

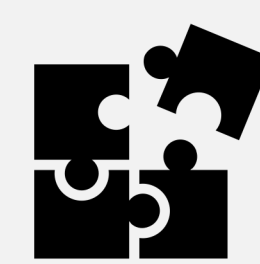
## ABSTRACT

“Unpacking” tasks into multiple component steps can decrease the planning fallacy, the tendency to underestimate project completion times (Kruger & Evans, 2004). Other studies show the opposite (e.g., Buehler & Griffin, 2003). We suggest **the perceived variant of uncertainty, epistemic or aleatory, moderates the effectiveness of unpacking:**

- Perceiving task uncertainty as **aleatory** (i.e., the outcome is perceived as random) **increases completion time estimates** for tasks with more (vs. fewer) steps.
- Perceiving task uncertainty as **epistemic** (i.e., the outcome is knowable but uncertain due to lack of knowledge or expertise) does not increase completion time estimates for projects with more (vs. fewer) steps.

## BACKGROUND

Distinct from amount of uncertainty, we differentiate between two variants of uncertainty (Fox & Ülkümen, 2011):



**Epistemic**  
Knowable

Pure Epistemic Example:  
Uncertainty about the answer to a trivia question

Knowledge, Skill



**Aleatory**  
Random

Pure Aleatory Example:  
Uncertainty about the outcome of coin flip

Chance, Luck

Most events contain BOTH: Perception is subjective

Why might “unpacking” change estimates under different variants of uncertainty?

Under epistemic uncertainty, each additional step might make the instructions feel more helpful. Under aleatory uncertainty, each step is an additional opportunity for things to deviate from plan in unpredictable ways.

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## STUDY 1

**Design:** 303 Mturkers identified an upcoming project and estimated how long it will take to complete (free-response in days).

- Measures:
  - Estimated # of steps to complete project
  - Estimated 80% confidence interval around the estimate
  - Epistemic-Aleatory Rating Scale (Fox & Ülkümen, 2011)

Study 1 Takeaway:

**For projects with high aleatory uncertainty, additional steps are associated with increased time estimates. The opposite is true for projects with high epistemic uncertainty.**

## STUDY 2

**Design:** 1150 Mturkers estimated how long a recipe will take to cook (in minutes) in a 2 (aleatory prime vs. epistemic prime) x 2 (5 “packed” steps vs. 15 “unpacked” steps) between-subjects study.

**COOKING IS A GAME OF CHANCE**

The next time you see a beautiful photograph of a new dish, remember that cooking a new dish from a recipe is like a **game of chance**.

A recipe can give you directions for cooking, but you will still feel like you are **flipping a coin** at each step to determine whether to turn left or right. What kind of tomatoes should you use? Is it better to chop or grind the garlic? Even when you use the same recipe, **every time you cook, at each step the right choice may be different, so make sure to bring your luck to the kitchen.**

Take the ingredients, for example. A recipe may call for simmering the tomato sauce for approximately 10 minutes until it thickens. However, the actual time it will take for the sauce to thicken may vary anywhere from 8 minutes for more ripe tomatoes to 12 minutes for harder tomatoes. The exact level of ripeness of the ingredients at the time of cooking is largely **random**, and therefore difficult to judge for a casual cook. Therefore, getting the timing right in cooking depends on **the luck of the draw!**

