current socioenvironmental crisis (Marcon et al., 2022; Zwicker et al., 2020). Staged models of behavior change have shown that SB adoption requires both motivation (goal intentions) and volition (goal planning) (Bamberg, 2013). Often individuals who are motivated to adopt SB do not enact their intentions (Carrington et al., 2010). This intention–behavior gap is a fundamental problem for SB adoption (Ateş, 2020; Chang and Hung, 2023; Bublitz et al., 2023). Two reasons are particularly relevant to explain this gap. First, individuals encounter barriers that increase the behavioral costs associated with intention enactment because performing the behavior requires more time, money or effort (Ran et al., 2022; Bray et al., 2011; Huang et al., 2020). With rising costs, attitudes are less predictive of behavior (Wyss et al., 2022).

Second, SB adoption involves breaking with past habits, which is not an easy task given the force of inertia (Hagger et al., 2023; Hoang et al., 2023).

The intention–behavior gap can be resolved with goal planning, since planning can support motivated individuals in carrying out the desired SB behavior (Bamberg, 2013; Carrington et al., 2010). Individuals should set SB adoption as a goal, identify a specific SB to carry out, and strive to enact this SB, navigating the barriers encountered and breaking with long-established habits (Bamberg, 2013; Linder et al., 2022). Goal planning is more necessary when individuals encounter difficulties in enacting their intentions (Bublitz et al., 2023; Gollwitzer and Brandstätter, 1997), which is usually the case for SB (Bray et al., 2011).

Implementation intentions (IIs) is the most popular goal planning intervention (Sheeran et al., 2024). IIs help individuals identify situations to act (if) and select the behavior to perform (then), linking anticipated critical situations to goal-directed responses ("Whenever situation X arises, I will initiate the goal-directed response Y!") (Gollwitzer, 1999). Because IIs help individuals anticipate barriers and pre-envisage ways to circumvent them (Marcon et al., 2022; White et al., 2019), IIs increase actual control over behavior and facilitate its performance (Wyss et al., 2022). IIs interventions successfully enable individuals to achieve their goals in different domains, such as healthy eating (Adriaanse et al., 2011a), physical activity (Bélanger-Gravel et al., 2013) or a reduction in alcohol consumption (Gollwitzer and Sheeran, 2006).

Beginning with the first experiment by Bamberg (2000), past work has studied IIs and SB adoption. Yet, these studies have yielded disparate results (e.g., Armitage et al., 2011 *vs.* Bell et al., 2016). This mixed evidence may be due to the different characteristics of SB actions and/or how the interventions were implemented. To illustrate, some SB such as bringing a broken washing machine to a depot recycling have high behavioral

costs as they require more time and effort, whereas others such as switching off the lights do not (Huang et al., 2020). Also, unlike behaviors such as saving energy (Seger et al., 2023) that can result in monetary savings, most SB do not provide clear self-benefits in the short term (Gifford and Nilsson, 2014; Steg and Vlek, 2009); this may reduce the motivation to strive for goal achievement. Regarding the intervention design, for instance, some studies used community samples (e.g. Castel et al., 2019) while others were interventions with students (Bamberg, 2002). Moreover, some studies used personalized plans (e.g. Buruiana, 2023) while others used prompted plans (e.g. Shreedhar and Galizzi, 2021). The effectiveness of IIs depends on factors such as the type of goal, barriers encountered, and intervention design (Gollwitzer, 1999); yet, a comprehensive synthesis that delves into these aspects for SBs is still lacking.

To reconcile these disparate findings, it is necessary to theorize and test the boundary conditions that define the "who, where, and when" IIs are more effective (Whetten, 1989). By conceptualizing and testing these boundary conditions, we extend the generalizability of goal planning theories across time, space, and context (Bacharach, 1989; Whetten, 1989) and contribute to the maturity and sophistication of this theory (Memon et al., 2019).

The objective of this study is to explain the effectiveness of IIs in promoting SB. Drawing on theories of goal planning and studies on IIs in other domains, we develop a conceptual framework that explains why and under what conditions IIs are most effective. Through a meta-analysis of 31 correlational and experimental studies, we empirically test how the identified moderators differentially influence the effectiveness of IIs in promoting adoption of SB. The overall pooled effect size of the relationship between IIs and behavior enactment was calculated, and multigroup analyses were carried out to examine the moderating effect of goal and intervention design characteristics.

The results demonstrate that IIs are an effective volitional strategy to support SB adoption with an overall effect size of 0.781. Furthermore, the study of moderators shows that this intervention is particularly effective for adopting high-costly behaviors and when plans are tailored to individual circumstances. Based on these results, we offer conclusions relevant for improving future research and the application of IIs to scale up SB adoption.

This paper makes two contributions to extant literature. First, while recent meta-analyses have included SB within broader IIs studies (Sheeran et al., 2024), the limited number of studies (6) hindered a deeper exploration of the "how" and "when" of IIs effectiveness. Our study contributes to the theoretical refinement and practical application of IIs as a tool for promoting SB, responding to past calls to explain how planning may help individuals enact their intentions (Bublitz et al., 2023). Second, this study is the first comprehensive synthesis that elucidates the overall effectiveness of IIs for SB adoption and the conditions under which they work best. Our focus on goal planning complements past reviews and meta-analyses of motivational interventions for SB adoption (e.g., Ammann et al., 2023; Harguess et al., 2020; Nisa et al., 2019), offering valuable evidence for enabling individual change (Bamberg, 2013).

2. Literature review

Drawing from goal planning theories and studies on IIs in other domains, notably health behaviors, this section articulates a conceptual framework to explain under which circumstances IIs are more effective at enabling SB adoption. We differentiate between four groups of moderators. First, we explain the goals or SB for which IIs are expected to be more effective and why; specifically, we propose three relevant moderators: costs associated with the action, existence of self-benefits, approach (*vs.* avoidance goals). Second, we identify three characteristics of the formulation of IIs that may also affect its

effectiveness: format of the IIs, planning personalization, and third-party checks. Third, we defend that IIs enrichment -goal planning accompanied with other additional interventions to increase volition, motivation or knowledge- will be more effective. Finally, we propose that the duration of the intervention moderates the effectiveness of IIs.

2.1. Goal characteristics: high-cost actions, self-benefits and approach vs. avoidance goals

Past work has explained the attitude-behavior gap or the fact that the intentions to behave sustainably are not realized, as a result of external (e.g., limited recycling facilities or premium prices) and internal (e.g., loss of comfort, inertia or forgetfulness) barriers (Carrington et al., 2010). These barriers make SB more costly: external barriers make SB more time or money costly, whereas internal barriers make SB more effortful thus requiring greater energy to carry them out (Bublitz et al., 2023; Huang et al., 2020). The greater the costs are, the greater the difficulties in moving from goal setting to goal achievement, because when these costs are encountered, individuals are reluctant to carry out their intentions to behave sustainably (Wyss et al., 2022). The attitude-behavior gap is then greater for high-cost actions (e.g., leaving an old washing machine at a recycling depot six miles away) than for low-cost actions (e.g., recycling a can) (Gómez-Olmedo et al., 2021).

Goal theories show that planning is more necessary when individuals encounter difficulties in enacting their intentions (Bublitz et al., 2023; Prestwich and Kellar, 2014; Tam and Spanjol, 2012). For high-cost SB, motivation and individual self-regulation are insufficient for goal enactment (Abid et al., 2021; Gómez-Olmedo et al., 2021): rather, for these, goal planning is necessary to ensure goal achievement (Gollwitzer and Sheeran, 2006). The formulation of IIs enhances self-regulation and shield individuals from

temptations or distractions that prevent them from performing sustainable actions (Gollwitzer and Sheeran, 2009). Because IIs help anticipate and overcome barriers (Bélanger-Gravel et al., 2013; Gollwitzer, 1999) and increase behavioral control (Bamberg, 2013), they may be effective in enabling goal enactment of high-cost actions, those requiring more time, effort, or expenditures. Moreover, we would expect that IIs would be more effective when behavioral costs are not reduced or alleviated as part of the intervention. For example, to reduce economic barriers, past studies have provided free tickets or vouchers to participants (Thøgersen and Møller, 2008); to reduce contextual barriers, they have provided a dustbin for recycling (Holland et al., 2006). In sum, we expect that because low-cost actions are under the volitional control of individuals, goal planning is less necessary for goal achievement, and thus, IIs may be less effective; the reverse would be true for high-cost actions, as they are more difficult goals that require planning to ensure achievement.

