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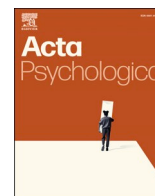
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# Self-enactable techniques to influence basic psychological needs and regulatory styles within self-determination theory: An expert opinion study

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## ABSTRACT

While a large body of research on Self-Determination Theory (SDT) has identified characteristics of social environments that are conducive to optimal motivation, research has scarcely considered what individuals might themselves do to optimize motivation. Using the compendium of self-enactable techniques, this expert opinion study aimed to identify conceptual linkages between 123 self-enactable techniques and nine core SDT constructs. International scholars ( $n = 67$ ) judged a block-randomized subset of 30–40 self-enactable techniques for their likely impacts on SDT constructs. Theoretically plausible linkages between self-enactable techniques and SDT constructs are visualized as a network. Seven techniques (i.e., Brainstorm options, Goal integration, Support others, Find meaning in target behaviour, Associate identity with changed behaviour, Valued self-identity, and Emphasize autonomy) were adjudged as having potential beneficial impacts on five or more SDT constructs. Interventions requiring participant engagement, for example self-management or lifestyle counseling, will benefit from a better understanding of motivation self-management.

## 1. Introduction

Self-determination theory (SDT) is a broad theory of human motivation, behaviour and functioning that is comprised of several 'mini-theories' (Deci & Ryan, 2000; Ryan & Deci, 2017). One of these mini-theories is Basic Psychological Needs Theory, which proposes that humans have three basic psychological needs: autonomy (i.e., feeling in control of one's own behaviours and goals), competence (i.e., feeling of having the skills and resources necessary to succeed in behavioural pursuits), and relatedness (i.e., feeling attached to and belonging with other people). When these basic psychological needs are satisfied, evidence suggests that psychological well-being and high functioning typically follow (Teixeira et al., 2020). Conversely, when basic psychological needs are thwarted, functioning is suboptimal, and the risk of ill-being increases. While SDT proposes these basic tenets, it should be noted that debate remains about the relative importance of the basic psychological needs (Sánchez-Oliva et al., 2017), and whether there might be more than three (Martela & Ryan, 2020). In any case, social and environmental conditions and interventions that support basic psychological need satisfaction are desirable for achieving optimal

outcomes and behavioural change (Hagger et al., 2020).

Cognitive Evaluation Theory and Organismic Integration Theory, two other mini-theories within SDT, describe intrinsic and extrinsic forms of motivation, respectively, which can be seen as lying on opposite sides of a continuum. Intrinsic motivation stems primarily from enjoyment of an activity: One engages in the behaviour simply for the sake of doing so, and not to achieve any external rewards or goals. Organismic Integration Theory describes different types of extrinsic motivation. Extrinsic motivation occurs when a behaviour is undertaken for various instrumental reasons, and it is therefore more varied than intrinsic motivation.

Types of extrinsic motivation vary in the extents to which they are internalized, and these too can be placed on a continuum of internalization (or self-congruence). External regulation is the least internalized type of extrinsic motivation and occurs when one undertakes a behaviour to please others. Next is introjection, which occurs for behaviours that are undertaken to avoid feelings of guilt or shame. External regulation and introjected regulation are commonly referred to as controlled regulatory styles (i.e. controlled motivation). As controlled motivation is associated with lower psychological well-being and reduced

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behavioural maintenance (Ng et al., 2012; Webber et al., 2010), interventions that reduce these variables are generally desirable, whereas interventions that increase external or introjected regulations could be seen as potentially detrimental to well-being. Then comes identified regulation, which occurs when one accepts the value of performing a behaviour. And finally, integrated regulation, the most internalized form of extrinsic motivation, occurs when behaviour is performed because of its congruence with the person's values and beliefs. Behaviours that satisfy the needs for autonomy and competence commonly result in autonomous motivation and can aid transitions to more internalized forms of behavioural regulation (i.e., internalization; Ryan & Deci, 2017). More internalized behavioural regulation, in turn, results in higher quality behavioural performance, behavioural persistence, and experiences of well-being more generally. Therefore, interventions based on self-determination theory typically aim to increase (and avoid decreasing) these autonomous forms of motivation.

When taken together, these three mini theories describe a process through which the satisfaction of basic psychological needs supports the development of adaptive regulatory styles, including shifts toward more autonomous, internalized forms of motivation. Situations that promote basic psychological needs satisfaction and internalization of motivation are more likely to foster well-being and optimal performance, and decades of SDT research support these basic associations between constructs (Ng et al., 2012; Ryan & Deci, 2017). Interventions that support basic psychological need satisfaction and the internalization of motivation are therefore warranted to improve well-being and behavioural performance outcomes.

### 1.1. SDT-based interventions

Several systematic reviews and meta-analyses indicate that interventions can produce beneficial effects on these core SDT constructs in health contexts. This includes significant small to medium sized effects on autonomy and competence need satisfaction, and non-significant to marginally significant cumulative effects on relatedness need satisfaction (Gillison et al., 2019; Ntoumanis et al., 2021). Meta-analytical evidence also indicates that interventions can produce beneficial effects on autonomous motivation (Knittle et al., 2018; Ntoumanis et al., 2021) and composite scores of motivation (Gillison et al., 2019). These earlier meta-analytical studies have not investigated the impacts of interventions on sub-dimensions of motivation quality however (e.g., intrinsic motivation, identified regulation, integrated regulation, extrinsic regulation).

Across interventions that have attempted to change SDT constructs, much methodological variation exists. Earlier systematic reviews and meta-analyses have therefore examined the extents to which variation in intervention content might explain the heterogeneity of intervention effects. Ntoumanis et al. (2021) used the Behaviour Change Techniques Taxonomy v1 (BCTTv1) (Michie et al., 2013) to code the contents of SDT-based interventions, and identified 43 behaviour change techniques (BCTs) that appeared more than twice across interventions. Meta-regression analyses subsequently revealed three BCTs associated with beneficial changes in autonomy need satisfaction, six associated with changes in relatedness need satisfaction, 12 associated with changes in autonomous motivation, and four associated with changes in controlled motivation. Of these, the BCTs 15.4 Self-talk, 10.3 Non-specific reward, 10.4 Social reward, 1.9 Commitment, and 1.3 Outcome goal setting were associated with changes in multiple SDT constructs.