**COOKING IS A GAME OF SKILL**

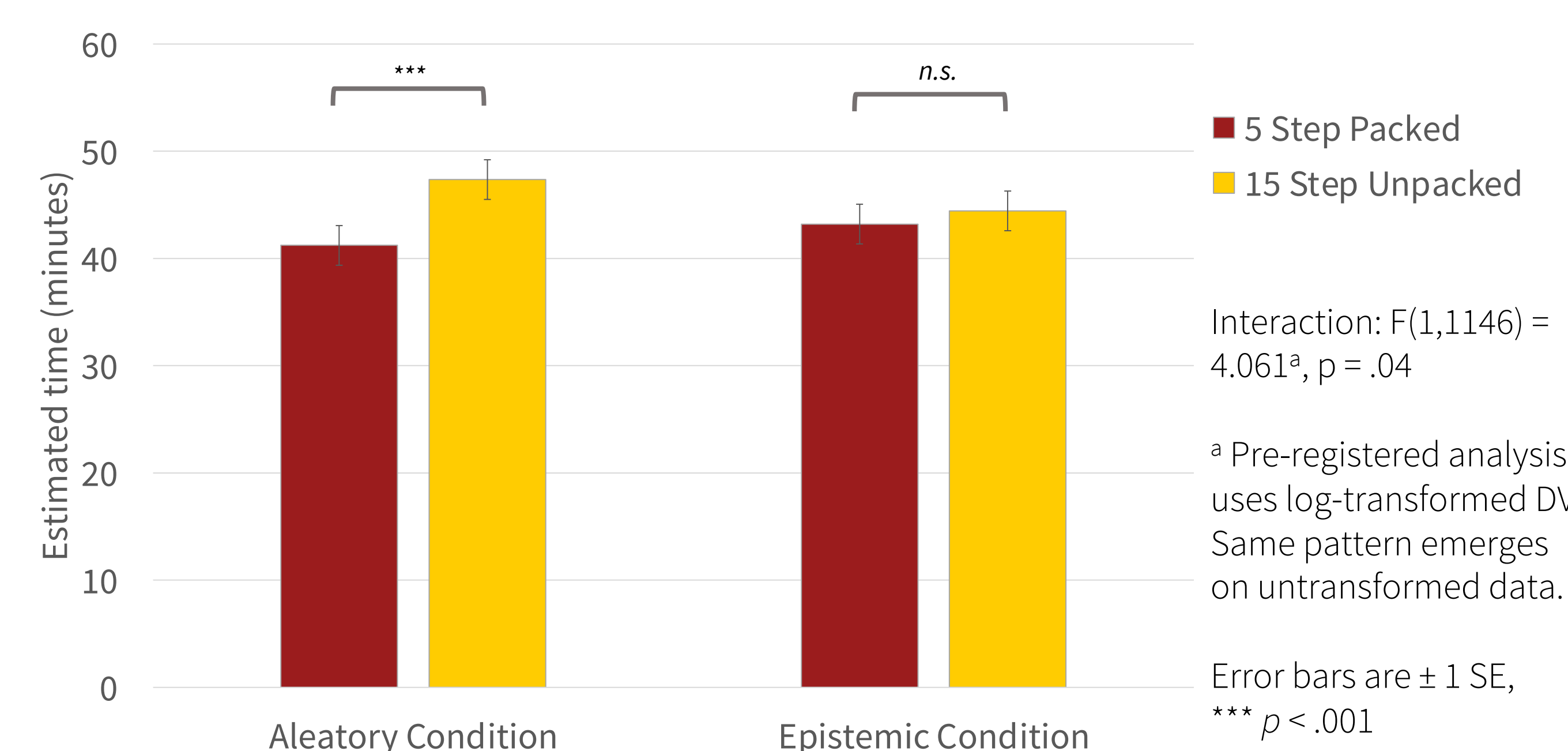
The next time you see a beautiful photograph of a new dish, remember that cooking a new dish from a recipe is like a **game of skill**.

A recipe can give you directions for cooking, but you will still feel like you are **answering a trivia question** at each step to determine whether you turn left or right. What kind of tomatoes should you use? Is it better to chop or grind the garlic? When you are cooking with a recipe, **there is a right choice at each step, so make sure to closely follow expert advice in the kitchen.**

Imagine that you are cooking tomato sauce. The actual time it will take for the sauce to thicken may vary from 8 minutes for more ripe tomatoes to 12 minutes for harder tomatoes. The exact level of ripeness of the ingredients at the time of cooking is theoretically **knowable**. Therefore, getting the timing right in cooking depends on **the cook's knowledge of the ingredients, and how closely they follow the instructions!**

**Study 2 Uncertainty Manipulation:** Participants first read an article about cooking manipulated to prime aleatory uncertainty (game of chance, left) or epistemic uncertainty (game of skill, right).