A second moderator is the existence of self-benefits (Sheeran et al., 2024). When individuals perceive direct personal benefits from engaging in a behavior, they are more motivated to carry out their intentions and goal planning is less necessary. Conversely, IIs may be more effective in helping people perform behaviors that have no apparent self-benefits (e.g., recycling); when a behavior is unattractive, goal attainment is less driven by motivation only and goal planning is more necessary (Gollwitzer and Oettingen, 2011; Ntoumanis and Sedikides, 2018). Therefore, we expect that IIs may be more effective for behaviors with no clear self-benefits for the individual.

A third plausible moderator of IIs effectiveness is the type of goal (i.e., approach *versus* avoidance goals). One difficulty in the adoption of SB is that the performance of sustainable actions usually requires changing automatized habits (Ammann et al., 2023; Gifford and Nilsson, 2014) and routinizing new actions (Nielsen, 2017). Changing habits

and forming new habits are not easy tasks given the force of inertia (Carrington et al., 2010; Hagger et al., 2023; Linder et al., 2022). Goal planning may be effective for approach goals, as it helps automatize the response of where, when, and how the action will be performed (Carrington et al., 2010; Gollwitzer and Sheeran, 2009; Gollwitzer et al., 2010; Gollwitzer and Oettingen, 2011), thus creating stable goal-means configurations that facilitate the routinization of new actions (Gollwitzer and Sheeran, 2009; Sheeran et al., 2024). Indeed, past meta-analyses in healthy eating have shown that IIs are more effective for initiating new actions (approach-like goals) than changing existing habitual actions (avoidance-like goals) (Adriaanse et al., 2011a; Carrero et al., 2019). In the case of unwanted habits, such as reducing car use or meat consumption, planning significantly facilitates goal enactment but only when the habit is weak (Kasten et al., 2017). In contrast, goal planning is less effective for changing long-established habits (Adriaanse et al., 2010; Adriaanse et al., 2011b). Consistent with these arguments and evidence, we expect that the effectiveness of IIs is greater for approach-type goals that reflect new habit formation (i.e., buying green certified products, choosing vegetarian meals, or separating waste) than for avoidance-like actions (i.e., reducing meat consumption or stopping the use of one's private car).

2.2. Implementation Intentions formulation: If-then vs. action plan, personalized vs. prompted, and II check

IIs is a flexible intervention that can be implemented in manifold ways. We defend that three characteristics of the intervention may moderate the effectiveness of goal planning on SB adoption: IIs formulation, which comprises IIs format and personalization, and IIs checks, or whether the plan was reviewed by the researcher. With respect to the format, IIs can take a simple if-then format (Gollwitzer, 1999; Gollwitzer and Sheeran, 2006) or a more complex format that specifies where, when, and what. This

latter format is called action plans (Chapman et al., 2009). If-then formats are highly specific, linking a situational cue (often identified as a barrier to overcome) with a concrete response. This specificity helps in clearly identifying when and what action should be taken. In contrast, action plans provide a broader framework for achieving a goal, outlining steps and strategies but often with a less concrete definition of the cue–response linkage, which then hinders the automatization of the behavior (Hagger and Luszczynska, 2014). Consequently, we expect that IIs interventions would be more effective when if-then plans are used than when action plans are used.

A second moderator is the personalization of planning as opposed to pre-formulated planning. In the former, individuals freely make their plans whereas in the latter they choose from a set of pre-defined plans (Sniehotta, 2009). We expect that personalized plans will be more effective for two reasons. First, personalization increases commitment to the plan which would, in turn, increase motivation to carry out the plan (Sniehotta, 2009). Second, personalization will facilitate goal enactment as it better adapts to the specific barriers encountered by the individual. Barriers to SB are distinct across individuals as they depend on the specific interaction of an individual with her environment (Bray et al., 2011); planning personalization may then enable individuals to better identify the specific barriers they face and the specific course of action to overcome them, resulting in greater SB adoption.

Finally, regarding the IIs check, previous meta-analyses revealed that when a third-party checked the formulation of the IIs to ensure the quality of the plan, the effectiveness of the intervention was significantly lower than when the participants did not receive any feedback about the plans sketched (Carrero et al., 2019). This effect is due to commitment to the plan: individuals are less committed to plans revised or changed

by a third party (Sniehotta, 2009). Therefore, we should expect greater effectiveness of IIs when individuals make their own plans without any assistance or checks.

2.4. Implementation Intentions enrichment: More than one psychological intervention, with increasing motivation intervention and initial training

IIs can be implemented on their own, or they can be enriched or supplemented with additional interventions. One such complementary intervention is mental contrasting, a self-regulation strategy that uses motivational and cognitive mechanisms to facilitate goal pursuit (Gollwitzer and Oettingen, 2008). In mental contrasting, individuals produce associative links between the desired outcome and the present barriers as well as between these barriers and the instrumental behavior to overcome this barrier (Kappes and Oettingen, 2014; Wang et al., 2021). Individuals first name a target wish (e.g., going to bed on time) and then elaborate on the desired outcome (e.g., feeling well-rested). Finally, they identify and imagine the barriers that may prevent them from reaching their wish (e.g., the urge to keep watching videos on the internet) to pre-emptively find options to overcome those barriers (Valshtein et al., 2020). This complementary intervention reinforces the goal planning intervention and helps individuals envision themselves carrying out their plans and imagine situational cues more vividly (Mutter et al., 2020). Moreover, combining mental contrasting with IIs seems to facilitate behavioral change in those who are less motivated. Unmotivated individuals have more difficulties imagining themselves following their self-generated plans; as mental contrasting helps them visualize themselves enacting their plans, they are more able to carry them out (Oh and LaRose, 2015). Therefore, we expect greater effectiveness when IIs are enriched with other volitional interventions.

IIs can also be supplemented with interventions aimed at increasing motivation for the problem (e.g., providing information about the environmental impact of meat

consumption). Goal planning is more effective when individuals are at least moderately motivated for goal achievement (McWilliams et al., 2019; Wright et al., 2023). Therefore, we expect that IIs will work better when the intervention increases the initial motivation of participants.

Finally, an IIs intervention can also be supplemented with initial training. Initial training can help individuals correctly formulate their plans or overcome barriers (Rodger et al., 2023; Vilà et al., 2022). Training enables individuals to accurately specify a situational cue that will elicit the target behavior; then, the action will be initiated automatically when the specified situational cue is encountered, facilitating habit formation (Gollwitzer, 1999). As individuals are more aware of alternatives, they can devise plans that better adapt to their circumstances. In contrast, when individuals fail to correctly specify when to act, the situational cue is not clear, there is no automatic enactment of the plan, and consequently, the effectiveness of IIs is limited (De Vet et al., 2011). Initial training may then increase the effectiveness of IIs, especially in the case of difficult goals, which may require more elaboration on how the action should be performed (Armeen et al., 2023). Therefore, we would expect better results in interventions that also include initial training.

2.5. Intervention duration

A final aspect to consider is the influence of IIs over time. Past evidence suggests that the effectiveness of IIs decreases over time. An IIs intervention was found to be efficient at the midpoint of the follow-up period (12 months), but the effect faded over time (24-month follow-up) (Guillaumie et al., 2013). In other studies, the most beneficial effect was found earlier, at the 9-week follow-up, and it was not maintained in the longer term (12 months) (Scholz et al., 2013). Providing further evidence of limited long-term

effects, IIs were found to be sufficient to maintain behavior over a 6-month period unless participants formulated a new II 3 months after initiating the study (Chapman and Armitage, 2010). Thus, consistent with these studies, we would expect greater effectiveness of IIs in the mid-term than in the short or long term.