Gillison et al. (2019) went one step further in examining the contents of interventions. In their approach, intervention contents were assessed using both the BCTTv1 and a taxonomy of techniques derived from motivational interviewing (Hardcastle et al., 2017), and also explored portions of intervention descriptions that did not fall into any of the categories put forth by those existing taxonomies. The resultant techniques were then clustered into a classification of 18 overarching SDT strategies, which had limited impacts on outcomes: Interventions that

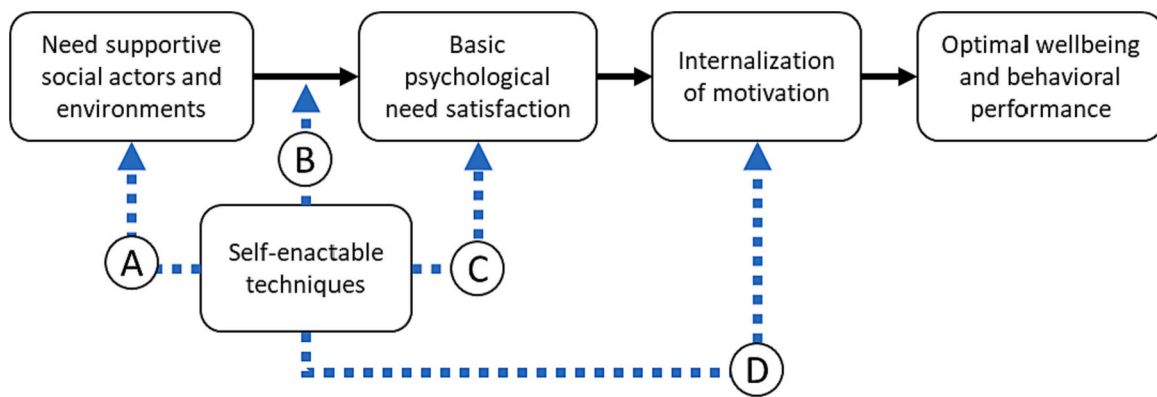
used non-controlling language (SDT strategy #4) were associated with increases in autonomy need satisfaction and interventions which provided a rationale (SDT strategy #3) were associated with improvements in autonomous motivation (Gillison et al., 2019). While all 18 of the SDT intervention strategies the authors identified are congruent with theoretical views on how to support need satisfaction and internalization of motivation, more SDT strategies were identified that had adverse effects on core SDT constructs. Interventions including SDT strategies #6 (providing structure) and #13 (providing information) were associated with adverse effects on autonomous motivation, SDT strategy #16 (involvement) was associated with adverse effects on both autonomy and relatedness need satisfaction, and SDT strategy #18 (group cooperation) was associated with adverse effects on competence need satisfaction. Although multicollinearity and other factors may partially underlie these regression-based results (Farrar & Glauber, 1967), it is clear that we need more understanding of which intervention techniques can most effectively support self-determination.

While empirical evidence in this area is lacking, theoretical ideas of techniques to support basic psychological need satisfaction abound. In 2020, Teixeira and colleagues published a classification of motivation and behaviour change techniques used in SDT-based interventions in health contexts (Teixeira et al., 2020). Their approach identified techniques used in interventions that were explicitly based on SDT, and incorporated further techniques suggested by SDT experts. Following several rounds of expert consensus exercises, a classification was developed that included 21 motivation and behaviour change techniques (MBCTs), arranged by their theoretical impacts on satisfaction of the three basic psychological needs.

Each of these previous approaches for identifying SDT-based intervention techniques examined the ways in which social actors or environments (i.e., interventions) can foster the satisfaction of basic psychological needs and the internalization of motivation. While this is a good starting point, SDT explicitly hypothesizes that people are growth seeking, and that internalization of motivation is “an active process that involves not just taking in values and practices, but working to integrate what is internalized” (Ryan & Deci, 2017). This person-centered viewpoint is therefore a critical part of SDT which has been lacking from efforts to identify the ways in which need satisfaction and internalization of motivation come about. Previous efforts have focused mainly on the influences of external social actors and environments in these processes, with little specificity given to the actions that a person might themselves undertake to initiate the processes or make them more efficient.

Within motivational and behaviour change interventions, peoples' own actions can impact their trajectories (Hankonen, 2021). Consistent evidence has begun to accumulate, suggesting that greater engagement with behaviour change techniques (i.e., BCT enactment) is associated with beneficial changes in motivation and behaviour (Burke et al., 2011; Hankonen, 2018; Hankonen et al., 2015; Knittle et al., 2016). Understanding not only what people receive during an intervention, but also what they do in response to that intervention receipt, is at the forefront of idiographic approaches to behaviour change science. Understanding individuals in their social contexts and how they use various self-motivational techniques to address everyday problems reveals unique person-specific patterning that would be masked with variable-centered analyses only (Renko et al., 2022). As self-guided approaches to health behaviour change, occupational well-being, self-leadership, education, and chronic disease management have become increasingly prevalent, it is important to understand how people can themselves improve well-being related outcomes proposed by SDT within these processes.

The compendium of self-enactable techniques, based on research literature across many fields, provides researchers with a common language for describing the actions that people can themselves take to change or self-manage their own motivation or behaviour (Knittle et al., 2020). Each of the 123 self-enactable techniques in the compendium has a label, a definition, and an instructive example that guides users in how



**Fig. 1.** Pathways through which self-enactable technique might impact on SDT-related constructs. Self-enacted techniques might be used to modify social environments to make them more need supportive (path A), to optimize the impacts of an existing social environment on basic psychological need satisfaction (path B), to directly bring about need satisfaction (path C), or to directly support the internalization of motivation (path D).

to enact the technique for their own self-management or behaviour change pursuits. The techniques in the compendium were derived from six existing classifications, lists and taxonomies of behaviour change techniques (including the SDT classification from Teixeira et al. (2020)), which included techniques taken from other sources, including manualized psychological interventions and therapies (e.g., cognitive behavioural therapy, self-regulation coaching, acceptance and commitment therapy). It therefore represents a broad multi-theory approach to behaviour change and self-management at the within-person level. However, the compendium itself does not include any information about which techniques are most effective in changing motivation or behaviour, and there is a dearth of evidence on how self-enacted techniques might impact on basic psychological needs satisfaction and the internalization of motivation for behaviour.

