

Article

A Sustainable Project Management Strategy against Multitasking Situations from the Viewpoints of Cognitive Mechanism and Motivational Belief

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Abstract: In modern society, multitasking is necessary for a worker to accomplish a final goal by their deadline, which could be pursued for either a single goal or multiple goals. Moreover, a worker who has the authority to prioritize their tasks can make plans about the process of behavioral strategies to perform each task by making a to-do list. This strategy is a way of unpacking that which seems to affect the expectancy of goal attainment and heighten the value and importance of the goal. Otherwise, a worker could write a to-do list without specific action plans. These effects of unpacking and packing can be used as management strategies for multitasking engagement and could impact a worker's cognition differently depending on the goal relations, including if there is a single goal or multiple goals. On the one hand, in pursuit of a single goal, unpacking can facilitate a worker's judgment of the importance of the task. On the other hand, in pursuit of multiple goals, a worker's judgment of one task's importance can conflict with another task due to contradictory unpacking guidelines. Additionally, self-regulation as an intrinsic motivation empowers conscious intentions to neglect the cognitive effects of the to-do list. Therefore, those with low self-regulation tend to be encouraged by the effect of unpacking, but those with high self-regulation have the effects of unpacking inhibited. This theoretical model was constructed to identify the cognitive mechanism and the role of self-regulation on boundary conditions in regard to the different effects on unpacking. This study was confirmed via the two-way experiment (single- and multiple-goal x packing and unpacking) to explore the effects of the cognitive mechanism on task importance. The following test was performed via the three-way experiment, using an additional variable, the levels of self-regulation (low self-regulation and high self-regulation), to verify whether they inhibit cognitive effects. This study suggests that the judgment of task importance is different in accordance with goal relations, packing and unpacking, and self-regulations for sustainable management strategies of multitasking.

Keywords: project management; multitasking; unpacking effect; self-regulation; goal structure

1. Introduction

Multitasking is essential for completing many projects. Many workplaces assign employees to participate in more than two tasks, requiring them to multitask until a certain deadline. Even if a worker feels too busy to complete multiple tasks, we can sometimes find that busyness encourages the worker to use effective time management for productivity [1]. However, multitasking demands spending a number of resources (e.g., money, time, and energy) at once as compared with monotasking. Most of all, the availability of the resources is limited, and therefore people can struggle with a heavy workload as the working environment is complex. If a worker thinks that the working environment is

too complicated to concentrate on their main task, the worker is more likely to neglect what he or she has to do [2].

For the sustainability of project management, the role of a project manager (PM) is important for effective management of a worker's limited resources. In particular, cognitive resources are used to pay attention to long-term effortful project processes and to control the attention of short-term gratification which interrupts the attention of desirable states during the project. A PM can give project tasks and direct project goals with a to-do list to clarify what a worker has to do for their goal attainment. Unpacking a to-do list is beneficial as a cognitive strategy to reserve a worker's cognitive resources and complete a project with less conscious effort.

If a project manager unpacks a harmonious to-do list, a worker's intention of performing a project can be strengthened, but as the relation of a to-do list is more diverse, the intention of performing a project can be distracted and viewed as micromanagement. Micromanagement occurs when a worker thinks that instructing project processes with a to-do list is too much detailed and burdensome to complete instructed activities. If to-do lists are unpacked for multiple goals, a worker grows more distracted by attempting to focus on project activities and inhibit other activities competing to the project processes. To-do lists can be detrimental in the pursuit of multiple goals as compared with the pursuit of a single goal. For example, while a worker is committed to "making a presentation for an ongoing project", and "writing an account report", both belonging to the distinctive goals, he or she may discover more task complexities. This working environment involves more diverse multitasking, which requires more complex information process and deteriorates the effectiveness of a to-do list [3]. Therefore, rather than unpacking to-do list, packing a to-do list in pursuing multiple goals seems to be an effective strategy in order to allow project workers to participate in the project.

Additionally, self-regulation contributes to motivation in that a person has confidence in the effective management of limited cognitive resources and in improving the magnitude of effort and attention to each task. The capacity for self-regulation determines the amount of effort used to implement tasks. This research is based on theoretical knowledge regarding cognition and motivation. To test the hypotheses, this study performs two analyses. At first, we verify the cognitive relationship between instruction types (packing and unpacking) and goal relations (single goal and multiple goals). Then, this study conducts a three-way experiment (instruction types, goal relations, and self-regulation) to verify the role of self-regulation within cognitive relationships.

2. Theoretical Backgrounds and Hypotheses

2.1. Project Management Strategies in Multitasking

In recent years, with the continuous development of technology and flexible changes in the organization [4], individuals are achieving their goals by organizing and managing various types of projects. A project is defined as a procedure in an individual's or a group's effort over a particular time period for a particular goal [5]. The role of the project manager (PM) is to build project management strategies that possibly help a project worker initiate multitasking. The PM can suggest project components including goals, periods, tasks, and actions. A goal is represented as a desired end state that a person wants to achieve [6]. A period is a time span that is assigned for the completion of a project process, and tasks are objectives on which a worker makes an actual effort.

Multitasking in human behavior refers to the engagement of more than two tasks in a period. There are two distinct typologies in the literature on human multitasking, dual tasking and task switching [7]. On the one hand, the notion of dual tasking is adaptable for a case in which people handle multiple tasks simultaneously. For instance, those who are experienced at driving a car can drive while talking to another passenger at the same time, but novice drivers cannot perform these tasks automatically [8]. On the other hand, task switching occurs as a way of alternating multiple tasks in sequential order [7,9]. The difference between dual tasking and task switching can be identified by the demand of different types of information processes. Dual tasking is performed from a relatively

unconscious, habitual, and automatic information process. Task switching typically requires high demands of cognitive resources so that a worker makes conscious efforts in switching intention and withdraws inappropriate automatic responses [10].

