

## Introduction

The planning fallacy (Kahneman & Tversky, 1979) describes the tendency of individuals to vastly and consistently underestimate the amount of time or money needed to complete a task, even when there are available statistics or prior experiences that directly provide more accurate estimates. As an example, construction project planners frequently give optimistic time estimates, despite being aware of various construction projects which went vastly over schedule and budget in the past, including their own previous projects. Kahneman theorized that the planning fallacy is the result of differences between “inside” and “outside” thinking, where “inside” thinking refers to an individual reasoning about a specific personal case without considering base rates for the general population and “outside” thinking refers to thinking which focuses on population base rates and which de-emphasizes individual traits and differences.

Subsequent research (Buehler et al, 1994) has supported Kahneman's hypothesis by showing that students are better at estimating how long it will take for others to complete tasks than they are at estimating how long they themselves will take. Furthermore, Buehler and his colleagues found specifically that, when making time estimates for themselves, people “focus on plan-based scenarios rather than on relevant past experiences,” and furthermore that “people’s attributions diminish the relevance of past experiences.” However, when making estimates for others they consider base rates and past experiences. Buehler and his colleagues found that while making plans, people often attribute past underestimates or obstacles to highly specific events which are not likely to recur, rather than personal traits or stable features of the task itself.

In later work (Buehler, Griffin, & Peetz, 2010), Buehler and his colleagues successfully reduced the effects of the planning fallacy. They asked participants to consider potential obstacles to goal completion and describe a detailed scenario in which a task takes much longer than expected as a result. They found a statistically significant increase in time estimates, such that the planning fallacy was mostly eliminated. Notably, merely listing the obstacles has no effect on time estimates due to individuals’ attributional biases (Newby Clark et al, 2000). Moreover, others (Kruger & Evans, 2004) have found that by “unpacking” a task, i.e. by describing a list of subtasks, the bias can be reduced. However, both procedures do not necessarily produce more accurate predictions, but rather eliminate the tendency to consistently underestimate, such that people are equally likely to overestimate.

Notably, all of Buehler’s studies framed time estimates in terms of date of task completion rather than net amount of time spent working on the task. As an example, predictions in his study were of the form “I expect this task to be completed by next Tuesday” rather than of the form “I expect this task to take 20 hours total.” The first form focuses on completion time, whereas the second focuses on time on task. Notably, experiments using the later form of prediction are relatively uncommon. In one set of experiments using this form of prediction (Byram, 1997), it was found that both of the debiasing procedures described above failed to produce any statistically significant effects for a short term furniture building task. Nevertheless, another study (Forsyth & Burt, 2008), found that for short tasks, using “task segmentation” where time estimates are made for each subtask and added to create a time estimate for the task, produces predictions

which on average overestimate the time needed for the task. In effect, their procedure appears to be creating an error in the opposite direction of the planning fallacy. Notably, some research on college students has found no evidence of the existence of a planning fallacy when time-on-task measures are used (Pychyl et al, 2000).

The effects of Buehler's pessimistic scenario writing procedure have not been tested using time-on-task predictions. Moreover, time-on-task procedures have only been used for tasks which take relatively short times. Byram's furniture assembly tasks and all of Forsyth and Burt's tasks have an average completion time under two hours. It is not clear whether their results apply to larger more complicated tasks that may be encountered in the real world, such as writing reports or engaging in extensive design-based projects. This paper hypothesizes that both debiasing procedures will have significant effects for long tasks (requiring an average of 10 or more hours of work) when tested using a time-on task procedure. Moreover, this paper will test whether the effects of the procedures are additive. Namely, the current work sets out to determine whether the debiasing procedures are more effective when used together.

Byram's studies suggested that the planning fallacy is more strongly effected by motivation than by cognition(see Byram 1997 experiment 5), and this has been supported by other researchers (Buehler et al, 1997). Both Byram and Buehler found that subjects were more likely to underestimate and by larger magnitudes when they had heightened motivation for the task(as induced by a monetary incentive). The current work will test the hypothesis that avoidance motivation and high conscientiousness will be associated with less planning fallacy bias across all four experimental groups. Buehler's obstacle-focused debiasing procedure (Buehler, Griffin, & Peetz, 2010) appears to be a more explicit version of some of the cognitive processes involved in defensive pessimism (Norem & Cantor, 1986). Presumably traits associated with defensive pessimism may also be involved with this debiasing technique. Ergo, this study will collect data on trait defensive pessimism for all subjects and additional will measure subjects moods to control for the potential that mood mediates the relationship between defensive pessimism and time estimates.