1.2. The present study

To summarize, much of the SDT literature to date has focused on the roles of social agents and environments in influencing basic psychological need satisfaction and motivation quality, and the active role of the person in influencing these factors has been largely overlooked – at least formally. This study aims to address this gap in the literature by

using expert ratings to identify theoretically plausible links between self-enactable techniques and the core constructs of self-determination theory. This will advance understanding of self-enactable techniques that people could potentially use to increase the satisfaction of their basic psychological needs and foster more internalized forms of motivation for themselves, and, in the same vein, understanding of techniques with likely detrimental effects on quality of motivation or basic psychological need satisfaction. Fig. 1 highlights several pathways through which this could theoretically occur. Collecting expert opinions on the plausible theoretical links between self-enactable techniques, basic psychological needs and regulatory styles may help improve SDT-based theorizing on the active roles that people play in optimizing their own motivation. Furthermore, it can inform the development of interventions to help people self-regulate their own motivation and behaviour and contribute to the accumulation of empirical evidence regarding the effectiveness of such techniques.

2. Methods

All data and analysis code are available from this study's Open Science Framework page (<https://osf.io/4gwj9/>). In line with the 2019 Finnish national guidelines on research integrity (Finnish National

**Table 1**  
Sample demographics.

	n (%)
Gender	
Female	27 (40.3 %)
Male	40 (59.7 %)
Career stage	
Professor or emeritus professor	20 (29.9 %)
Assistant/associate professor	26 (38.8 %)
University lecturer or researcher	11 (16.4 %)
Postdoc	6 (9.0 %)
PhD Student	3 (4.5 %)
Working in industry	1 (1.5 %)
Domains of stated SDT experience	
Educational	46 (68.7 %)
Health-related	41 (61.2 %)
Sport-related	32 (47.8 %)
Occupational or organizational	16 (23.9 %)
Family and relationships*	6 (9.0 %)
Policy*	4 (6.0 %)
Gaming*	2 (3.0 %)
Self-rated knowledge of SDT**	
SDT in general	5.78 (0.94)
Basic psychological needs theory (autonomy, competence, relatedness)	5.93 (0.89)
Cognitive evaluation theory, Organismic integration theory (intrinsic and extrinsic motivation, regulatory styles)	5.64 (1.26)

Note. \* - Gathered from a free response 'other' field. \*\* - Reported values are mean (SD) of responses given on a 7-point scale. Ratings of 4 or higher were taken to indicate a sufficient level of expertise for participation in this study.

Board on Research Integrity TENK, 2019), this type of study did not require an ethical review statement from a human sciences ethics committee. All procedures were conducted in line with the Declaration of Helsinki and the study was conducted using informed consent principles.

2.1. Participants and procedures

Participants were 67 international scholars experienced with using self-determination theory constructs in research and/or with expertise in planning, developing, and evaluating SDT-based interventions. Moreover, some had practical experience in treating patients and delivering interventions congruent with SDT. Efforts were made to obtain a sample of expert participants representing different countries, backgrounds, and research fields of applying SDT. Table 1 describes the sample demographics.

Potential SDT experts were identified from those listed on the Center for Self-Determination Theory website ([www.selfdeterminationtheory.org](http://www.selfdeterminationtheory.org)). We also approached researchers about participating if their work had been acknowledged by name in the most recent Self-Determination Theory book (Ryan & Deci, 2017). Authors of studies included in a recently published meta-analysis of self-determination theory-informed intervention studies (Ntoumanis et al., 2021) were also approached for

participation. Besides this, participants could recommend other experts who they thought could meaningfully contribute to the study (snowballing method). These potential experts (n = 281) received an invitation email explaining the study, and a maximum of three reminder emails. To further boost participation, a recruitment email was sent to the 1548 subscribers of the SDT ListServ. Fig. 2 presents an overview of the recruitment and data collection process.

People who responded with interest in participating received further information about the study's background, aims and methods, and had the opportunity to ask questions before providing informed consent to participate. After providing informed consent, participants received an email with clear instructions of how to complete the survey and a personalized link to the online questionnaire in LimeSurvey.

In the online questionnaire, participants provided background information on their geographical location, gender, current career phase, and the research domains in which they have worked with SDT (e.g. education, behaviour change, sport psychology, occupational psychology). Participants then completed three items assessing their levels of expertise with SDT in general, with basic psychological needs theory, and with regulatory styles. Responses to these items were on an 8-point scale, with 0 indicating "no knowledge or expertise" and 7 indicating "profound knowledge or expertise." These items were adapted from an earlier study with similar methods, and scores  $\geq 4$  indicated sufficient