Estimated completion time estimates (Study 2)



Study 2 Takeaway:

**Under aleatory uncertainty, “unpacked” recipe led to increased time estimates.**

Regression Coefficients predicting log-transformed Completion Time Estimates (Study 1)

| Variable                      | B              | SE   | $\beta$ |
|-------------------------------|----------------|------|---------|
| (Constant)                    | 1.698***       | .412 |         |
| Epistemic                     | 0.147*         | .075 | 0.163   |
| Aleatory                      | 0.002          | .054 | 0.003   |
| # of Steps                    | 0.103*         | .050 | 0.639   |
| <b>Epistemic x # of Steps</b> | <b>-0.031*</b> | .012 | -1.007  |
| <b>Aleatory x # of Steps</b>  | <b>0.019**</b> | .007 | 0.494   |
| CI (Uncertainty) <sup>a</sup> | 0.006***       | .001 | 0.515   |

Notes.  $R^2 = .323$  ( $N = 303, p < .001$ ).

<sup>a</sup> Participants provided 80% confidence interval around their estimate. Controls for amount of uncertainty. Pattern remains the same without control, with Aleatory x Steps remaining significant.

\*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$

Paella



Ingredients

- 3 tablespoons olive oil
- 1/2 pound meat, like chicken thighs, chorizo, pork, etc. (optional)
- Salt and pepper to taste
- 1 onion, chopped
- 1 bell pepper, minced
- 2 cups rice
- 1 pinch saffron
- 3 1/2 cups liquid (chicken, lobster or vegetable stock; water, wine, etc., or a combination)
- 1/2 pound seafood, like shrimp, mussels, squid, etc. (optional)
- 1/2 pound vegetables, like olives, tomatoes, snow peas, mushrooms

- Put 3 tablespoons olive oil in a 12-inch skillet over medium-high heat. When hot, add about 1/2 pound of meat (or a combination of meats), sprinkle with salt and pepper and cook until nicely browned. Add chopped onion and minced bell pepper at the same time and cook until soft.
- Add 2 cups rice, cook, stirring, until heated, and lay it on top of the rice.
- Put 3 tablespoons olive oil in a 12-inch skillet over medium-high heat.
- When hot, add about 1/2 pound of meat (or a combination of meats), sprinkle with salt and pepper and cook until nicely browned.
- Add chopped onion and minced bell pepper at the same time and cook until soft.
- Separately, heat 3 1/2 cups of your liquid of choice until lukewarm.
- Add 2 cups rice and a pinch of saffron and cook, stirring, until shiny.
- Add the heated 3 1/2 cups of your liquid of choice and stir until just combined.
- Stir in seafood (or lay it on top of the rice).

**Study 2 Steps Manipulation:** Participants then saw a recipe with 5 “packed” preparation instructions (top/back) or 15 “unpacked” preparation steps (bottom/front). Actual information was held constant.

## DISCUSSION

- In two pre-registered studies, we uncover perception of uncertainty as an important moderator of when “unpacking” calibrates completion time estimates.
- “Unpacking” tasks increases time estimates **only** under aleatory uncertainty

Future work will explore evidence of process and test whether this effect impacts actual project completion times and the associated planning fallacy error.

## REFERENCES

- Buehler, R. & Griffin, D. (2003). Planning, personality, and prediction: The role of future focus in optimistic time predictions. *Organizational Behavior and Human Decision Processes*, 92(1-2), 80-90.
- Fox, C. R. & Ülkümen, G. (2011). Distinguishing two dimensions of uncertainty. In W. Brun, G. Kirkebaen, & H. Montgomery (Eds.), *Perspectives on Thinking, Judging, and Decision Making* (pp. 1-14). Universitetsforlaget.
- Kruger, J. & Evans, M. (2004). If you don't want to be late, enumerate: Unpacking reduces the planning fallacy. *Journal of Experimental Social Psychology*, 40, 586-598.