## Methods

The proposed experiment will use a procedure derived from Wiese et al (2016) experiment 4. As per Wiese et al's methodology, Amazon's Mechanical Turk (MTurk) will be used to collect time estimation data from Mturkers of varied demographics. Unlike Wiese's procedure, this experiment will not require survey participants to complete a follow-up survey with actual completion times. Additionally, the Mturkers will be restricted to college educated people and they will be asked the number of years since they graduated from college in order to control for potential differences in their recollection of college related tasks, as well as major to control for potential differences in educational experiences.

Participants will be given a description of a writing task that presumably all college educated people will be familiar with: writing a ten-page research paper for a class.

"Imagine that you are writing a ten-page academic paper for a college course in the humanities or social sciences, and imagine that the paper is due two weeks from today. Try to use your prior experiences to guide your responses to the following questions."

Participants will then be assigned to one of four task groups. The first will be a control group in which participants will make time estimates without engaging in any debiasing procedure. They will then be prompted “Please make a estimate for how many hours it will take you to write the paper” and will be provided with a textbox in which to write their response. Separately, they will be prompted: “Please estimate the number of days from today that you will complete the paper” and will be provided with a drop-down list with options 1(expect to complete it today) through 14(expect to complete it on the day it is due). Additionally, to control for the possibility that the order in which they are requested to make their estimates will influence the results, the presentation order will be counterbalanced, such that which estimate is requested first is random.

The second group will engage in task segmentation (Forsyth & Burt, 2008). Specifically, they will be asked to break down the larger project into various subtasks and will make time estimates for how long each task will take to complete as follows:

” Please use the following boxes to make a list of tasks you will need to complete as part of writing your paper and make a time estimate in minutes for each task in your list.

	Task	Time estimate
1)	<input type="text"/>	<input type="text"/>
2)	<input type="text"/>	<input type="text"/>
....		
20)	<input type="text"/>	<input type="text"/>
“		

Participants will be presented with twenty rows in which to list their tasks. Presumably, the use of twenty rows will prime the participants to provide a number of tasks somewhere close to twenty. This is desirable as this will force the participants to use more specific tasks as opposed to lump tasks together in categories. In prior works (Forsyth & Burt, 2008), task segmentation has been conducted using highly specific tasks generally taking minutes each rather than hours. After making their lists of subtasks and estimates, participants will be asked to make a time-on-task and completion time estimate using an identical prompt to what was used for the control group.

The third group will list five potential obstacles and will afterward be prompted to write a short (1-2 paragraph) narrative describing a scenario in which the selected obstacles cause the task to take longer to complete. First, they will be prompted to list obstacles as follows:

“Please use the following five textboxes to describe five potential obstacles to completing your paper. Preferably, list obstacles which you have encountered while writing in the past. “

They will then be provided with five separate text boxes in which to describe their potential obstacles. Next, they will be prompted to write a short narrative in which the obstacles they listed interfere with writing the paper and cause it to take longer than expected.

“Please use the obstacles you described to write a 1-2 paragraph story about the obstacles interfering with the process of writing the paper during the next two weeks.”

They will then be prompted to make a time estimate and task completion date estimate for the task just as in the first two conditions.

In the fourth condition, subjects will engage in the task listing procedure from the second condition and the obstacles listing/narrative writing procedure from the third condition and will then report time-on-task and completion date estimates just as for the other three conditions.

For all four conditions, participants will be given a survey focusing on defensive pessimism and a more general mood survey after completing their tasks. Specifically, we will be using the Revised Defensive Pessimism Questionnaire (Norem, 2001) and the Positive and Negative Affect Schedule (Watson et al, 1988) both reproduced on the following pages.

Exhibit 4.1.  
The Revised Defensive Pessimism Questionnaire

When you answer the following questions, please think about how you prepare for and think about (academic/social) situations.<sup>a</sup> Each of the statements below describes how people sometimes think or feel about these kinds of situations. In the blank space beside each statement, please indicate how true it is of you, in (academic/social) situations.