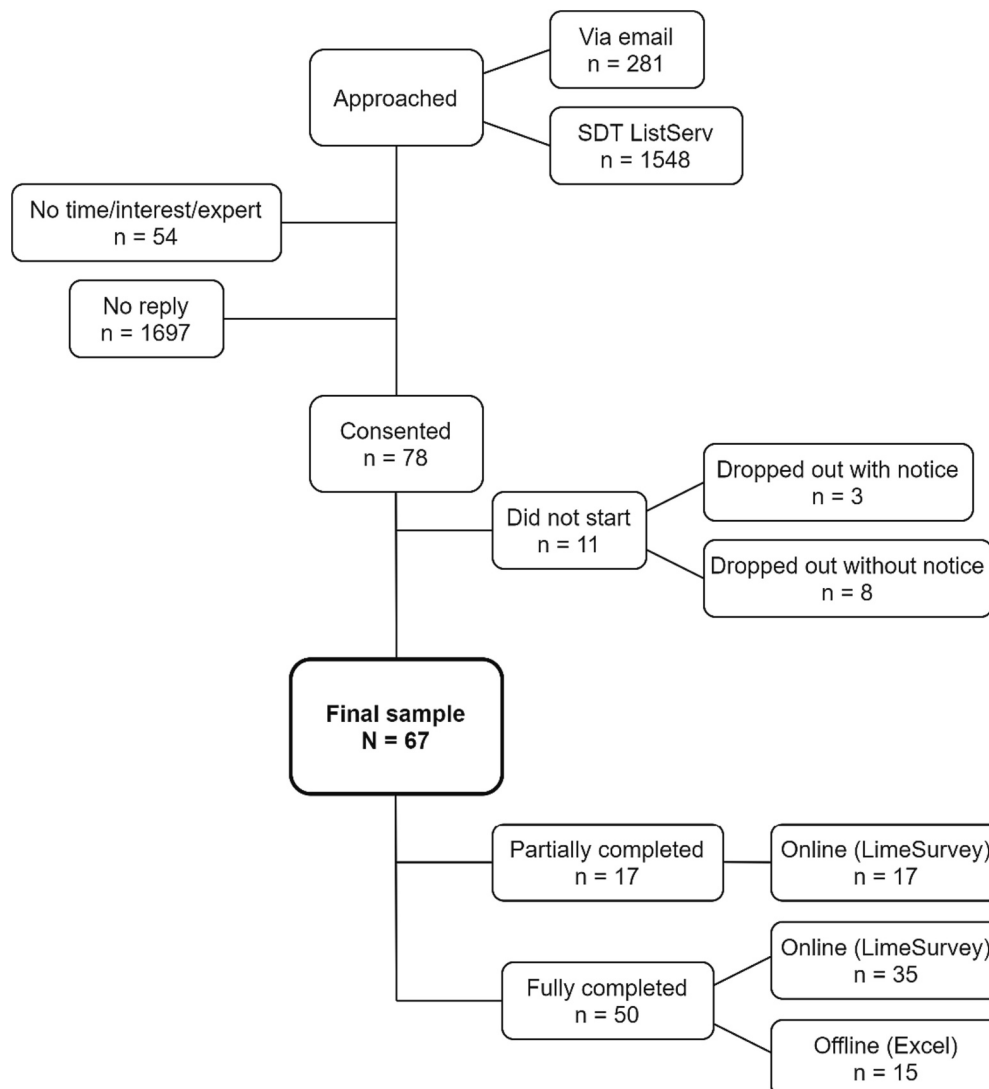


Fig. 2. Flow of expert recruitment and participation.



expertise to complete the exercise (Connell et al., 2019).

After completing this background information, the instructions for the main task were presented, along with definitions of the three basic psychological needs (autonomy, competence, relatedness) and six regulatory styles (intrinsic motivation, integrated regulation, identified regulation, introjected regulation, external regulation, amotivation) addressed in the study. These definitions were also reproduced on each subsequent page of the online questionnaire.

Participants were then presented with one self-enactable technique at the top of each page, including its label, definition and instructive example from the compendium of self-enactable techniques (Knittle et al., 2020). Below this, participants were asked to rate the likely impact of this technique on the basic psychological needs and regulatory styles under study. This was done by responding to the stem “When a person self-enacts this technique, what is its likely effect on the (basic psychological needs/regulatory styles) listed below?”. Responses were then given for each SDT construct on a 7-point scale with anchors of much more likely to increase (+3) and much more likely to decrease (−3). Participants could also choose ‘don't know’ if they did not have sufficient knowledge or understanding of the technique to make a judgment. In these cases, participants were asked to provide details on the reasons for their ‘don't know’ rating in a free response field. The wordings for these question stems and answer options were developed through discussions within the research team, and this method was pilot tested with colleagues and collaborators (all experienced SDT researchers) to ensure that the items were understood as intended. A screenshot of the full task for one example technique is shown in Supplementary Fig. A (<https://osf.io/8anhw>).

While this study investigated all compendium techniques (k = 123), pilot testing revealed that it would be too burdensome to have all experts rate all techniques impacts on all SDT constructs. To reduce participant burden, each expert rated a maximum of 40 randomly selected techniques. Randomization was done using an inbuilt randomization tool in LimeSurvey. While 40 was the target number of techniques, experts could also choose to rate fewer techniques if they could not commit to the full 2–3 h needed for full participation. Participants received up to four reminders to fill in the questionnaire. When experts did not respond, we assumed they had dropped out of the study. Any ratings that they had already submitted were retained and analyzed (no participants objected to this). The data collection process lasted three months. Most experts (75 %) fully completed the survey. During the study, some participants experienced a technical issue in LimeSurvey which did not allow them to return to the survey after taking a break. This issue was due to the LimeSurvey license type held by the sponsor organization, which suffered compatibility issues with some browsers. To get around these technical problems, the research team generated an excel spreadsheet that allowed participants to complete their ratings offline. These data were then combined with those obtained in LimeSurvey for analysis.

## 2.2. Statistical analyses

Means and 95 % confidence intervals of expert ratings were calculated with SPSS 27. Techniques were adjudged to have a potential impact on a construct if the 95 % confidence interval of mean ratings did not include 1.0 or −1.0. In a literal sense, scores outside of this range indicate that the technique had been judged to be at least ‘slightly more likely to increase (or decrease)’ the construct in question. Network graphs visualizing possible connections between self-enactable techniques and SDT constructs were created by exporting the data to Flourish (<https://flourish.studio/>).

## 3. Results

Supplementary File A includes the full results of this study with means and 95 % confidence intervals for all technique-SDT construct

pairings, and can be sorted or configured as the viewer wishes (<https://osf.io/tw52z>).