3. Methods

Consistent with the most rigorous standards for meta-analysis (Page et al., 2021), the present study followed the PRISMA principles (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) as the basis for conducting and reporting our method and our results (Holden et al., 2014). A comprehensive search strategy was developed to identify relevant literature. Studies were screened in two stages: title/abstract screening and full-text review (see Figure 1). Data from the studies included were extracted systematically (Table S1 and Table S2). The publication bias (Figure 2) and risk of bias (Table S2) were assessed using appropriate tools to ensure the reliability of results. Finally, a meta-analysis was conducted to aggregate data and provide a quantitative summary of the evidence and test the moderators proposed in section 2.

3.1. Search and selection of studies

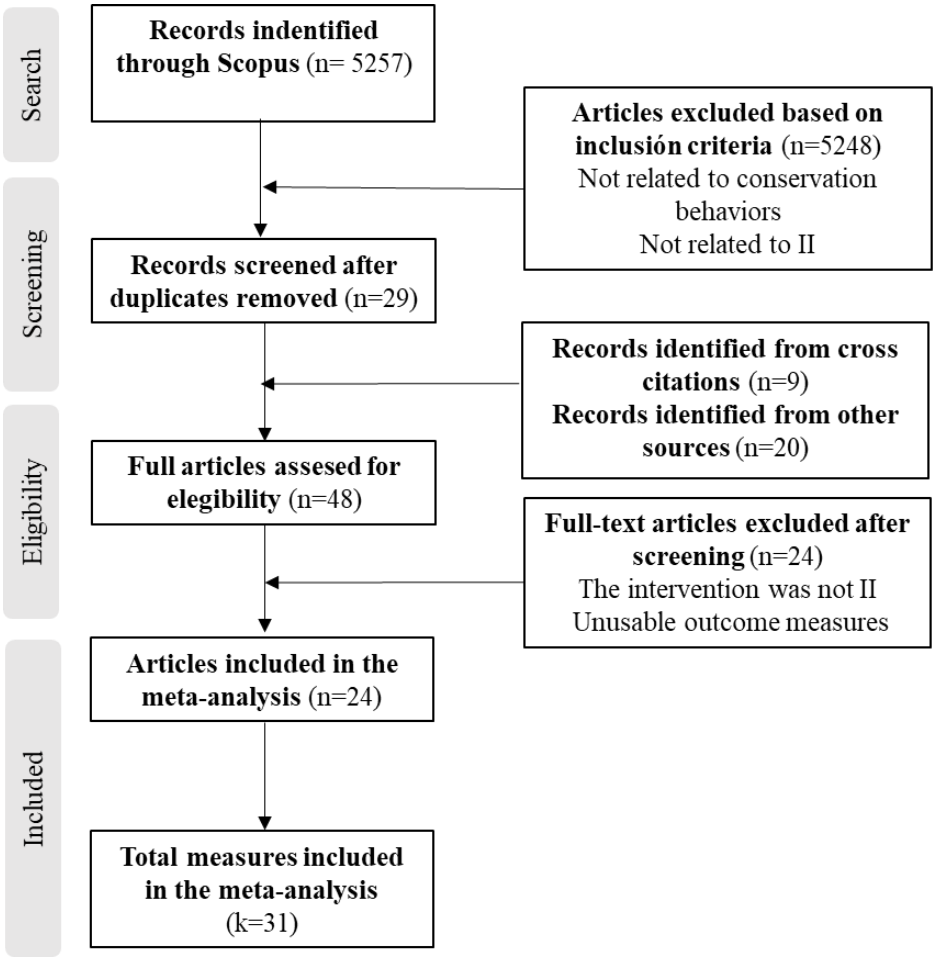
The systematic search was conducted between December 2023 and May 2024 in the Scopus database, as it is the largest and most representative scientific database of peer-reviewed journals (Zhu and Liu, 2020). In accordance with the aim of the review, the search was conducted via the following keyword search terms: "implementation intentions" "if-then" or "coping plan*" or woopor "wish-outcome-obstacle-plan" or "planning intervention" or "action plans" or "action planning" in all combinations with the words: sustainb* or pro-environmental or reduc* or recycl* or reus* or repar* or sav* or and excluding the words: health* or financ* or medic*. We refined the search

excluding evidence published before 1990, as the first paper on IIs was published that year (Gollwitzer, 1990). This search resulted in 5,257 articles. Then, we applied the following inclusion criteria: (1) the dependent variable was adoption of sustainable behaviors, (2) the studies assessed any format of IIs, (3) the use of planning could be either measured or manipulated, and (4) the study provided information for calculation of effect sizes. Two authors screened the title and abstract, and according to the mentioned criteria, only 29 articles were considered valid. This high level of attrition was due to the use of several of the keywords (e.g., "if-then", "action plan", sav*) in other domains.

Consistent with the PRISMA guidelines, it was necessary to include unpublished evidence that can attenuate the effects of publication bias on the sample of studies. For this, we followed several strategies. First, we ran a manual Google Scholar search of references that cited Gollwitzer (1990) or Bamberg (2000)-the first paper about IIs and SB-, obtaining 17 new studies. Second, a call for unpublished studies was posted in an academic newsletter with a wide readership (Elmar, managed by the American Marketing Association) and in the Facebook group of APA Division 34; no additional studies were received. Third, we screened electronic databases such as Proquest for MSc or Ph.D. dissertations, resulting in three more studies. Finally, nine cross-citations from the selected articles were also included in the sample of studies. The 48 remaining reports were then fully read for coding. During this process, another 12 articles were excluded because the intervention was not precisely IIs or were conceptual papers. Another six articles were excluded because of a lack of data to calculate the effect size or because the sample size was the same as that used in other studies. The authors of these papers were contacted when relevant data were missing; unfortunately, they either did not respond or responded that they were not able to provide the data. Finally, we included 24 relevant articles (*n*) in the sample for the meta-analysis, including 31 studies, each reporting its

corresponding measure to calculate its effect size (*k*) together involving 10,466 participants (*N*). The sample of studies is significantly larger than the six studies included in Sheeran, Listrom, and Gollwitzer (2024).

Figure 1. Prisma flow chart



n represents the number of articles at each stage of the screening process; *k* indicates the total number of measures included in the meta-analysis

3.2. Data coding and analysis

To ensure consistency and reliability in the coding process the remaining studies were coded independently by two reviewers (Author 2 and Author 4), and disagreements were resolved by consensus with a third reviewer (Author 1). Before analyzing the data set, following Bijmolt and Pieters (2001), some decisions were made: when multiple follow-ups were reported, only the final follow-up measure was used; in those cases in

which it was possible to include more than one measures per study (e.g., Sureth et al., 2019; Hsieh et al., 2017; Thøgersen and Møller, 2008), only one measure per intervention was used to ensure the statistical independence of effect sizes contributing to the overall effect size (Świątkowski et al., 2024); and only groups with equivalent interventions were included to isolate the effect of the intervention.

An in-depth examination of full-text content was carried out to extract data from experimental and correlational studies. All coded data were recorded in a standardized coding sheet to facilitate transparency and reproducibility. Studies were assessed against 36 codes derived from the conceptual framework reported in section 2. This procedure ensured that the coding process was systematic and aligned with the research objectives. An adapted version of the coding sheet can be found in Table S2. First, sociodemographic information about the sample was coded, namely, sample size, percentage of droppers, sex (% of female), education (% of individuals with higher education studies), country, age (mean), and type of sample (student/otherwise). Second, we coded the type of design (experimental/correlational). Third, we also coded whether the study reported that the behavior had barriers and was then costly, whether the study alleviated the potential barriers, types of goal (approach/avoidance) and target behavior. Additionally, for the experimental studies, we coded the following intervention characteristics: whether the participants personalized their IIs, the II format (if-then *vs*. action plans), whether the intervention included a check of plans after the formulation, whether the participants received initial training to formulate the plans (and if it was motivational or volitional), the total number of interventions and the length of the intervention in weeks.