The notion of task switching is applied in order to understand human behavior in controlling automatic responses and in making a conscious effort. It is noteworthy that dealing with a series of project tasks is required for cognitive control. Cognitive control, called the controlled information process in past research, has been of interest in exploring self-regulatory behaviors in many areas of psychological research [11,12]. Cognitive control underlies one's capability to regulate thoughts and actions in the pursuit of goals, in which a project worker suppresses undesirable or inappropriate behaviors at will. However, cognitive resources are limited. Once multitasking is too demanding of cognitive resources, a worker can possibly experience depleted cognitive resources in the wake of conflicting requirements of multitasking and the burden of the workload. Depletion of cognitive resources causes failure of self-regulatory behaviors [10]. This self-regulatory failure underlies the automatic information process and disturbs task commitment [13]. Therefore, a worker should reserve cognitive resources, otherwise the worker likely chases instant gratifications and avoids making an effort on long-term project activities as a result of resource depletion [14].

To overcome the threat of cognitive resource depletion, a PM can design a to-do list as a cognitive strategy with the advantage that it enables a worker to alleviate pressure on their controlled information process. Establishing a to-do list is based on a format of if-then planning. For example, whenever a certain situation (e.g., if a situation "A" happens) accompanies a to-do list, the worker is able to initiate actions (e.g., then they will act on "B"). A benefit of the to-do list is that it makes it possible for an individual to follow relatively automatic, habitual behaviors which draw immediate actions in particular situations [15–18]. A key role of automatic, habitual behavior is that people can perform multitasking unconsciously. Previous research has demonstrated that the "to-do list" heightens goal intention, helps workers abstain from immediate satisfaction, and creates goal-oriented behaviors [19]. In addition, a to-do list can increase commitment to the pursuit of a goal and the likelihood of goal attainment [17,20].

In many workplaces, PM can give information of project components about project goals, tasks, and to-do list. However, the distinctive relationships of the project components may influence the complexity of information processes, in which a project worker can be discouraged to conduct adequate behavior and the will of making an effort [3]. A lot of workload, mental fatigue, and time pressure imposed in complex work affect workers to be interrupted from their conscious effort and can have difficulties catching up with detailed instructions [3,21,22]. An individual is more likely to show a tendency of effort avoidance during high demands on their limited cognitive resources. As a result of complex project cases, a worker may hesitate to initiate behaviors related to project activities and may have a weakened willingness to engage in the project [23,24].

In this research, project management strategies are conceptualized with two different perspectives, cognitive mechanism and motivational belief, as shown in Figure 1. These two perspectives of project strategies can be regarded as considerable determinants of an appropriate fashion of engagement in project tasks. From the perspectives of cognitive mechanisms, personal behavior is influenced by mental associations such as external impulses or reactions that have been automatically activated without intention or consciousness [3,25]. The relations between a single goal and multiple goals are constructed via the individual cognitive structure, consisting of different types of goal systems. The PM should consider goal relations (a single goal vs. multiple goals) and whether to unpack a to-do list or not in the multitasking environment.

On the other hand, intrinsic motivation refers to the belief that an individual is able to undertake tasks at will, reflecting the intensity and duration of one's efforts and intention to finalize the project goal. Self-regulation involves strategies in coping style to control emotions, cognition, behavior, physiology, and environment in stressful events or circumstances [21,26]. Moreover, self-efficacy concerns an individual's beliefs of one's own ability to successfully accomplish the final goal. These

are fundamentally influential to human motivation, performance, accomplishments, and emotional well-being [27]. A PM should understand the worker's intrinsic motivational belief as self-regulation and self-efficacy. In this study, we focus on the role of self-regulation and examine how cognitive mechanisms are regulated by self-regulation contributing to the suppression of automatic reactions and concentration on the focal task [10].

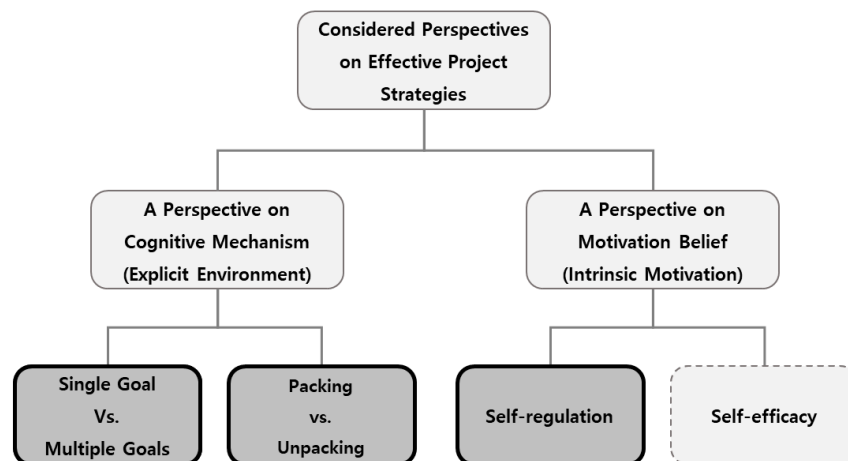


Figure 1. Project strategies concerning perspectives of the cognitive mechanism and motivational belief.