### 3.1. Potential effects of techniques on basic psychological need satisfaction

Table 2 lists all techniques adjudged as having a likely beneficial impact on at least one basic psychological need or regulatory style. In total, experts identified techniques as having potential beneficial impacts on (i.e., increases in) the needs for autonomy (k = 21), competence (k = 36) and relatedness (k = 7). Sixteen techniques were identified as having likely beneficial impacts on two basic psychological needs, primarily the needs for autonomy and competence. No techniques were adjudged as likely to foster the satisfaction of all three basic psychological needs, nor were any techniques adjudged as likely to have detrimental effects on any of the basic psychological needs.

### 3.2. Potential effects of techniques on regulatory styles

Of the six regulatory styles examined, techniques with potential beneficial impacts were found for increases in intrinsic motivation (k = 7), integrated regulation (k = 18), identified regulation (k = 32), and decreases in amotivation (k = 13). The techniques *Brainstorm options* (#2), *Consider behavioural options* (#3), *Find meaning in target behaviour* (#102) and *Emphasize autonomy* (#122) were adjudged as having likely beneficial impacts on all three forms of autonomous motivation (i.e., intrinsic motivation, integrated regulation, and identified regulation). Some techniques were adjudged as having potential detrimental effects, including decreases in intrinsic motivation (k = 3), and increases in introjected regulation (k = 6) and external regulation (k = 7). The techniques with potential detrimental effects are shown in Table 3.

### 3.3. The big picture

Fig. 3 visualizes the linkages between self-enactable techniques and SDT constructs as a network. Thicker lines between SDT constructs indicate a greater number of techniques with likely beneficial impacts upon both constructs. For example, a thick line connects competence and identified regulation, as many techniques were adjudged to have likely beneficial impacts on both; whereas competence and relatedness are connected with a much narrower line, as far fewer were adjudged to have likely beneficial impacts on both constructs. Introjected and external regulations are not shown in the graph, as no techniques were adjudged as having likely beneficial impacts on these constructs. The graph also does not show any of the detrimental effects mentioned above. An interactive version of Fig. 3, which shows technique names when hovering over a number and allows for manipulating the dot positions, is available at: <https://public.flourish.studio/visualisation/4939619/>.

## 4. Discussion

An accumulation of research clearly indicates the importance of basic psychological need satisfaction and more-internalized forms of motivation for optimizing behavioural performance and improving well-being (Ryan & Deci, 2017). While SDT provides thorough descriptions of how social agents and environments can optimally support basic psychological need satisfaction and the internalization of motivation, earlier research has scarcely addressed the actions which people themselves might take to achieve these desired outcomes. This hypothesis-generating expert opinion study identified multiple self-enactable techniques that might be useful for this purpose.

Experts identified 21 and 36 self-enactable techniques as likely to increase satisfaction of the basic psychological needs for autonomy and competence, respectively. Of these techniques, 11 were adjudged as having likely beneficial impacts on both autonomy and competence

**Table 2**  
Techniques adjudged as having likely beneficial impacts on core SDT constructs.

#	Label	Autonomy (k=21)	Competence (k=36)	Relatedness (k=7)	Intrinsic (k=7)	Integrated (k=18)	Identified (k=32)	*Amotivation (k=13)	# of likely beneficial effects
1	Agenda mapping	✓						✓	2
2	Brainstorm options	✓	✓		✓	✓	✓	✓	6
3	Consider behaviour change options	✓			✓	✓	✓		4
4	Hypothetical thinking	✓	✓			✓	✓		4
5	Behavioural goal setting	✓	✓			✓	✓		4
6	Outcome goal setting		✓				✓	✓	3
7	Problem Solving		✓				✓	✓	3
8	Action planning	✓	✓						2
9	Review behavioural goal(s)		✓						1
10	Review outcome goal(s)						✓		1
15	Obtain feedback on behaviour		✓				✓		2
17	Self-monitoring of behaviour		✓				✓		2
18	Self-monitoring outcome(s) of behaviour	✓	✓				✓	✓	4
19	Monitoring of emotional consequences						✓		1
21	Biofeedback		✓						1
24	Adding objects to the environment	✓	✓						2
29	Task crafting (enjoyment)	✓	✓			✓		✓	4
30	Task crafting (skills and ability)		✓						1
31	Add challenge		✓		✓		✓		3

32	Goal integration	✓	✓			✓	✓	✓	5
33	Behavioural experiments	✓	✓			✓	✓		4
34	Obtain information about antecedents	✓	✓			✓	✓		4
35	Obtain information about health consequences						✓		1
41	Memory aids		✓						1
42	Contrast/compare pros and cons						✓		1
43	Comparative imagining of future outcomes	✓				✓	✓		3
44	Empathy training			✓					1
50	Personal contact with the outgroup			✓					1
52	Support others		✓	✓		✓	✓	✓	5
54	Obtain practical social support			✓					1
55	Obtain emotional social support			✓					1
56	Obtain instruction on how to perform the behaviour		✓	✓	✓		✓		4
69	Behavioural practice or rehearsal		✓						1
70	Habit formation		✓						1
73	Generalization of target behaviour		✓						1
74	Graded tasks		✓						1
75	Training executive function		✓						1
86	Social reward		✓	✓				✓	3
88	Self-incentive based on approximation		✓						1
89	Self-incentive based on completion		✓						1
98	Reflect on desire to perform behaviour						✓		1
99	Reflect on ability to perform behaviour		✓						1
100	Reflect on reasons to perform the behaviour	✓				✓	✓		3
101	Reflect on need to perform the behaviour						✓		1



102	Find meaning in target behaviour	✓			✓	✓	✓	✓	5
105	Associate identity with changed behaviour	✓	✓			✓	✓	✓	5
106	Valued self-identity (personal strengths)	✓	✓			✓	✓	✓	5
107	Verbal self-persuasion about own capability	✓	✓			✓	✓		4
108	Mental rehearsal of successful performance		✓			✓	✓		3
109	Focus on enjoyment (pleasant aspects) of behaviour				✓	✓			2
111	Focus on past success		✓						1
114	Normalize difficulty						✓		1
115	Self-kindness	✓							1
116	Acceptance	✓					✓		2
119	Interpreting physiological and emotional states		✓				✓		2
122	Emphasize autonomy	✓			✓	✓	✓	✓	5