3.3. Meta-analysis strategy

We used the standardized mean difference (SMD) *d* to measure the effect size. In a meta-analysis, effect size is a quantitative measure of the strength or magnitude of a

phenomenon across studies, in our meta-analysis, it represents magnitude of the effect that developing II has on sustainable behavior adoption. According to Cohen's (1992) power primer, *d*=0.20 is a "small" effect, *d*=0.50 is a "medium"-sized effect, whereas *d*=0.80 is a "large" effect. The effect size was calculated for those papers not reporting it. We calculated the effect sizes for all the studies selected according to the inclusion criteria applied, using the standardized mean difference (*d*) and the linear correlation coefficient (*r*). All measures were transformed into *d*, as described by Borenstein and colleagues (2021) and Laroche and Soulez (2012), using the following conversion formula:

$$d = \frac{2r}{\sqrt{1-r^2}} \text{ and } V_d = \frac{4V_r}{(1-r^2)^3} \text{ where } V_r \text{ is the variance of } r$$

The conversion of correlations (*r)* into effect sizes (*d)* is highly relevant in meta-analysis as this allows to include both correlational (reporting *r*) and experimental studies (reporting *d*) because it ensures that results from these two designs can be synthesized into a single analysis despite their differences (Borenstein et al. 2021).

Given the variety of measures for the dependent variables in the analyzed studies, the fact that IIs worked well for a specific outcome may yield a positive effect size (e.g., increase in the purchase of sustainable products) or a negative effect size (e.g., decrease in energy use). To avoid the compensation of positive and negative signs, we used the absolute (positive) value of the corresponding *d* when the IIs worked well and its opposite (negative) value when they did not work.

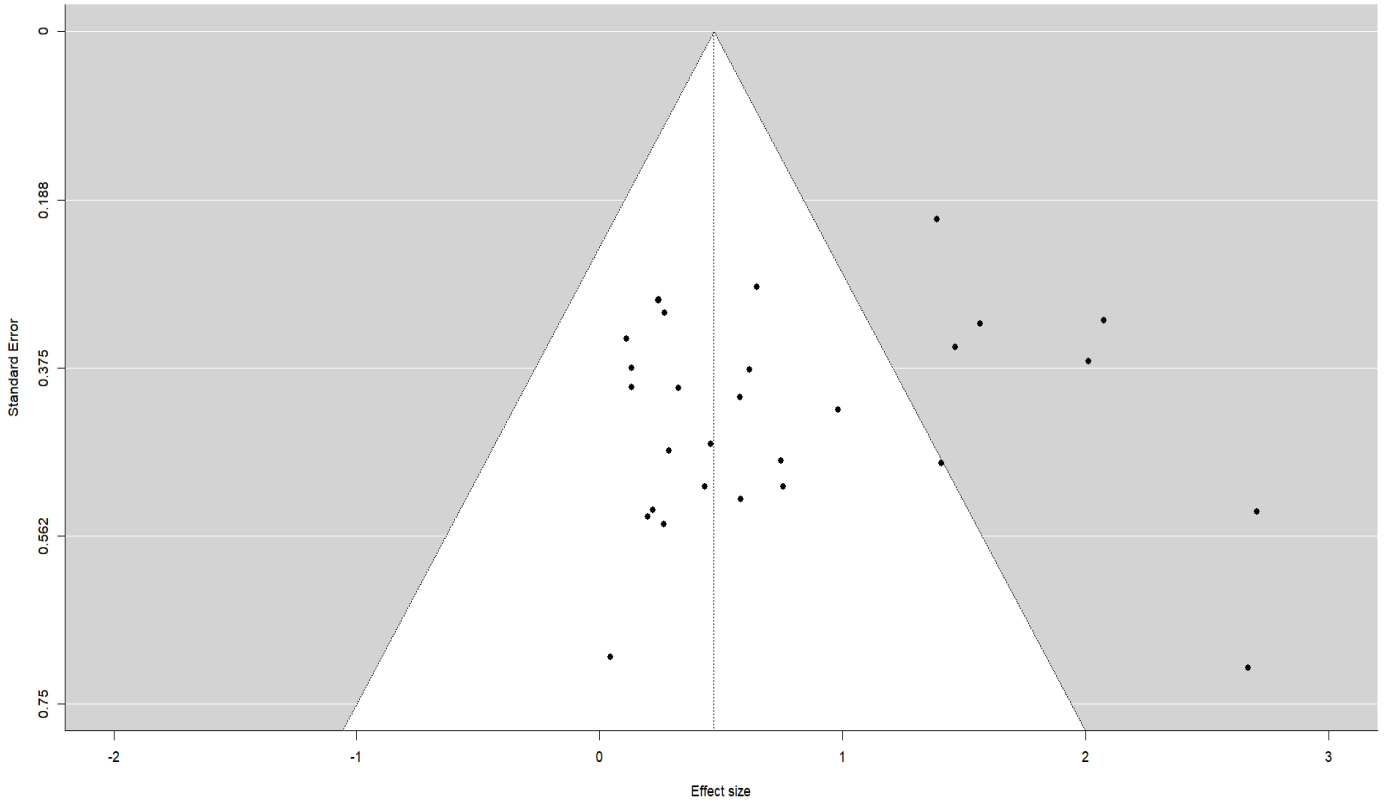
In the first step, the meta-analysis was conducted with pooled effect sizes via the inverse variance statistical method with random effects models (REMs). An REM is a more general meta-analytical method than fixed-effect models because it allows the true effect to differ from study to study. Following this method, the pool effect size is calculated as a weighted mean of effect sizes, where the weight assigned to each study is

the inverse of the within-study variance for the corresponding study plus the between-studies variance. The pooled effect sizes were reported as Hedge's measure of the SMD with a 95% confidence interval (CI). We chose Hedge's measure instead of Cohen's because it corrects for small sample sizes (Swiatkowski et al., 2024). Homogeneity was reported with the Q, I^2 and p values. In the second step, we examined whether the moderators conceptualized in section 2 affected the effect size. We offer statistical inference measures.

3.4. Risk of bias of the sample of studies

As only one of the studies included in the meta-analysis was a nonpublished study (Buruiana, 2023), the possible existence of publication bias was examined via a funnel plot, as shown in Figure 2. An inspection of the funnel plot shows that although this plot is not symmetrical, no gap appears near the bottom left in comparison to the bottom right. In particular, there is one size effect at the bottom of the funnel, with a size effect very close to zero. Therefore, it seems that no small (high standard error) or nonsignificant studies (effect size close to zero) were missing in the sample, suggesting no evidence of publication bias (Borenstein et al., 2021). Nonetheless, owing to the slight asymmetry of the funnel, we also conducted Egger's test to reassure the absence of publication bias. This test consists of performing a linear regression between the precision of the studies (independent variable) and their effect size (dependent variable), weighted by the inverse of the variance. In the absence of publication bias, the regression line originates at the origin of the Y-axis, and the further it is from zero, the greater the evidence of publication bias (Sterne and Egger, 2001). Thus, a nonsignificant intercept of this regression highlights the nonexistence of publication bias. In our case, the corresponding *p* value is 0.264, confirming the absence of this bias risk.

Figure 2. Funnel plot.



4. Results

Among the 24 articles (*n*) included in the meta-analysis, 31 effect sizes (*k*) were computed since some articles reported on more than one experimental group (e.g., Bamberg, 2002; Shreedhar and Galizzi, 2021). Hereafter, the descriptions of results are based on studies and their corresponding measures (*k*) and not on individual articles to avoid confusion, unless otherwise specified. In this section, first we provide a description of studies. Second, we examine the risk of bias of each of the studies included. Third, we provide the size effects for the overall sample of measures with and without outliers; we also provide the effect size according to study designs (correlational *vs.* experimental studies), risk of bias, domain of behavior (diet, energy, green purchases, and mobility), and type of outcome measure employed (self-reported *vs.* observed). In subsequent sections we test the moderating effects of goal type theorized in section 2.1, of the II-formulation theorized in section 2.2., of the IIs enrichment with other interventions theorized in section 2.3. and of the duration of the intervention, theorized in section 2.4. Table 1 summarizes the results.