2.2. Goal System Theory

Goals are considered representation of the desired end states [6]. Importantly, a person rarely pursues project goals in isolation. A project worker needs to carry out a series of actions to implement an array of tasks and to achieve a final goal. Goal system theory can assume that a final goal connects closely with a project's components such as project tasks and activities in someone's cognition. Considering the three hierarchical levels of a goal system, interconnectivity of project components can facilitate one's awareness. More precisely, a superordinate goal hierarchically structured in a goal system contains project tasks, which are semantically and conditionally associated with the superordinate goal. Moreover, activities in a goal system actualize the way to accomplish project tasks [28,29]. In order to move further in a project, a worker may engage in goal-relevant activities with preplanned project components including project tasks and a to-do list.

Goal systems involve goal facilitation and goal conflict depending on whether the project components are interdependent or exclusive [25,29]. Consideration of goal facilitation and goal conflict in goal systems can provide an understanding of distinctive cognitive mechanisms. Goal facilitation refers to the situation in which project components are complementarily associated in a goal system. As seen in Figure 2, goal facilitation is reflected as instrumentality via vertically linked goal-means chains within project components [30,31]. As its hierarchical association in pursuit of a single goal is closer to semantic or conditional contexts, a worker seems to effectively manage cognitive resources. Goal facilitation is reported to have greater expectancy for one's positive effects on successful goal attainment.

However, goal pursuit typically requires competition for cognitive resources and pursuing multiple goals is constrained due to limited cognitive resources. When a worker confronts a situation in which multiple goals have to be obtained, conflicting relations occur. According to the goal system, mutually-exclusive goal relations are located with horizontal inhibitory links, which assumes that in multiple goals, a worker activates a focal goal and deactivates the other competitive goals [18], see Figure 3. Nevertheless, when an individual has difficulties to make decision on which goal is prioritized in resources competition, he or she suffers from a depletion of cognitive resources [13]. Under a depletion of cognitive resources, a worker's decision to choose a focal goal among multiple goals becomes to be incompatible and uncertain derived from a self-regulatory dilemma [2,32,33].

A worker stuck in the self-regulatory dilemma predicts ambiguous goal attainment, feels more time pressure and uncertainty for the goal attainment, and pays more attention to alternative activities than to goal-related activities. In conflicting relations, a worker is more likely to be frightened and exhausted in pursuing multiple goals to achieve a focal goal [10,34].



Figure 2. Vertical relations of a goal, tasks, and actions in a single goal.

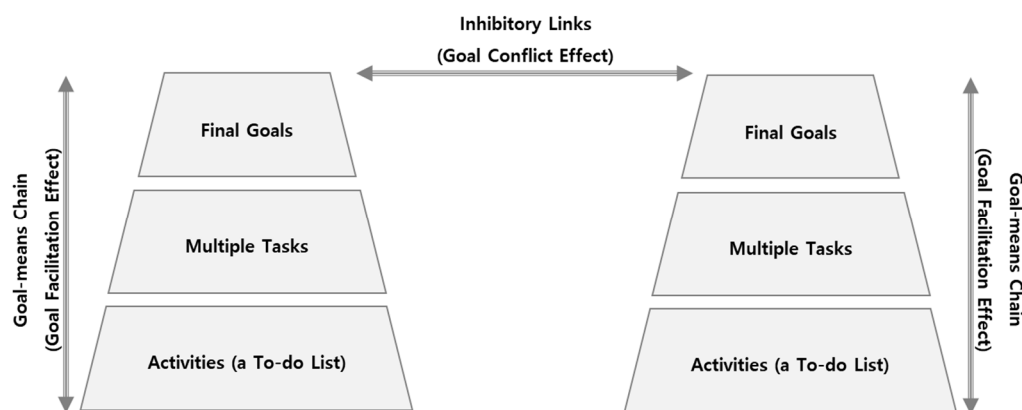


Figure 3. Horizontal conflicts between relations of a goal, tasks, and actions.

In summary, the project components may be independent, complementary, or contradictory according to the relations of goal systems. On the one hand, goal facilitation occurs when a worker pursues a single goal closely associated with the project components. For example, a graduate school student plans for what he or she has to do such as “I will have to finalize research papers and making presentation materials”. This multitasking seems to be harmonious because each of them is complementary and interrelated as one is achieved. On the other hands, if a project worker pursues multiple goals, the effects of goal facilitation may not continue, and is more likely to recognize the relations as conflicting. Goal conflict underlies the association of project components exclusively linked within multiple goals. The more distinct the relationship of the multiple goals seems to be, the more conflictive the intentions of commitment to multiple goals will be. For example, a graduate school student engages in multiple goals and “I will have to finalize research papers but I will have to prepare for final exams until a certain day”. This relationship of goals can be very conflictive if they have constraint resources (e.g., time, physical energy, mental effort, etc.). In many cases of project management, the PM takes into account whether detailed work guidance, including a to-do list, should be allocated to an employee to facilitate behavioral performance and draw attention to project success. There can be two branches for effective project management strategies, i.e., unpacking a to-do list to facilitate project performance or packing a to-do list to prevent goal conflict and make a worker committed in multitasking by oneself.

2.3. Packing and Unpacking Effects

Tasks can be perceived as more or less important depending on whether the goals are packed or unpacked as a communication strategy. Unpacking is a way of describing more details of a future event category, which leads to an increased perceived likelihood of a future event. Unlike unpacking, packing refers to a way of holistically integrating project components [35]. Previous researches have highlighted the fact that unpacking a set of future events intensifies one's mindset, emotions, and judgment of an event category [18]. For example, people tend to see themselves as more likely to die from unpacking a plausible event such as "heart disease, cancer, or other natural causes" than packing future events such as "natural disease" (unpacked condition 78% vs. packed condition 58%). The assumptions are based on a support theory which explains that those who are able to consider constituent elements unpacked around a future event or a category would perceive greater probability and frequency of an event rather than with a packed condition [36,37].