Note. Technique numbers listed in the leftmost column are taken from the Compendium of self-enactable techniques v1 (Knittle et al., 2020). \* - Likely decreases in amotivation were interpreted as beneficial. Check marks indicate that the confidence interval for the mean expert rating did not include 1.0 or -1.0.

need satisfaction, but none were adjudged as having likely beneficial impacts on all three basic psychological needs. Interestingly, no techniques were adjudged as having likely detrimental impacts on basic

**Table 3**  
Techniques adjudged as having likely detrimental impacts on core SDT constructs.

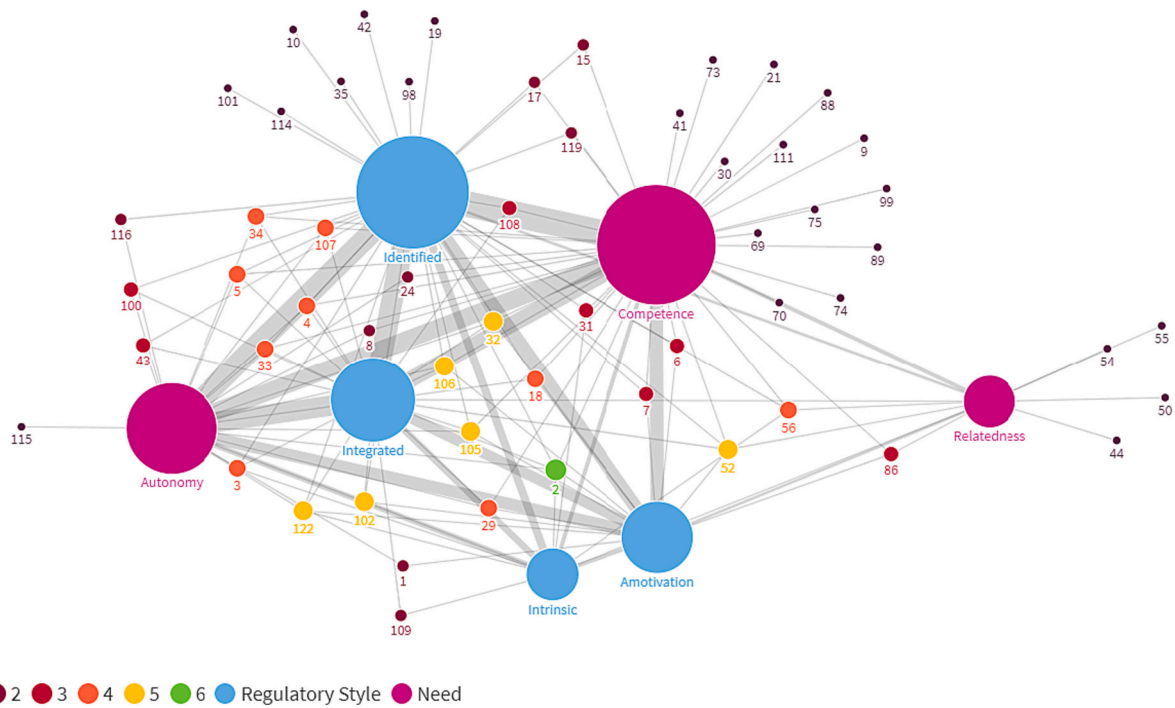
#	Label	Intrinsic* (k = 3)	Introjected (k = 6)	External (k = 7)	# of likely detrimental effects
13	Public commitment		✓		1
14	Make a behavioural contract		✓		1
78	Self-incentive (behaviour)			✓	1
80	Self-reward (behaviour)			✓	1
82	Self-incentive (outcome)			✓	1
84	Self-reward (outcome)		✓	✓	2
87	Self-incentive based on situation			✓	1
91	Self-disincentive		✓	✓	2
92	Behaviour cost	✓			1
93	Self-penalty	✓	✓		2
94	Remove reward or incentive	✓		✓	2
96	Imaginary punishment		✓		1

Note. Technique numbers listed in the leftmost column are taken from the Compendium of self-enactable techniques v1 (Knittle et al., 2020). \* - Likely decreases in intrinsic motivation were interpreted as detrimental. Check marks indicate that the confidence interval for the mean expert rating did not include 1.0 or -1.0.

psychological need satisfaction. The techniques identified here can add to a published classification of SDT-consistent techniques (Teixeira et al., 2020) which might be used to increase basic psychological need satisfaction. For example, the self-enactable techniques *Behavioural goal setting* (#5), *Self-monitoring of outcomes of behaviour* (#18) and *Associate identity with changed behaviour* (#105) were all adjudged by experts in this study to have likely beneficial impacts on the need for autonomy, but no corollaries for these exist in the Teixeira listing (2020). Similarly, the techniques *Brainstorm options* (#2), *Hypothetical thinking* (#4) and *Verbal persuasion of own capability* (#107) could potentially add to the available options for increasing competence satisfaction. The real-world impacts of these self-enactable techniques on basic psychological need satisfaction therefore merit experimental testing.

Comparatively fewer self-enactable techniques were identified as having likely benefits for relatedness need satisfaction (k = 7). Two of these seven (#86 *Social reward* and #55 *Emotional social support*) were identified as effective techniques for promoting relatedness satisfaction in a previous meta-analysis (Ntoumanis et al., 2021). Ntoumanis et al. (2021) also identified outcome goal setting, commitment, and self-talk as associated with relatedness increases, but those techniques were not identified here. Given that self-enactable techniques are actions that people take themselves, the limited number of potentially relatedness-inducing techniques identified here is not particularly surprising. Nevertheless, developing novel self-enactable techniques that might foster relatedness should nevertheless be a research priority.