Table 1. Summary of results of moderators

Moderators	Hypotheses	Results
Goal characteristics	Goal planning is more effective for high-cost actions and when barriers are not removed	Supported: effect sizes are greater for high-cost actions and the differences between groups are significant
	Goal planning is more effective for actions with no clear self-benefit	Not supported: effects sizes are greater for actions with self-benefits, but differences are not significant

	Goal planning is more effective for approach-type goals	Not supported: effects sizes are greater for avoidance goals, but differences are not significant
Intervention format	Goal planning is more effective for if-then formats	Supported: effect sizes are greater for if-then and the differences are significant
	Goal planning is more effective for personalized plans	Supported: effect sizes are greater for personalized plans and the differences are significant
	Goal planning is more effective when there are no third-party checks	Not supported: effect sizes are smaller for non-checks, but differences are not significant
Intervention enrichment	Goal planning is more effective when supplemented with other volitional interventions	Not supported: effect sizes are greater for more than one intervention, but differences are not significant.
	Goal planning is more effective when supplemented with other motivational interventions	Supported: effect sizes are greater, and differences are significant
	Goal planning is more effective when supplemented with training	Supported: effect sizes are greater, and differences are significant
Intervention duration	Goal planning is more effective in the mid-term	Partially supported: effect sizes are greater, but differences are only found with short-term and not with long-term

4.1. Description of studies

A detailed description of the studies can be found in Table S1. Beginning in 2015, there was an increase in published studies (21 studies, 68% of the sample), indicating increasing interest in the topic. The regions where the studies were conducted were mainly European countries (58% of the sample), notably Germany (7) and the UK (5). Regarding the methodological design, the average sample size was 337 participants. Excluding the study by Wang and Mangmeechai (2021) with 3,113 participants, the average sample size decreased to 245, with an average dropout rate in experimental studies of 28.65%. Most measures were based on community samples (k=21), with only 10 based on student samples. The samples were quite balanced by sex, although the percentage of females was slightly greater (59.84% females on average), and most of the participants had a bachelor's degree or higher (58.47% on average). The mean age of the participants was 32.01 years. Finally, regarding the type of SB, most studies have focused on mobility (11), and few have examined recycling (4) or energy conservation (4). Changes in diet and green-certified product purchases were analyzed in 6 and 5 studies, respectively. One correlational study analyzing environmental consumer behavior (Mishra et al., 2023) included several of these actions.

Most studies followed an experimental design, with only 8 correlational studies. Among the experimental studies, high-cost behaviors were identified in 12 studies, 9 studies included self-benefit actions (i.e., saving money or improving health), and 10 studies included approach-type goals. The intervention followed an if-then format in 13 studies, and only 3 studies conducted a check of the IIs formulated by participants. In 18 studies, the participants could personalize their plans. In 11 experimental groups, the intervention included only the formulation of IIs, whereas 12 studies included an additional intervention (mental contrasting, coping plans, or monetary incentives, to name

a few). There were 10 studies that provided training to participants before initiating the intervention and 6 studies motivated participants regarding environmental problems. On average, follow-up measurements were performed 2.83 weeks after the beginning of the study, with a range of 0.5 to 7 weeks after starting.

4.2. Risk of bias of the experimental studies

All experimental studies included in the meta-analysis were assessed for quality. The studies were evaluated by using the SIGN (Scottish Intercollegiate Guidelines Network) controlled trials checklist tool (2022). Accordingly, we considered whether the studies used random sequence generation and randomness checks, had allocation concealment, had deviations from intended interventions, did not have baseline imbalance or selection bias, had relevant, valid and reliable outcome variables (self-reported *vs.* observed measures), had incomplete outcome data, showed selective reporting of statistical results and reported bias, offered power analysis, and used or reported relevant covariates or confounding variables (see Table S2).

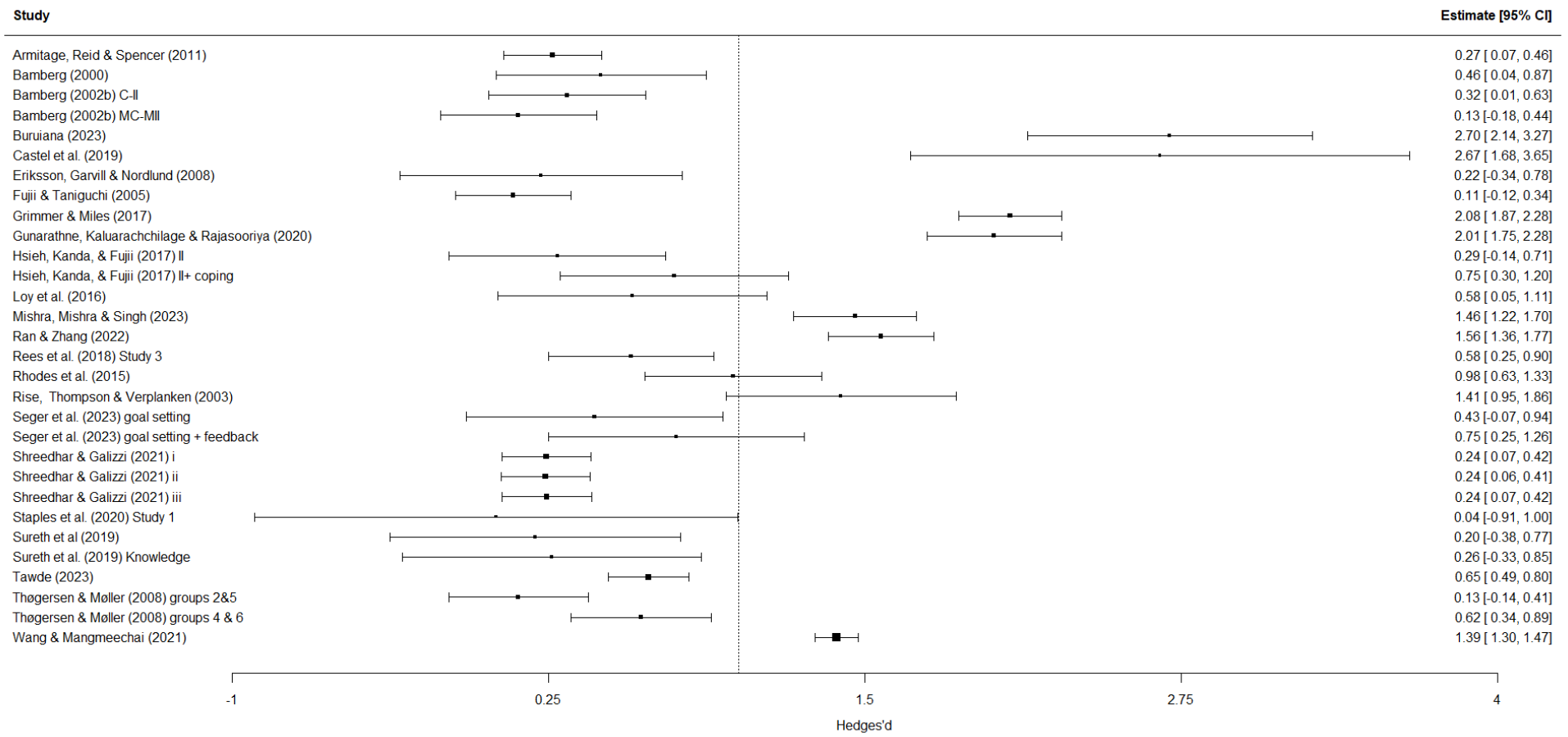
To independent reviewers (Author 1 and Author 4) read and rated the 16 papers reporting experimental studies for all intervention groups included in the meta-analysis. However, if the ratings were the same across studies, we depicted the ratings by article to avoid confusion. The only exception is Hsieh et al. (2017), where the risk assessment changed for the two intervention groups considered; thus, they are reported separately. When disagreement existed, the ratings were discussed with a third reviewer (Author 3) until a consensus was reached. The risk of bias was assessed as high, low, or unclear for each of the domains considered (Higgins et al., 2011). The overall risk of bias was rated as low when most of the domains assessed (at least 7 domains out of the 10 considered) were assessed as low, moderate when the study received a positive assessment in 4-6 domains, and high when the study had a low risk in 3 or fewer domains (Luberto et al.,

2018). Eight studies were assessed as exhibiting overall moderate risk, seven were assessed as high-risk, and only one study was assessed as low risk. In general, studies showed a lower risk of bias in terms of randomness checks, homogeneity of groups at baseline and baseline imbalance, and higher risk regarding power (generally not calculated) and the reliability and attrition of the outcome variable.