Unpacking a future event allows workers to visualize realistic plans or guidelines to make progress toward narrowing discrepancies between desired states and actual states [15,16]. In addition, unpacking affects expectancy mechanisms and availability mechanisms and encourages the confidence to attain a personal goal successfully [38]. It is also effective for an individual to procrastinate less frequently in their tasks, finish the goal on time, and be willing to spend more time on the tasks [39,40]. However, its impacts on multiple goals no longer have the same result as a single goal. It has recently been emphasized that as the number of goals participants have to achieve in the future increases, unpacking to-do lists can be detrimental and even harmful from human cognitive perspectives [18,20].

It has been reported that an unpacked condition in pursuit of multiple goals potentially disturbs making appropriate efforts toward task initiation [25,41]. From the perspective of the goal system, when a worker pursues a single goal in multitasking, unpacking a to-do list leads to goal facilitation. Unpacking a to-do list creates complementary associations among project components such as the goal, multiple tasks, and activities, and the importance of tasks that can be facilitated. On the other hand, the effects of unpacking make a worker feel conflicted about multiple goals in that unpacking a to-do list is instructing them to do more things than packing, and the association between each goal is conflicted in pursuit of multiple goals. Thus, a worker may be too distracted to concentrate on a focal goal due to contradictorily facilitated goal relationships. Therefore, the research hypothesizes that packing may be a better way for those pursuing multiple goals in multitasking as follows:

Hypothesis 1. *In pursuit of a single goal, task importance is higher in unpacking to-do lists rather than packing to-do lists.*

Hypothesis 2. *In pursuit of multiple goals, task importance is higher in packing to-do lists rather than unpacking to-do lists.*

2.4. Self-Regulation

Even in a complex multitasking environment, an intrinsically motivated worker is enabled to overcome difficulties in multitasking. A motivational belief refers to the level of actualizing one's behavior in order to reach the desired state of a final goal, and contributes to controlling emotional and impulsive responses [42,43]. Self-regulation is a personal belief that one's capacity can control impulsive and emotional responses. It affects how much effort an individual has to achieve a target goal and how willing an individual is to reach the final goal with better performance. According to dual-mode models, human information processing is divided into a "cool system" and a "hot system." Cool systems are involved in human decision making by suppressing impulsive and emotional responses and reflecting conscious processing information. The cool system implies a possibility in which people can control emotional, habitual, and automatic behavior and thoughts while engaged in adaptive ways of project processes. Hot systems, also called impulsive systems, are reported to

underlie impulsivity and habitual responses in which a worker engaged in a project process is more likely to be dependent on acquisitions of reinforcement such as to-do lists [10].

Utilizing self-regulation plays a role in reflecting a cool system that can temporarily inhibit external or irrelevant cognition and intensify conscious goal-oriented behaviors. Therefore, a highly-motivated worker makes the decision to prioritize focal tasks to maximize their performance during a project and to show more intensity and duration in their effort to control deviating attention from short-term gratification or alternatives. Those who have high self-regulation tend to strongly believe that they are capable of performing the project tasks by themselves. This research predicts that those who have strong self-regulation will try not to be immersed in the cognitive strategies of unpacking a to-do list. Therefore, judgment on task importance may no longer be influenced by unpacking's effects because a participant inhibits the conflicting and facilitating relationships in the unpacking condition.

In contrast, those with weak self-regulation are subject to the effects of unpacking a to-do list, which provides intuitive and immediate access to activities on project tasks [10,44]. The weak self-regulating individual regards unpacking a to-do list as a helpful guideline to reduce the discrepancy between desired states and current states of goal attainment [45,46]. Therefore, this study assumes that unpacking a to-do list provides benefits for goal facilitation in pursuing a single goal. Moreover, when unpacking a to-do list, the employee's judgment on task importance is reinforced for a single goal. However, in a multitasking situation with multiple goals, this benefit is no longer valid. For people with weak self-regulation and lack of cognitive resources, releasing a bunch of tasks for different goals can be a stress, and it may be hard to know what to do first or how to do it. In the pursuit of multiple goals, the effect of unpacking turns out to be no more beneficial than in the pursuit of a single goal due to goal conflicts. This research assumes that those who have low self-regulation are more likely to have difficulties in prioritizing the focal goal when multiple goals are unpacked, meaning that evaluating task importance seems to be weaker in unpacking a to-do list than in packing.

Hypothesis 3. *For a group with low self-regulation, task importance is higher in unpacking to-do lists around a single goal rather than packing;*

Hypothesis 4. *For a group with low self-regulation, task importance is higher in packing to-do lists around multiple goals rather than unpacking;*

Hypothesis 5. *For a group with high self-regulation, task importance is no longer affected by packing and unpacking to-do lists around a single goal;*

Hypothesis 6. *For a group with high self-regulation, task importance is no longer affected by packing and unpacking to-do lists around multiple goals.*

3. Research Design

3.1. Participants and Experiment Design

A total of 108 participants were recruited for this experiment as panelists in a Korean research company. The average age of the participants was 31.63 years and male participants comprised 51.4%. The research was performed on the basis of a web-based survey. The participants were randomly assigned to one of four scenarios. To analyze the data, four participants out of all the participants were excluded from the dataset due to their failure to respond to all of the questions on the questionnaire.