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1-----2-----3-----4.....5.....6-----7  
*Not at all* *Very true of me*  
*true of me*

1. I go into these situations expecting the worst, even though I know I will probably do OK. **(PESS)**
2. I generally go into these situations with positive expectations about how I will do. **(PESS—R)**
3. I've generally done pretty well in these situations in the past.<sup>b</sup>
4. I carefully consider all possible outcomes before these situations. **(REFL)**
5. When I do well in these situations, I often feel really happy. **(Filler)**
6. I often worry, in these situations, that I won't be able to carry through my intentions. **(PESS)**
7. I often think about how I will feel if I do very poorly in these situations. **(REFL)**
8. I often think about how I will feel if I do very well in these situations. **(REFL)**
9. When I do well in these situations, it is usually because I didn't get too worried about it beforehand. **(Filler)**
10. I often try to figure out how likely it is that I will do very poorly in these situations. **(REFL)**
11. I'm careful not to become overconfident in these situations. **(Experimental item)**
12. I spend a lot of time planning when one of these situations is coming up. **(REFL)**
13. When working with others in these situations, I often worry that they will control things or interfere with my plans. **(Experimental item)**
14. I often try to figure out how likely it is that I will do very well in these situations. **(REFL)**
15. In these situations, sometimes I worry more about looking like a fool than doing really well. **(PESS)**
16. Prior to these situations, I avoid thinking about possible bad outcomes. **(REFL—R)**
17. Considering what can go wrong in academic situations

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*Note.* PESS = Item loads on Pessimism factor; REFL = Item loads on Reflectivity factor; R = reverse-scored item.

<sup>a</sup>The domain of interest should be specified here.

<sup>b</sup>This item is included to differentiate between those who are realistically pessimistic and those who are defensively pessimistic, on the assumption that those who report having done very badly in the past are realistic when they anticipate doing badly in the future. In college student samples, typically fewer than 20% of respondents rate themselves below 5 on this item.

Positive and Negative Affect Schedule (PANAS-SF)

Indicate the extent you have felt this way over the past week.		Very slightly or not at all	A little	Moderately	Quite a bit	Extremely
PANAS 1	Interested	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
PANAS 2	Distressed	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
PANAS 3	Excited	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
PANAS 4	Upset	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
PANAS 5	Strong	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
PANAS 6	Guilty	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
PANAS 7	Scared	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
PANAS 8	Hostile	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
PANAS 9	Enthusiastic	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
PANAS 10	Proud	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
PANAS 11	Irritable	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
PANAS 12	Alert	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
PANAS 13	Ashamed	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
PANAS 14	Inspired	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
PANAS 15	Nervous	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
PANAS 16	Determined	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
PANAS 17	Attentive	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
PANAS 18	Jittery	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
PANAS 19	Active	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5
PANAS 20	Afraid	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5

## Results(PROJECTED\*)

This experiment is expected to yield distinctions between the effectiveness of debiasing measures, as well as defensive pessimism and low mood as mediators which strengthen the effects of the debiasing procedures. Hypothesized results are graphed below, and will later be compared against experimentally derived data.

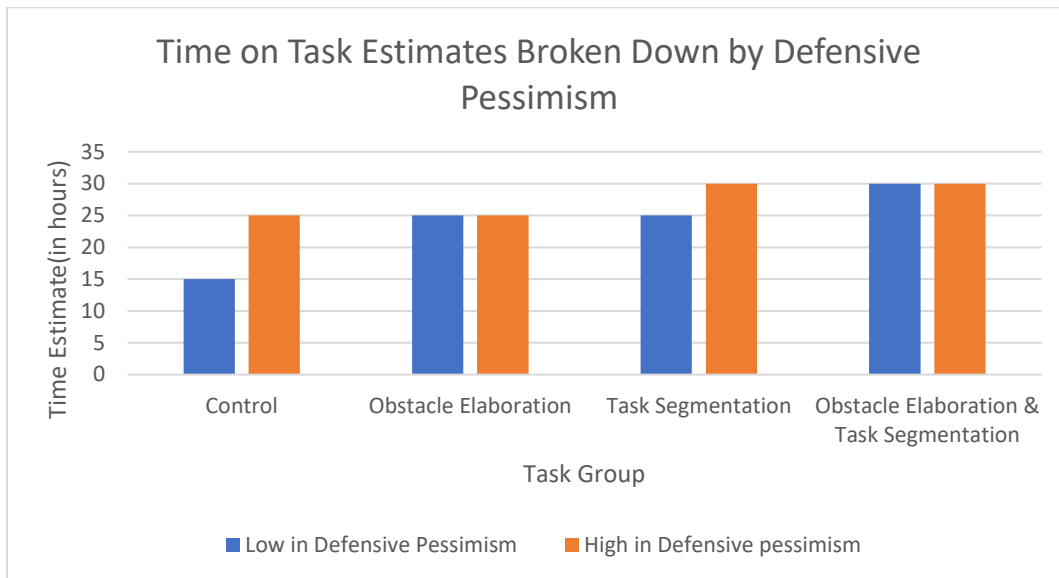


Figure 1: Task Group Vs. Time Estimate, striated by defensive pessimism score. “High in Defensive Pessimism” includes all participants who had a defensive pessimism score above the group median. Similarly, “Low in Defensive Pessimism” contains all participants who had defensive pessimism score at or below the median.