4.3. Overall size effect

The overall effect size of IIs interventions for SB was 0.920; this effect size significantly differed from zero, p <0.001 (95% confidence interval of 0.647–1.192). An effect size of 0.920 is considered large (Cohen, 1992). Homogeneity was not found (Q=1004.650, p<0.001, I^2 =97.01%), indicating that the variance between studies could not be attributed to a sampling error or other systematic differences across the studies (Lipsey and Wilson, 2001). An initial forest plot of effect sizes revealed that the effect size by Bell and colleagues (2016) was an outlier (d=5.461). In order not to inflate results, this study was excluded in subsequent analyses. The forest plot without the outlier is shown in Figure 3. The overall effect size with this outlier eliminated was 0.781 (p<0.001; confidence interval 0.531-1.031). Heterogeneity was again detected (Q=806.011; p <0.001; I^2=96.40%).

Figure 3. Forest plot.



Since previous meta-analyses of IIs and of SB have reported significant differences between correlational and experimental studies (Grabe et al., 2008; Shipley and van Riper, 2022), we also checked for possible differences between measures from experimental (k =22) and correlational (k=8) studies (see Table 2). The effect size in the correlational group was 1.442 (p<0.001, 95% confidence interval of 1.111–1.773), whereas in the experimental group, it was 0.473 (p<0.001, 95% confidence interval of 0.308–0.639). The differences were statistically significant (p<0.001) despite the small number of studies in the correlational group. These results seem to be consistent with the meta-analyses published by Gollwitzer and Sheeran's (2006) and Shipley and van Riper's (2022), which revealed that correlational studies presented greater effect sizes than experimental studies did. The effect size of experimental studies is also more consistent with the findings reported by Sheeran et al. (2024).

To better explore these differences, we analyzed the population characteristics and cultural contexts of the corresponding studies. However, we did not find significant differences between correlational and experimental studies regarding education, percentage of female participants, mean age of participants or country. Thus, we attribute the difference in effect size between correlational and experimental studies to two main reasons. First, in correlational studies, participants did not form IIs; instead, they reported the existence of a plan, measured with a scale, and the analyses reported the correlation between that plan and the outcome behavior. It is plausible that individuals with a stronger intention are those who anticipate how and when they are going to perform the behavior and, for this reason, greater effect sizes in the relationship between planning and SB are found. Second, regarding the study design, experiments have a controlled design and attempt to isolate specific variables. This leads to more conservative estimates of effect sizes. Correlational studies, in contrast, reflect real-world associations that might

incorporate unmeasured or external influences, inflating observed effects. Additionally, the correlational studies included in this meta-analysis rely on self-reported measures, which may amplify associations due to common-method bias, social desirability or shared variance (Podsakoff et al., 2003), whereas the experimental studies use more objective measures (e.g. Bamberg 2002; Bamberg 2000), which diminish the size of the observed effects.

No group homogeneity was found in correlational or experimental measures ($Q=157.382$, $I^2=95.55\%$, $p<0.001$ and $Q=114.865$, $I^2=81.718\%$, $p<0.001$, respectively). Given these differences in effect size, the low number of correlational studies and the risk of effect size inflation among correlational studies, the subsequent analyses will be conducted only in a sample of experimental studies.

Table 2. Overall pooled effect sizes

Subset	***k***	***d***	**95%CI lower bound**	**95%CI upper bound**	**Q**	**p-val**	**I^2(%)**	**p-val for multigroup analysis**
Pool	31	0.920	0.647	1.192	1004.650	<0.001	97.014	
Pool excluded outliers	30	0.781	0.531	1.031	806.011	<0.001	96.402	
Excluding outliers								
Correlational	8	1.442	1.111	1.773	157.382	<0.001	95.552	**<0.001**
Experimental	22	0.473	0.308	0.639	114.865	<0.001	81.718	
Experimental excluding outliers								
Low-Medium risk of bias	12	0.277	0.196	0.358	7.013	0.798	0.000	**0.019**
High risk of bias	10	0.740	0.361	1.120	102.637	<0.001	91.231	
Change in diet	6	0.685	0.289	1.081	74.250	<0.001	93.266	
Energy conservation	3	0.293	-0.413	0.998	1.894	0.388	0.000	
Green purchase	2	0.226	0.007	0.445	0.735	0.391	0.000	
Mobility	11	0.409	0.197	0.620	35.656	<0.001	71.954	
Self reported behavior	18	0.524	0.331	0.718	112.450	<0.001	84.882	0.067
Observed behavior	4	0.334	0.269	0.398	114.865	<0.001	81.718	

d: Standardized mean difference. k: Number of studies or effect sizes included in the meta-analysis. N: Total sample size of all included studies. I^2: Percentage of total variation in effect sizes due to heterogeneity. Q: Q statistic for heterogeneity testing.

For experimental studies, we also examined differences according to the risk of bias by comparing low- to moderate-risk studies with high-risk studies (see Table 2). The effect sizes were 0.277 (p <0.001, 95% confidence interval of 0.196–0.358) in the low–moderate risk of bias group and 0.740 in the high risk of bias group (p <0.001, 95% confidence interval of 0.361–1.120). Additionally, the differences were statistically significant (p=0.019). Homogeneity was reached in the low-moderate risk of bias group (Q=7.013, I^2=0%, p=0.798), whereas the degree of heterogeneity in the high-risk of bias group was significant and high (Q=102.637, I^2=91.23%, p<0.001). The homogeneity in the group of low–moderate risk of bias studies suggests that the studies included are sufficiently similar in terms of their design, methods, and findings.

Table 2 also shows differences in effect size across types of behaviors, classified in four groups: changes in diet, energy conservation, green purchases and sustainable mobility. Effect sizes were very different: a small effect was observed in the effectiveness of IIs for energy conservation and green purchases; moderate effect for sustainable mobility and large effect for changes in diet. However, an examination of the studies included in each group shows that they were very different in how IIs were implemented. This suggests that the distinct effect sizes can be attributed to the moderators theorized in section 2 and tested in sections 4.4., 4.5 and 4.6.

Finally, studies with self-reported outcome measures showed a greater effect size of 0.524, with a 95% CI from 0.331 to 0.718, and high heterogeneity (Q=112.450, p<0.001, I^2 = 84.882%). Those using an observed outcome measures reported an effect size of 0.334 with a 95% CI from 0.269 to 0.398 and similarly high heterogeneity (Q=114.865, p<0.001, I^2 = 81.718%).

4.4. Analysis of moderators related to goal characteristics

We first examined whether the characteristics of the goal theorized in section 2.1. moderated the efficacy of the intervention (Table 3). To test the moderation of costs, we compared measures of costly behaviors—for which the individual encountered substantial situational barriers (price, distance, time effort) that were not alleviated in the intervention with additional measures (for instance, by giving a free coupon or free travel pass)—and measures of less costly behaviors—those with fewer barriers or for which barriers were alleviated. The effect size almost doubled when barriers were present and not alleviated (d=0.615 *vs*. 0.296), and the comparison between these two groups revealed significant differences (p=0.048). This result supports our expectation: planning is more effective when it is used to promote more costly goals and costs are not alleviated as part of the intervention.

Second, we compared interventions related to behaviors that involve a clear benefit for the individual (i.e., saving money) and those without a self-benefit. Although the effect size was greater in the self-benefit group (d=0.590), the difference between groups did not reach significance. Thus, we conclude that self-benefit is not a moderator in this context, contradicting our expectations.