The scenarios instructed all participants to do two types of tasks around either a single goal or multiple goals and, then, were showed either packing or unpacking goals. All scenarios allowed them to perform a couple of tasks as a senior undergraduate student. In the scenarios with a single goal setting, tasks that participants had to implement were Task A and Task A'. Specifically, Task A was "to prepare a final project for the class" and Task A' was "to prepare for the final test in the class". All tasks were associated with the same goal, "to get an A+ grade in the class". Additionally, there were packed

or unpacked conditions. In an unpacked condition, participants were instructed using a to-do list in terms of Task A as follows: “make presentation materials” and “write report papers.” Task A’ was instructed “to write a summary note” and “to go through the textbook.” On the other hand, packed conditions were not used with the to-do list for Task A and Task A’ but described Task A and A’ as pursuing a single goal, “to earn an A+ grade in the class”.

The multiple goal scenarios were Task A and Task B. Task A was “to prepare a final project for the class” and Task B was “to prepare for the TOEIC, Test of English for International Communication.” Scenarios with multiple goals were also separated with packed and unpacked conditions. In an unpacked condition, Task B also contained a to-do list with the following: “organize the important contents from class notes” and “review previous test papers”, whereas, a packed condition used no to-do list for Task A or Task B. The goal of Task A and A’ was “to earn an A+ grade in the class” and Task B was “to achieve a TOEIC score 100 points higher than the previous exam”. The task we provided is the primary workload in the scenario situation. The scenario was a college student seeking credit management and improving English grades in order to get a job after graduation. Since college credit and English grades are an important part of employment in Korea, both of them in a scenario would be considered primary tasks for participants in the experiment.

When we provide participants with tasks A, A’, and B, we present a time constraint of two months. The reason for this is that we assumed college life in the scenario, and therefore four months, which can be considered as one semester, were the standard. Within this period, most college students assumed a period after the midterm that they were concerned with credit management. The two-month period was also considered to be a good time to improve English.

3.2. *Dependent and Independent Variables*

3.2.1. Task Importance

Task A (to prepare a final project for the class) was commonly indicated in all given scenarios. We assume that Task A was designated as a primary task, but Task A’ and B were designated as alternative tasks, so this research’s aim was to examine the importance of Task A. The participants responded to three items about how important Task A is. All ratings were done on a seven-point Likert scale (one = strongly disagree, seven = strongly agree). Cronbach’s α for task importance A (Cronbach $\alpha = 0.840$) was higher than the generally acceptable criteria (0.700).

3.2.2. Self-Regulation

Participants completed items in a survey measuring the emotional and cognitive capacity of self-regulation. Each item was assessed on a seven-point scale (one = strongly disagree, seven = strongly agree). Cronbach’s α for self-regulation was 0.824. This was higher than acceptable measurement standards (0.700). Furthermore, self-regulation was measured on a continuous scale and dichotomized into two groups as low and high levels of self-regulation. These groups were divided via median splits (median score = five). Participants who rated the same as the median score were excluded ($N = 39$). The average rate of the “high” self-regulation group had more than five on the scale of self-regulation ($N = 68$). The “low” self-regulation group had less than five on the scale of self-regulation ($N = 70$).

4. Research Results

4.1. Manipulation Check

We manipulated four scenarios in terms of task diversity and quantity of tasks. This research predicted that multiple goals would be perceived as having more diverse tasks than a single goal, and that unpacking would be perceived as having a larger number of tasks than packing. The participants responded to the manipulation check questionnaires on how diverse and how much workload there seemed to be. All ratings were done on seven-point Likert scales (one = strongly disagree,

seven = strongly agree). To verify each manipulation check item, a one-way ANOVA was conducted. As predicted, the participants rated the pursuit of multiple goals as more diverse than the pursuit of a single goal ($M_{\text{multiple goals}} = 5.06$ vs. $M_{\text{single goal}} = 4.64$, $F(1, 176) = 4.337$, $p < 0.039$). In addition, participants using unpacked conditions estimated that they must do more tasks than using packed conditions ($M_{\text{packing}} = 5.17$ vs. $M_{\text{unpacking}} = 5.82$, $F(1, 176) = 14.887$, $p < 0.001$).

4.2. Hypotheses Test

The hypotheses test of the study was conducted via two stages of analysis. The first test was conducted to gain insight into cognitive mechanisms, in terms of goal facilitation or goal conflict. The last analysis was conducted to examine the effects of self-regulation under cognitive mechanisms. The first analysis was performed using a two-way ANOVA (goal structures * packing and unpacking) on task importance. The results of the analysis indicated that the two-way interaction between single and multiple goals and packing and unpacking was significant, but the main effects of two variables were not significant (see Table 1).

Table 1. Two-way ANOVA between single and multiple goals, and packing and unpacking.

Source	d.f.	MS	F	Sig.
Model	3	4.541	6.890	0.001
Single/Multiple goals (A)	1	1.224	1.857	0.175
Packing/Unpacking (B)	1	2.364	3.586	0.060
A*B	1	10.621	16.113	0.001
Error	176	0.659		

In pursuit of a single goal, task importance did not differ significantly for an unpacked condition versus a packed condition ($M_{\text{single goal, unpacking}} = 5.785$ vs. $M_{\text{single goals, packing}} = 5.526$, $F(1, 89) = 2.238$, $p > 0.050$). However, in pursuit of multiple goals, a task in a packed condition was measured as more important than in unpacked condition ($M_{\text{multiple goals, unpacking}} = 5.461$ vs. $M_{\text{multiple goals, packing}} = 6.183$, $F(1, 87) = 17.567$, $p < 0.001$). Figure 4 shows a graphic representation of the relationships of packing and unpacking and a single goal and multiple goals. On the one hand, packing a to-do list is a significantly effective way to pursue multiple goals and to encourage task importance rather than unpacking a to-do list. On the other hand, neither packing nor unpacking had distinctive effects on the pursuit of a single goal in terms of task importance. These results mean that unpacking is a more effective strategy for a single goal than packing is, but packing for a single goal has no significant effect on task importance.