This study also identified a multitude of self-enactable techniques associated with regulatory styles and the internalization of motivation. Experts adjudged 13 techniques as having likely beneficial impacts on amotivation and further techniques as having likely beneficial impacts on three forms of autonomous motivation (i.e., increases in identified regulation (k = 32), integrated regulation (k = 18) and intrinsic motivation (k = 7)). Portions of these results support the recent idea of motivation within SDT as having a semi-radex structure (Howard et al., 2020), which means that different types of motivation or regulatory styles, while predictably ordered along a continuum of internalization, each uniquely contribute to well-being. For example, the techniques *Add challenge* (#31) and *Obtain instruction on how to perform the behaviour*

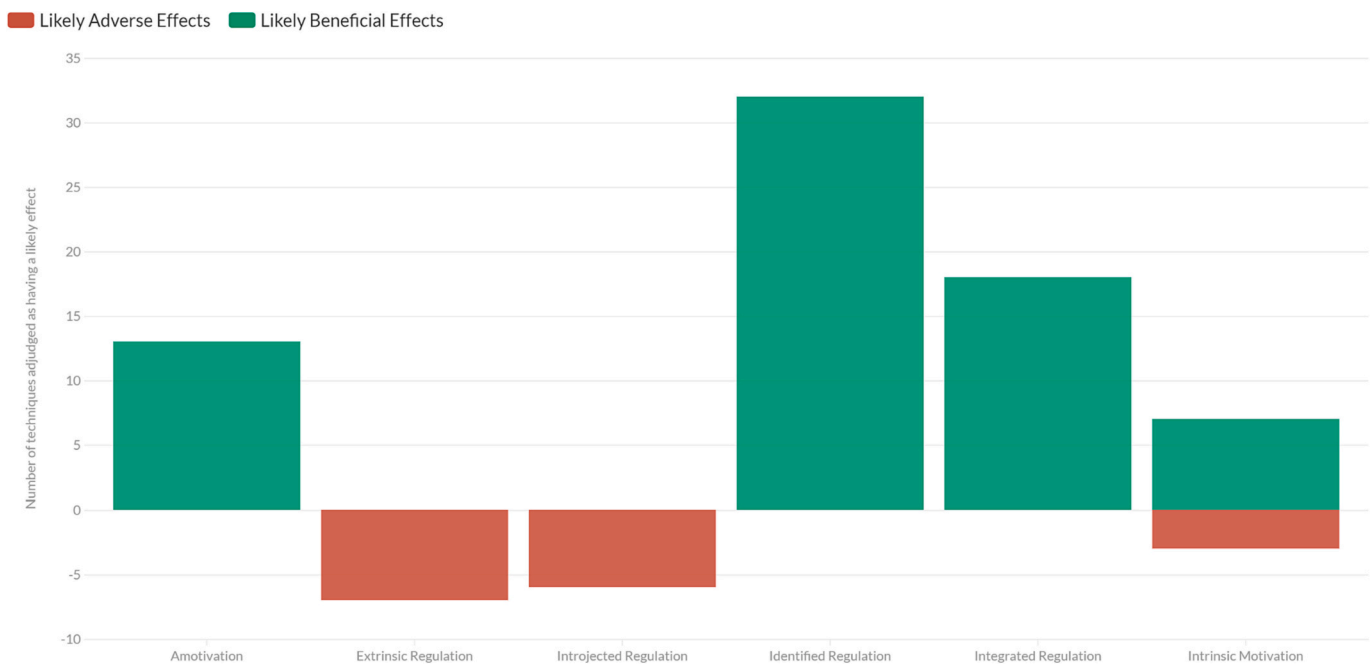


**Fig. 3.** Network graph of expert-judged likely beneficial impacts of self-enactable techniques on core SDT constructs. Dot colors indicate the number of SDT constructs each technique was adjudged to have likely beneficial impacts upon (see figure legend); magenta dots represent basic psychological needs and sky blue dots represent regulatory styles. Larger dots indicate more connections, and thicker lines between SDT constructs indicate a greater number of techniques with likely beneficial impacts upon both constructs. Technique numbers shown are from the compendium of self-enactable techniques (Knittle et al., 2020). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article or the interactive version of the figure available at <https://public.flourish.studio/visualisation/4939619/>.)

(#56) were adjudged to have likely beneficial impacts on non-adjacent regulatory styles within the standard continuum. In general, however, the greatest adjudged overlaps of impact on regulatory styles were between integrated and identified forms of autonomous motivation - important constructs within the process of internalizing motivation

(Vansteenkiste et al., 2018).

Finally, this study identified some self-enactable techniques that likely have detrimental effects on regulatory styles: Three techniques which might decrease intrinsic motivation, six techniques which might increase introjected regulation, and seven techniques which might



**Fig. 4.** Expert-judged likely impacts of self-enactable techniques on regulatory styles. Likely beneficial effects include increases in identified regulation, integrated regulation and intrinsic motivation, and decreases in amotivation; whereas likely adverse effects include decreases in intrinsic motivation and increases in extrinsic regulation and introjected regulation.

increase external regulation. As intrinsic motivation is central to behavioural maintenance, individuals may require guidance on how the techniques *Behavioural cost* (#92), *Self-penalty* (#93) and *Remove reward or incentive* (#94) can be used without bringing about unwanted decreases in intrinsic motivation. To go one step further, as none of these techniques were adjudged as having any likely beneficial impacts, self-enactment of these techniques should not generally be encouraged. As for the techniques that were adjudged as likely to increase introjected and/or external regulations, they may in fact be useful, but only for individuals high in amotivation, and who have difficulty in self-enacting any of the other techniques identified in the study as having likely beneficial impacts upon SDT constructs. This is because external and introjected regulations can, through the internalization process, manifest more internalized regulations, and thereby act as steppingstones to behavioural initiation and maintenance.