Finally, we determined whether the interventions were more effective at promoting new behaviors or eliminating old behaviors (approach *vs*. avoidance goals). Effect sizes in both groups were statistically similar, contrary to our expectation and what has been reported for other behaviors, such as healthy eating (Adriaanse et al., 2010; Adriaanse et al., 2011b; Webb et al., 2009). Therefore, we cannot confirm that this is a moderator of the efficacy of IIs in the case of SB.

Table 3. Results of moderation related to goal characteristics

Subset	***k***	***d***	**95%CI lower bound**	**95%CI upper bound**	**Q**	**p-val**	**I^2 (%)**	**p-val for multigroup analysis**
High-cost behaviors	12	0.615	0.312	0.918	104.582	<0.001	89.482	**0.048**
Low-cost behaviors	10	0.296	0.206	0.386	8.871	0.449	0.000	
No self-benefits	13	0.362	0.212	0.511	34.031	<0.001	64.738	0.275
Self- benefits	9	0.590	0.208	0.973	74.826	<0.001	89.308	
Approach behavior	9	0.353	0.177	0.529	31.422	<0.001	74.540	0.264
Avoidance behavior	13	0.550	0.253	0.846	80.030	<0.001	85.006	

d: Standardized mean difference. k: Number of studies or effect sizes included in the meta-analysis. N: Total sample size of all included studies. I^2: Percentage of total variation in effect sizes due to heterogeneity. Q: Q statistic for heterogeneity testing.

4.5. Analysis of moderators related to II formulation

We examined differences in effect sizes according to the II formulation, as conceptualized in section 2.2. The results are reported in Table 4. As expected, larger effect sizes were found for if-then plans (d=0.667) than for detailed action plans (d=0.303). Yet, studies using if-then formats were very heterogenous (I^2=88.83%). We noted that most of the interventions that used the if-then format focused on low-cost behaviors; in contrast, studies that used action plans focused on high-cost behaviors. The interaction between behavioral costs and format of IIs may have confounded the results. The best results were observed in two studies (Buruiana, 2023; Castel et al., 2019) that used the if-then format with costly behaviors (d=2.696). Conversely, the lowest efficacy was found when if-then plans were used with less costly behaviors (d=0.296) and when action plans were used (d=0.303).

Table 4. Results of moderation related to II formulation

Subset	***k***	***d***	**95%CI lower bound**	**95%CI upper bound**	**Q**	**p-val**	**I^2 (%)**	**p-val for multigroup analysis**	
If-then	12	0.667	0.363	0.971	98.480	<0.001	88.830	**0.003**	
Other	10	0.303	0.176	0.430	14.662	0.101	38.618		
If-then + High-cost behaviors (1)	2	2.696	2.207	3.184	0.004	0.948	0 .000	1--2	**<0.001**
If-then + Low-cost behaviors (2)	10	0.296	0.206	0.386	8.871	0.449	0 .000	1--3	**<0.001**
Else (3)	10	0.303	0.176	0.430	14.662	0.101	38.618	2--3	0.931
No personalized	5	0.241	0.142	0.339	0.030	0.998	0 .000	**0.001**	
Personalized	17	0.578	0.341	0.815	108.873	<0.001	85.304		
No II check	19	0.447	0.276	0.618	92.720	<0.001	80.587	0.363	
II check	3	0.923	-0.087	1.933	22.139	<0.001	90.966		

d: Standardized mean difference. k: Number of studies or effect sizes included in the meta-analysis. N: Total sample size of all included studies. I^2: Percentage of total variation in effect sizes due to heterogeneity. Q: Q statistic for heterogeneity testing.

With respect to plan personalization, the effectiveness is significantly greater for personalized plans (d=0.578) rather than those that were prompted (d=0.241; p=0.010). Regarding third-party checks of plans, we found wide differences depending on the intervention included these checks (d=0.923 in the II check group and d=0.447 in the no check group). However, owing to the high levels of heterogeneity and the sample size in one of the groups, these differences were not found to be significant. Thus, the direction of the effect sizes is not consistent with our expectation that the effectiveness is greater when no check is provided.

4.6. Analysis of moderators related to Intervention enrichment

No significant differences were found in the effect sizes depending on the presence of more than one intervention (Table 5). Similarly, studies supplemented with interventions aimed at increasing motivation for the problem for all participants had significantly greater effect sizes (d=0.613) than those that did not (d=0.297) (p<0.001). Moreover, significant differences were observed between the effect sizes of the intervention groups that received initial training (d = 0.549) and those that did not (d=0.308) (p=0.011). This finding supports our expectation that initial training, be it administered to all groups or only to the group doing goal planning, would increase effectiveness.

Table 5. Results of moderation related to II enrichment

Subset	*k*	*d*	95%CI lower bound	95%CI upper bound	Q	p-val	I^2 (%)	p-val for multigroup analysis
One intervention	10	0.363	0.160	0.566	29.797	<0.001	69.796	0.244
More than one intervention	12	0.558	0.300	0.817	83.735	<0.001	86.863	
Not increasing motivation	16	0.297	0.221	0.372	16.505	0.349	9.117	**0.001**
Increasing motivation	6	0.613	0.435	0.791	88.881	<0.001	94.375	
No initial training	13	0.308	0.222	0.394	15.725	0.204	23.688	**0.011**
Initial training	9	0.549	0.384	0.713	93.306	<0.001	91.426	

d: Standardized mean difference. k: Number of studies or effect sizes included in the meta-analysis. N: Total sample size of all included studies. I^2: Percentage of total variation in effect sizes due to heterogeneity. Q: Q statistic for heterogeneity testing.

4.7. Analysis of moderation of the intervention duration

Differences in effect sizes were found depending on the length of the intervention. Short-term interventions (one week or less) had an effect size of 0.277, whereas medium-term interventions (more than one week and less than a month and a half) had a significantly larger effect size of 0.825. In contrast, long-term interventions (more than a month and a half) had an effect size of 0.592. Additionally, there were significant differences between the short-term and medium-term groups (p=0.048) but not with the long-term group, likely due to the low number of studies in the latter group. This led us to conclude that IIs interventions are more effective in the mid-term than in the short term.

5. Discussion

Findings from 31 measures involving 10,466 participants indicate that the overall effect size associated with the impact of implementation intentions on SB enactment is large (d=0.781), and considering only the final sample of experimental studies, the effect size is moderate (d=0.473). These results show that goal planning has at minimum a moderate and significant influence on SB adoption, consistent with the findings reported in Sheeran, Listrom, and Gollwitzer (2024). The results offer empirical confirmation to Carrington et al.'s (2010) proposition that individuals who make specific plans are more likely to engage in SB than those who do not make such plans.

This meta-analysis contributes to a better understanding of goal planning theories as it explains under which conditions goal planning may help attenuate the intention-behavior gap noted in SB. Furthermore, this meta-analysis identifies the boundary conditions of IIs effectiveness contributing to the theoretical refinement and practical application of IIs as a tool on SB adoption. Specifically, the meta-analysis finds

confirmation for six boundary conditions that influence the effect of goal planning on SB adoption. First, the strength of the effects was greater for behaviors with greater behavioral costs. This finding reinforces Osbaldiston and Schott's assertion that there is no "silver bullet" for SB adoption, meaning that there is no intervention suitable for promoting all types of SB behaviors (2012: 280). The moderation study shows that IIs are especially appropriate to facilitate the adoption of high-cost SB actions. Because II interventions involve formulating specific plans that link a behavior with a situational cue or trigger, they can help individuals overcome the barriers that make SB costly and increase the likelihood of performing the behavior (Fennis et al., 2011; Gollwitzer, 1999). Reducing barriers remains an effective approach to fostering SB (Osbaldiston and Schott, 2012; Varotto and Spagnoli, 2017); however, when such reductions are impractical, IIs provide a viable and effective alternative.

Second, if-then plans were found to be more effective than action plans. The interaction between barriers and the II format indicates that the effectiveness of if-then plans is maximized when they are used to address specific barriers, highlighting their capacity to facilitate automaticity in behavior change (Hagger and Luszczynska, 2014).