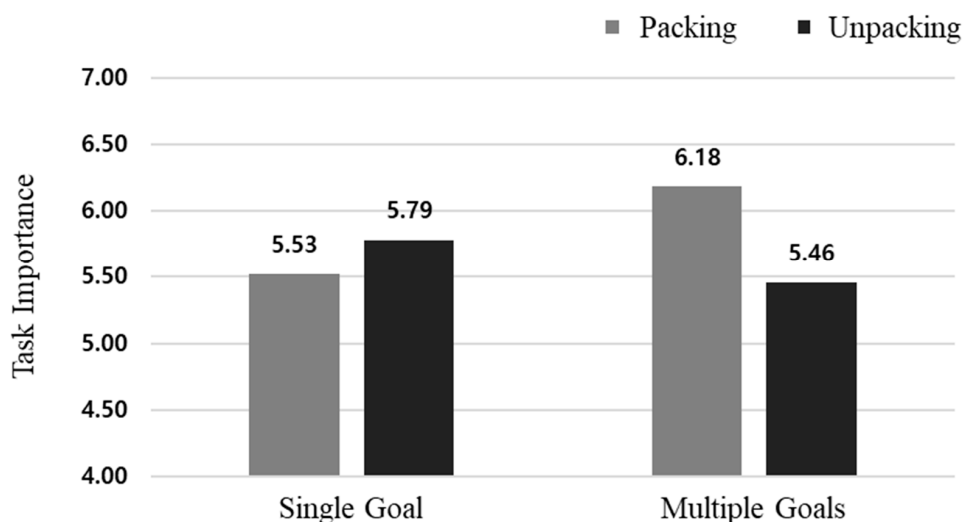


Figure 4. Interaction effect of single and multiple goals, and packing and unpacking on task importance.

Next, an analysis to gain insights into how self-regulation affected cognitive mechanisms on goal facilitation and goal conflict was conducted. We performed the three-way ANOVA (Single/Multiple goals * Packing/Unpacking * Self-regulation). Self-regulation as an additional variable is dichotomized into low- and high-level groups to examine the boundary condition within the relationship of single/multiple goals and packing/unpacking. The result revealed that three-way interaction ($F(1, 130) = 7.46, p < 0.001$) and a two-way interaction of single/multiple goals and packing/unpacking were significant ($F(1, 130) = 15.013, p < 0.001$). Meanwhile, the main effects of each variable were not significant on task importance ($p > 0.050$). It is noteworthy that self-regulation played a role in meditating these two-way interactions between single/multiple goals and packing/unpacking (see Table 2).

Table 2. Three-way ANOVA for task importance.

Source	d.f.	MS	F	Sig.
Model	7	3.899	6.513	0.001
Single/Multiple Goals (A)	1	1.489	2.481	0.118
Packing/Unpacking (B)	1	1.129	1.881	0.173
Self-Regulation (C)	1	7.653	12.753	0.001
A*B	1	9.009	15.013	0.001
A*C	1	1.994	3.323	0.071
B*C	1	0.124	0.206	0.650
A*B*C	1	4.476	7.459	0.007
Error	130	0.600		

The follow-up analysis was examined to test hypotheses three to six among groups with either low or high self-regulation. The two-way ANOVA analysis of single goal/multiple goals and packing/unpacking was performed through separated groups with low or high self-regulation. Focusing on the participants of low self-regulation, the two-way ANOVA analysis (2: packing vs. unpacking and 2: single goal vs. multiple goals) was carried out (see Table 3). The results indicated a significant two-way interaction effect between single/multiple goals and packing/unpacking ($F(1, 66) = 18.006, p < 0.001$) but main effects of single/multiple goals and packing/unpacking are not significant to task importance ($p > 0.050$).

Table 3. Two-way ANOVA in low self-regulation.

Source	d.f.	MS	F	Sig.
Model	3	4.456	6.110	0.001
Single/Multiple goals (A)	1	0.378	0.518	0.474
Packing/Unpacking (B)	1	0.061	0.084	0.773
A*B	1	13.131	18.006	0.001
Error	66	0.729		

In order to test hypotheses three and four, we investigated the impact of packing/unpacking and a single goal/multiple goals for groups with low self-regulation. In pursuit of a single goal, participants of low self-regulation indicated that the task importance was rated greater in an unpacked condition than in a packed condition ($M_{\text{a single goal, unpacking}} = 5.956$ vs. $M_{\text{a single goal, packing}} = 5.019, F(1, 31) = 10.296, p < 0.003$). In contrast, in pursuit of multiple goals, participants in packed conditions rated task importance as significantly greater than in unpacked conditions ($M_{\text{multiple goals, unpacking}} = 5.227$ vs. $M_{\text{multiple goals, packing}} = 6.044, F(1, 35) = 7.87, p < 0.008$).

As predicted, this research implied that unpacked conditions in a single goal lead to goal facilitation as a beneficial impact of to-do lists on the perception of task importance. In the pursuit of multiple goals, unpacked conditions offer adverse impacts on task importance, as unpacking around multiple goals seems to be a goal conflict (see Figure 5). Figure 5 shows that among those who are involved in

low self-regulation, on the. One hand, unpacking a to-do list around a single goal leads to facilitating relationships as compared with packing a to-do list, on the other hand, packing is a more effective way (than unpacking) to prevent goal conflicts in the pursuit of multiple goals. Therefore, it is rather beneficial when it comes to multiple goals. Therefore, both hypothesis three (for a group with low self-regulation, task importance is higher in unpacking to-do lists around a single goal rather than packing) and hypothesis four (for a group with low self-regulation, task importance is higher in packing to-do lists around multiple goals rather than unpacking) were accepted.