The bird's eye view of these results (Fig. 4) offers several interesting insights. First, except for the techniques adjudged as likely to decrease intrinsic motivation ( $k = 3$ ) and amotivation ( $k = 13$ ), self-enactable techniques were almost exclusively adjudged as being capable of increasing various regulatory styles. In other words, there is a gap in understanding of the methods with which one might successfully decrease his or her own levels of controlled motivation. While this result could potentially be attributable to the wording of the items in the expert task, the known relationships between controlled forms of motivation and deficits in behavioural maintenance and well-being mean that identifying methods to reduce controlled motivation is an important research gap worthy of further exploration. Second, within the three forms of autonomous motivation examined here, the more internalized the regulatory style, the fewer likely beneficial techniques one has at their disposal to improve it. This is consistent with much theorizing on the internalization process, wherein transitions to fully intrinsic motivation are not always possible, and depend on the nature of the behaviours being undertaken (Ryan & Deci, 2017).

As for which self-enactable techniques might be most useful overall in SDT-based self-guided interventions, seven techniques were adjudged as having likely beneficial impacts on five or more of the nine SDT constructs examined in this study. These seven are: *Brainstorm options* (#2), *Goal integration* (#32), *Support others* (#52), *Find meaning in target behaviour* (#102), *Associate identity with changed behaviour* (#105), *Valued self-identity* (#106), and *Emphasize autonomy* (#122). It should be noted however, that the optimal use of these techniques may necessitate the use of other supporting or prerequisite techniques, as specified in the compendium (Knittle et al., 2020). For example, to consider how one's important life goals are integrated with each other, one must first have goals in place.

Some techniques are perhaps more applicable to some behaviours or domains than they are to others. Therefore, we cannot assert that the identified associations between techniques and SDT constructs would remain constant across behavioural domains. Relatedly, we did not investigate any potential effects of expert domains of experience on rating strengths, as any such analyses would have been greatly underpowered.

#### 4.1. Methodological considerations

This study has several limitations to consider. First, while experts were systematically sampled based on predefined inclusion criteria, they came from different backgrounds and had different views and areas of expertise (e.g., sport vs. education). Participants self-rated their expertise with SDT and may not have all been actual experts. This is however commonplace in expert opinion studies, and the recruitment procedure and selection methods followed previous examples (Connell et al., 2019) to help minimize this potential bias.

Second, experts may have lacked familiarity with some of the techniques under study. While experts were likely familiar with techniques that are well-established in the SDT literature and used in SDT

interventions, techniques that are less often used or considered in SDT research may have been subconsciously downgraded by experts. Possible familiarity bias can therefore not be excluded. Relatedly, some expert participants may not have been familiar with the idea of "self-enactable" techniques. In the instructions for the task, we tried to clearly convey that self-enactable techniques would generally be used by people of their own free will, and not out of force or coercion. Some experts asked questions about this feature of the task, but as experts were not provided with any training on self-enactable techniques, we cannot rule out the possibility that some techniques were rated as more controlling than they might otherwise have been in a true self-enactment situation. The use of consensus procedures could rule out such consideration in future research.

In this study, we sought to identify techniques that were 'at least slightly more likely' to increase (or decrease) the SDT constructs under study. This led to many "hits", whereas utilizing a more stringent cut-off point (e.g., a 95 % CI that does not include 1.5, instead of 1.0) would have yielded fewer potentially impactful techniques. Given that this study was hypothesis generating rather than hypothesis confirming, we elected for this looser cut-off, thereby broadening the potential research topics that might stem from these initial indications. Supplementary File A (<https://osf.io/tw52z>) presents means and confidence intervals for all associations between techniques and SDT constructs, so we welcome researchers to apply more stringent criteria for selecting techniques of interest in their own research should they so choose.

Finally, SDT interventions often use combinations of different techniques to bring about change (Teixeira et al., 2020), and such combinations may produce synergistic effects (Gillison et al., 2019). However, experts in this study judged each technique in isolation, and we did not examine interrelatedness or combined use of techniques. Hence, even techniques that were not identified here might still have strong need-supportive or internalization effects when used in combination with some other techniques. When possible, SDT researchers should take more holistic approaches to assessing interrelationships between SDT constructs and interventions (Howard et al., 2020).

#### 4.2. Avenues for future research

Future studies should investigate the techniques for which the likely impact on SDT constructs remains unclear, for example, by investigating expert consensus or uncertainty. In addition to expert opinion studies, robust empirical research is needed to test the relevance and effectiveness of self-enactable techniques on SDT constructs in real-life settings. Specifically, potential *negative* impacts, as well as synergistic effects of combining self-enactable techniques, could be of interest for future research. Research is also needed to examine how people might use self-enactable techniques to shield their autonomous motivation from need-threatening social agents or controlling and chaotic social environments.

Further research is also needed on self-enactable techniques in general. Clear descriptions and instructive examples for the techniques are essential as a starting point for their use (Knittle et al., 2020), but people likely need further guidance in learning to self-enact in real life. Self-enactable skills can be used socially, harnessing interpersonal support and also together with others (Rothman et al., 2020). There is indeed evidence that self-regulatory techniques such as goal setting may be more effective when done socially as opposed to individually (Epton et al., 2017). In other words, focusing on self-enactable techniques does not necessitate adopting a view of the individual as an island or an independent individual, but rather it is possible - and even recommendable - to study socially situated self-regulation, embedded in (and in dynamic interplay with) individuals' social contexts.

#### 4.3. Conclusions

This study brings an important addition to the current Self-Determination Theory literature, by expanding the focus from what

social agents can do to alter an individual's motivation, to self-enactable techniques that people can themselves use to manage their motivation and basic psychological need satisfaction. Expert participants evaluated the theoretically plausible effects of 123 techniques on basic psychological needs and regulatory styles, with the techniques Brainstorm options, Goal integration, Support others, Find meaning in target behaviour, Associate identity with changed behaviour, Valued self-identity, and Emphasize autonomy adjudged to potentially benefit at least five of the investigated constructs. This expert study is but one attempt to 'put the self back into self-determination theory', and more empirical studies are needed to investigate how to best help individuals navigate and steer their own need satisfaction and motivation optimization journeys within complex social environments.

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### Declaration of competing interest

None.

### Data availability

All data and materials are freely available at <https://osf.io/4gwj9/>.

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