Third, personalized plans were more effective than prompted plans, as they adapt to individual circumstances and help individuals identify opportunities for implementing intentions (Gollwitzer, 1999). This finding aligns with evidence from energy audits, which provide tailored advice for energy conservation and have been shown to be highly effective (Delmas et al., 2013), probably because these audits help households identify the best courses of action for their goals according to their context.

Fourth, interventions including initial training, which equips participants with the necessary knowledge and skills from the beginning to form their specific plans, had

significantly greater effect sizes than those without such training. The provision of training overcomes consumers' information lacuna that prevents consumers from enacting their intentions to adopt SB (Valor et al., 2018). The provision of training that addresses common barriers for SB adoption, such as a lack of knowledge about socioenvironmental problems and solutions, empowers individuals and enhances the overall effectiveness of interventions (Olander and Thøgersen, 1995).

Fifth, providing training information about the environmental impact of behaviors enhances the effectiveness of IIs by increasing motivation consistent with findings in other domains (Carraro and Gaudreau, 2013). Motivated individuals benefit more from IIs as these interventions help overcome barriers such as goal conflicts and distractions (Gollwitzer and Sheeran, 2009).

Finally, the analyses reveal an inverted U-shaped effect over time. IIs are most effective in the medium term, with reduced but sustained effectiveness in the long term. A plausible explanation for the lower efficacy in the short term would be that all participants (control and experimental) initiate the intervention with strong intentions, which may hinder behavioral differences between the intervention and control groups; however, in time, those planning how to carry out the behavior perform it to a greater extent than those who do not (Gollwitzer and Sheeran, 2006; Sheeran et al., 2005).

While a meta-analysis is a useful tool for synthesizing research, it has several limitations that should be considered when interpreting such results and for opening avenues for future research. Significant differences were found between correlational and experimental studies, consistent with previous research (e.g., Mackay and Schmitt, 2019; Shipley and van Riper, 2022). Correlational studies often show higher effect sizes due to, *inter alia*, unmeasured external factors and common-method bias, as participants report already existing plans and outcomes rather than forming IIs. In contrast, experimental

studies control variables in structured settings, yielding more conservative effect sizes. Additionally, correlational studies rely on self-reported measures, which are prone to biases like social desirability and shared variance. This discrepancy poses a limitation for meta-analyses, as combining effect sizes from these two designs may overestimate the overall effect. For this reason, we decided not to combine the measures from the two types of studies in our meta-analysis, ensuring that their methodological differences did not distort the overall results. Yet, this decision inevitably implied reducing the number of studies in the moderation analyses.

Compared to other domains such as healthy eating, we acknowledge that the studies applying goal planning to SB adoption are fewer. Furthermore, the heterogeneity in interventions and results emphasizes the need for further research. We need more and better studies examining how goal planning influence SB adoption, to rigorously determine its effectiveness. Our assessment shows that many experimental measures had a high risk of bias, a result also noted in other meta-analyses on SB interventions (Möser and Bamberg, 2008). This bias could be attributed to the interdisciplinarity of the research pool, which likely followed varying conventions depending on the journal or discipline. We agree with Nisa and colleagues (2019) that a more rigorous impact evaluation of interventions is fundamental to elucidate which behavioral interventions should be prioritized, depending on the target profile and behavior to be promoted.

Although the present study conceptualizes and tests a comprehensive number of moderators, some of them (namely, dispositional behavioral control and perceived self-efficacy) could not be included, even when they influence the effectiveness of IIs (Bamberg, 2013; Gollwitzer and Sheeran, 2009). Because these two variables were seldom controlled in the studies reviewed or, when they were, we could not obtain comparable measures across studies, we could not test differences across studies. Also,

past work has shown that the effects of goal planning are moderated by the commitment to action plans (Gollwitzer and Sheeran, 2009). Since most of the studies in our sample did not control for this variable, we could not examine this moderator. Finally, the cultural context may also affect the effectiveness of IIs. Past meta-analyses suggest that the intention-behavior gap decreases in individualistic and developed countries, where cultural characteristics and better infrastructure facilitate intention realization (Morren and Grinstein, 2016). However, because the reviewed studies did not provide sufficient details about the cultural context, it did not allow us to examine this moderator. Future studies could examine whether the cultural context moderates the effectiveness of IIs.

These limitations observed in past studies should also motivate future work. Future research should examine whether and how variables overlooked in past work such as commitment to plan or perceived self-efficacy, influence IIs effectiveness on promoting SB adoption. Studying whether a combination of motivational and volitional interventions is more effective than IIs alone is another line of research. Likewise, more longitudinal studies are necessary to establish the duration of effects and whether they are maintained when interventions cease, given that other sustainable interventions often fail to maintain long-term effects (Delmas et al., 2013; Nisa et al., 2019). Finally, we invite for more field interventions that provide a testing of IIs in practical settings. Field interventions could help refine IIs design features and assess their scalability and impact. For instance, goal planning has been seldom applied in the workplace even when it may provide an optimal setting to encourage and measure adoption of sustainable actions.

6. Conclusion

After more than twenty years of studies on IIs and SB adoption, to our knowledge, this is the first meta-analysis that synthesizes and evaluates existing evidence and that

comprehensively assesses the overall effectiveness of IIs interventions on SB. Moreover, this is the first study that conceptualizes and tests a comprehensive list of factors that may moderate the effectiveness of goal planning for SB adoption. We found that goal planning was more effective when the action has greater behavioral costs, the plans had an if-then format, personalized and preceded by training about how to form plans and the impact of different behaviors. Additionally, this meta-analysis also contributes to the refinement of goal planning theories by identifying moderators that had been significant in other domains -such as healthy behaviors-but not in sustainable behavior. For instance, whereas in healthy eating, goal planning has proven more effective for approach-type goals, we could not replicate this effect in the case of sustainable actions. Similarly, we could not find that combining interventions increase the effectiveness of goal planning in SB.

The findings from this meta-analysis offer valuable insights for policymakers and practitioners seeking to design effective interventions for promoting SB. For instance, developers of websites and apps facilitating SB adoption, campaigners for SB, or human resource managers encouraging green behavior among their employees can benefit from understanding when, where and for whom goal planning, and specifically formulating IIs, may enable SB adoption.

IIs emerge as a robust strategy, particularly in contexts where reducing barriers and the associated costs is challenging or infeasible. By linking specific behaviors to situational cues, IIs facilitate automaticity, helping individuals overcome obstacles and enact behaviors that might otherwise be hindered by high costs or complexity.

Our findings also emphasize the importance of tailoring IIs to specific behaviors and contexts. If-then plans, when explicitly designed to address barriers, are particularly effective. Conversely, generic action plans that do not incorporate the barriers

encountered by individuals tend to be less effective, highlighting the need for personalized and context-sensitive approaches. Personalized plans not only adapt to individual circumstances but also help identify actionable opportunities for implementing intentions.

The role of initial training in intervention design is another critical consideration according to our findings. Participants equipped with the necessary knowledge and skills at the outset are better positioned to create actionable and efficient plans. Moreover, our findings show that interventions that combine motivational components (e.g., information on the environmental impact of behaviors) with volitional strategies (e.g., IIs) have proven to be particularly effective at fostering SB.

Timing and reinforcement are also essential elements of successful interventions. The results reveal that IIs are most effective in the medium term, with sustained but reduced efficacy in the long term. Policymakers should consider incorporating mechanisms for ongoing support, such as reminders or prompts, to maintain behavioral changes over time. A combination of goal planning with prompts may then be appropriate to sustain adoption in the long-term.

Finally, this study highlights a potential gap in the practical application of IIs. Although evidence strongly supports the use of if-then plans for overcoming barriers, many interventions fail to integrate barriers explicitly into their designs. Practitioners and policymakers should strive to align intervention formats with the specific needs of target behaviors, ensuring that IIs are employed in a manner that maximizes their strengths. Our findings provide useful suggestions for this endeavour.

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