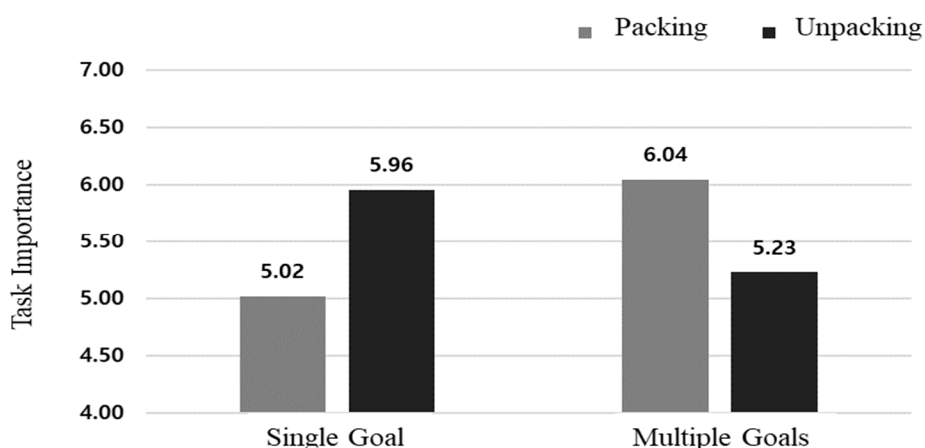


Figure 5. Interaction effect of single/multiple goals and packing/unpacking on task Importance in low self-regulation.

A two-way ANOVA (2: packing vs. unpacking and 2: single goal vs. multiple goals) was conducted for the participants who rated higher on the self-regulation scale than the median score of 5 (see Table 4). The main effect of packing/unpacking was significant ($p < 0.013$), while the main effects of single/multiple goals and the two-way interaction were insignificant ($p > 0.050$).

Table 4. Two-way ANOVA in high self-regulation between single/multiple goals and packing/unpacking.

Source	d.f.	MS	F	Sig.
Model	3	1.501	3.215	0.029
Single/multiple goals (A)	1	1.232	2.639	0.109
Packing/unpacking (B)	1	3.053	6.539	0.013
A*B	1	0.391	0.838	0.363
Error	64	0.467		

To test hypotheses five and six, we verified the supposition that participants among groups with high self-regulation have a tendency of inhibiting the impacts of packing/unpacking in each case of a single goal/multiple goals (see Figure 6). As predicted, for those involved in high self-regulation, task importance in pursuit of a single goal was not significantly different in either unpacked conditions or packed conditions ($M_{\text{a single goal, unpacking}} = 5.768$ vs. $M_{\text{a single goal, packing}} = 6.037$, $F(1, 33) = 1.382$, $p > 0.050$). Nevertheless, participants with high self-regulation in pursuing multiple goals still indicated that task importance in packed conditions was significantly higher than in unpacked conditions ($M_{\text{multiple goals, unpacking}} = 5.882$ vs. $M_{\text{multiple goals, packing}} = 6.458$, $F(1, 31) = 5.885$, $p < 0.021$). Figure 6 indicates that among those who are involved in high self-regulation, the difference between unpacking and packing a to-do list around a single goal is not significant. In the pursuit of multiple goals, task importance was significantly different between packed and unpacked conditions. This study investigated the role of self-regulation in playing a boundary condition in pursuit of a single goal, but there is still a difference in packing and unpacking on task importance. In conclusion, hypothesis five

(for a group with high self-regulation, in pursuit of multiple goals packing is an effective strategy to perceive task importance rather than unpacking) is accepted. Hypothesis 6 (for a group with high self-regulation, packing a single goal is an effective strategy to perceive task importance rather than unpacking) is rejected.

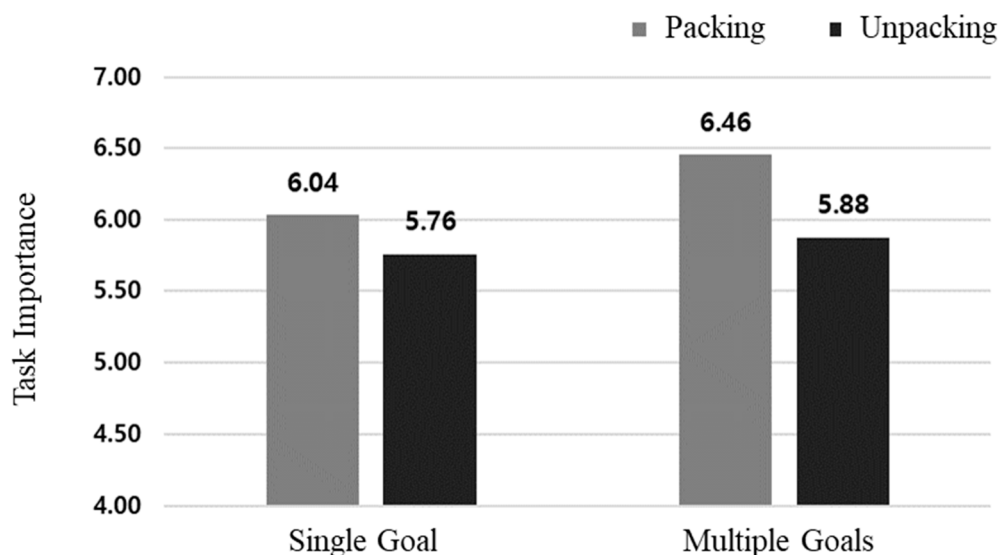


Figure 6. Interaction effect of single/multiple goals and packing/unpacking on task importance in high self-regulation.