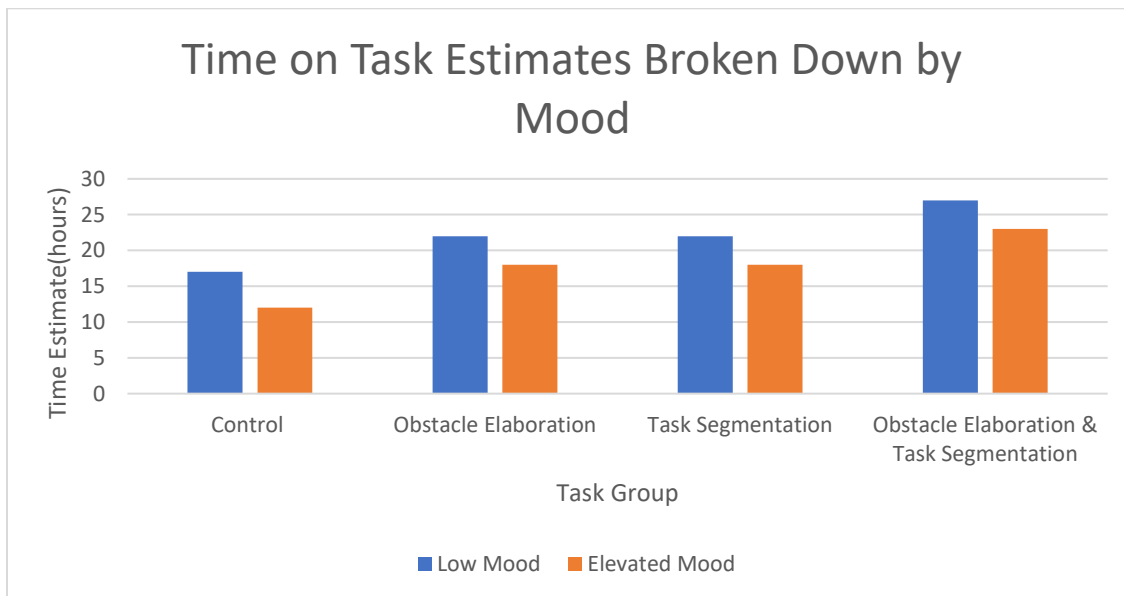


Figure 2: Task Group Vs. Time Estimate(hours), striated by mood score. “Low Mood” includes all participants at or below the median mood and “High Mood” includes all participants above it.

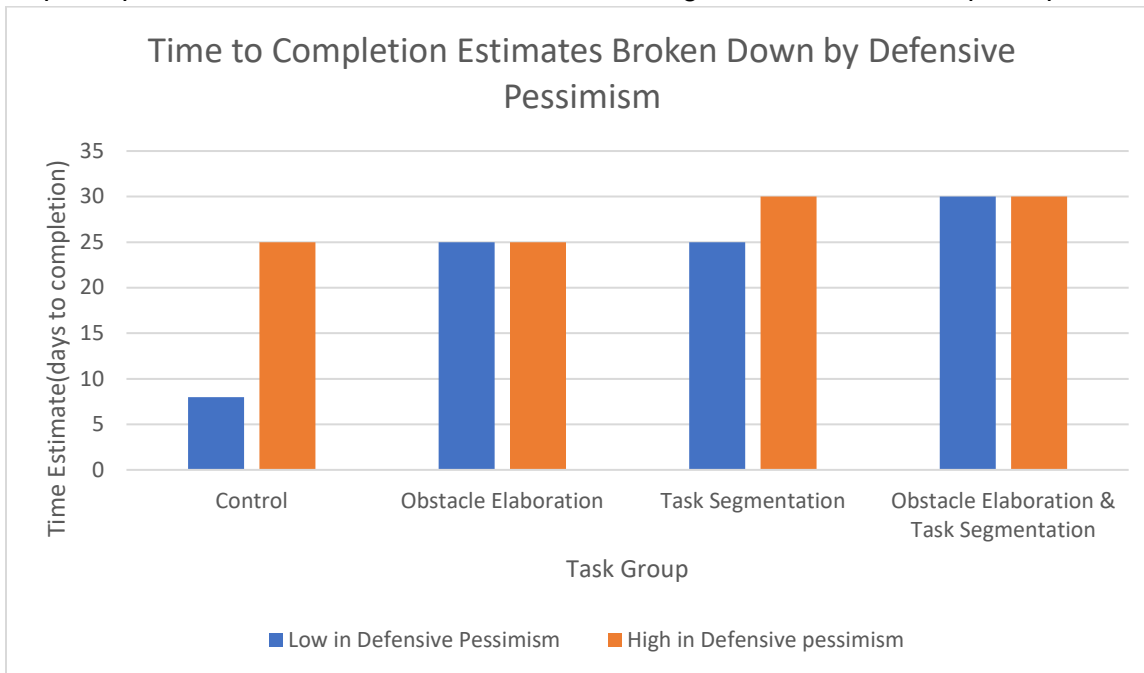


Figure 3: Task Group Vs. Time Estimate(hours), striated by defensive Pessimism

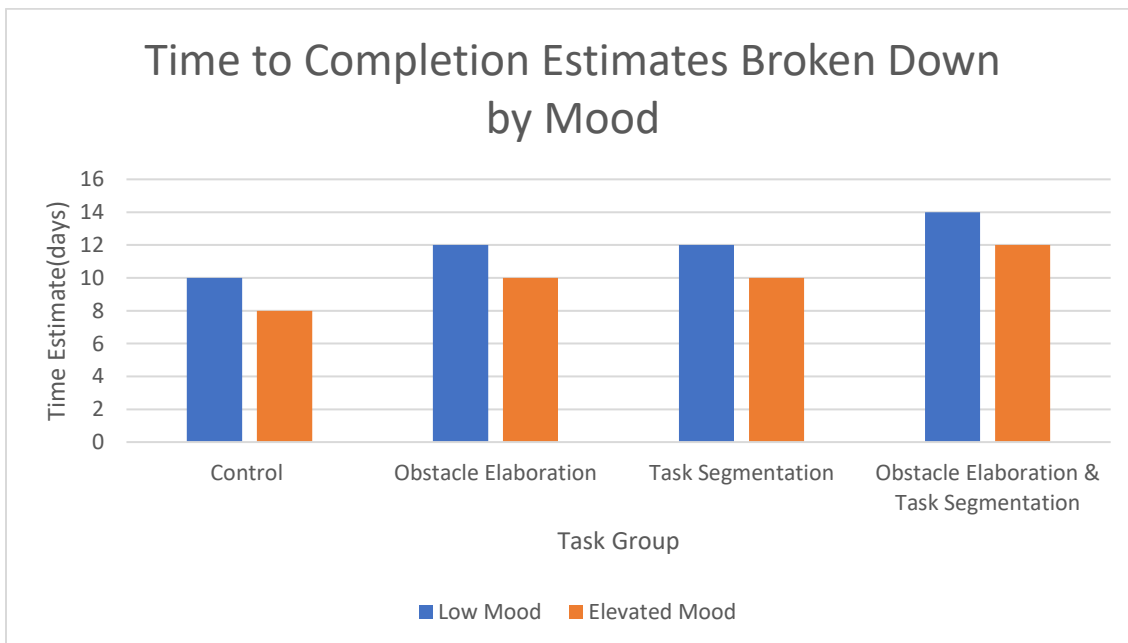


Figure 4: Task Group Vs. Time Estimate(hours), striated by mood.



## **PROJECTED\* RESULTS/ANALYSIS** \*experiment not yet carried out

There was substantially less variation in time-on-task predictions between task groups than there is for days to completion estimates. This suggests that the debiasing procedures are more effective for the later form of time estimate. This may imply that time-on-task estimates are more stable and less subject to the effects of existing manipulations.

Moreover, as demonstrated in figures 2 and 4, there appears to be a negative relationship between mood and time estimates, such that low mood leads to high time estimates and vice versa for both time-on-task and days to completion estimations. A similar effect was found for defensive pessimism and time estimates (see figures 1 and 3). Moreover, the fact that there is still a distinction between estimates in the control group and in the obstacle elaboration group for people who scored low in mood suggests that the effects of defensive pessimism on time estimates cannot be entirely explained by lowered mood.

Notably however, there appears to be no difference between the time estimates of the control group and the obstacle writing group for participants high in defensive pessimism. This may suggest that defensive pessimists are not substantially affected by the process of obstacle elaboration. Possibly, they already spontaneously engage in a mental process of obstacle elaboration such that cognitively there is little difference between the control procedure and the obstacle elaboration procedure.

Furthermore, for people low in defensive pessimism, there appears to be an additive effect between the two debiasing procedures, such that obstacle elaboration with task segmentation is more effective than either procedure performed in isolation. This suggests that these procedures may be operating through distinct processes. This is a potential area for future research.

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