5. Conclusions

The purpose of this study was to examine the cognitive mechanisms of goal relations (single goal vs. multiple goals) in addition to packing/unpacking effects and also to identify the role of self-regulation (high vs. low) as a motivational belief on the inhibitory process in cognitive mechanisms. The result of the hypotheses test of cognitive mechanisms is that unpacking a to-do list is in conflict with multiple goals but is not to be facilitated under a single goal. In addition, in the case of a low level of self-regulation, a strategy that involves unpacking a single goal is significantly efficient in enhancing task importance. In the case of the pursuit of multiple goals, a strategy that involves packing led participants to evaluate the tasks as significantly more important, however, in the case of high self-regulation, neither packing nor unpacking a single goal was significantly efficient in increasing task importance. In pursuit of multiple goals, task importance was still ranked greater in a packed condition rather than an unpacked condition.

This research suggests theoretical contributions to the existing literature by expanding theoretical knowledge on packing and unpacking effects in project management strategies. The assumption that people mostly overlook the details that help them understand discrepancies between desired end states and current states emphasizes the necessity of the unpacking strategy. However, it rarely attempted to examine potentially different effects based on the pursuit of either a single goal or multiple goals. It is noteworthy that in competitive relations within multiple goals, unpacking can lead an individual to have deteriorated judgment. If the PM unpacks the to-do list, diverse task relationships have detrimental impacts on a worker's intention to implement tasks, due to goal conflicts. The concept of goal conflict provides understanding of a worker's decision-making behavior, which demonstrates difficulties in committing to a focal goal in the case of multiple goals. Therefore, this study suggests that packing is necessary to relieve the burden of a workload in the case of multiple goals and for sustainable management strategies in multitasking.

This study sheds light on the relationship of multitasking in cases of the pursuit of either a single goal or multiple goals. Previous studies in the literature on goal relations has mostly highlighted degenerating or even deteriorating effectiveness of unpacking a to-do list while pursuing multiple

goals. Planning with a to-do list in the case of multiple goals is proven to distract one's intention and attention, and therefore makes the final goal less seemingly attainable and less beneficial than in pursuit of a single goal. This research applies certain cases of multitasking to examine the effect of the relationship of multiple tasks while pursued a single goal or multiple goals. This research concludes that only in the case of those who are under weak self-regulation, does unpacking a to-do list lead to goal facilitation in the pursuit of a single goal but goal conflict in the pursuit of multiple goals. It implies that the role of self-regulation acts as a boundary condition of the human cognitive system and plays the role of identifying the distinctive impacts on packing and unpacking a to-do list in pursuit of either a single goal or multiple goals. The notion of self-regulation has been well-established in a significant number of studies, leading to goal-oriented behavior and intentional behavior that is constitutive for human agency. Nevertheless, it seems that adopting self-regulation in the relationships of goal relations and packing/unpacking has never been attempted. This research verifies that self-regulation contributes to facilitating relations within a cognitive system.

This study also suggests the practical implication that a project manager can apply different strategies to project workers, considering the cognitive mechanism involving goal relations and packing/unpacking as well as motivational beliefs such as self-regulation. Previous research has highlighted that unpacking a to-do list has been demonstrated as an opportunity to broaden the likelihood of achieving a final goal and lead to better performance. If a PM unpacks detailed work guidance with to-do lists, project workers recognize more things to-do, and they are able to focus on what they have to-do in pursuit of a single goal. In a firm, for example, a PM can give workers a to-do list for project tasks in pursuit of a single goal to enhance project performance. On the other hand, if a worker has sufficient self-regulation, the judgment of task importance no longer is affected by packing and unpacking. On the contrary, if a worker has little confidence in exerting self-regulatory behavior, a to-do list would greatly influence them. However, when a PM assigns something to a worker with multiple goals, the worker perceives conflicting relationships between the multiple goals if they have weak self-regulation or are physically or psychologically exhausted. It is important that a PM considers the fact that unpacking makes a project worker suffer from goal conflict in multiple goals, and therefore the PM packs a to-do list for a worker to relieve the workload of what activities he has to follow. Finally, because this study focuses on the individual's cognitive mechanisms and motivational beliefs, we can expand our thinking about human behavior in a broader sense [47].

The limitation of this study is that only self-regulation is used as a boundary condition. A variety of variables probably affect multitasking behavior. These variables can be divided into three categories. One is the nature of the project itself, which may be the difficulty or novelty of the project [48]. The other category is for project members, where you can derive relationships among members (e.g., intimacy or familiarity and organization identity) [49,50]. The last category is the environment variables such as time [51], space (e.g. online vs. offline) [52–55], or social norm and pressure which encloses the task and the project members. Among these various variables, this study focused on project's goal structure and individual competence of self-regulation. Other variables not included in this study are considered to have value for future studies. Specially, individual characteristics of participants can significantly affect the effect of packing and unpacking. Individual differences in knowledge [56] or involvement [57,58] would also have a significant impact on the need for unpacking. Following similar logic, this study focused on the impact of self-regulation on the individual's competency level. People with high self-regulation could manage their own resources and determine the amount of work actually needed to achieve their goals rather than the number of tasks shown. Thus, it is argued that unpacking, whether given a large number of low-level tasks or a small number of high-level tasks, does not significantly affect the perception of the importance of individuals. The individual's level of knowledge may be a variable that can be fully considered. Moreover, task importance as a dependent variable is one of the products related to goal value and expectancy. The other variables, such as the willingness of time and effort invested in a project task needs to be included in future studies.

Author Contributions: J.P. and D.-H.P. designed the model, built the logic for the hypotheses, analyzed the data and carried out the insights and implementation fully together.

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