

# Anticipating Workload: Which Facets of Task Difficulty are Easiest to Predict?

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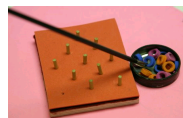
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## Background

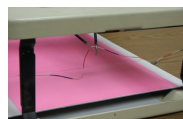
Previous research using the NASA Task Load Index (NASA-TLX) to predict workload found that some aspects of workload (effort, frustration, mental demand) are more difficult to predict than others (Hart & Staveland, 1988; Sublette et al., 2009). Budget, time, and safety constraints of some tasks necessitate assessment of workload *prior to* (prospective) or *instead of* actually performing the task, based solely on verbal or pictorial descriptions. Reactivity, validity, and reliability are considerations for determining whether prospective workload assessments can be used in place of after-performance (retrospective) judgments. This study compares participants' anticipated workload to workload assessments made after task completion.

## Tasks

Participants used two Maryland dissectors in a surgical training box to complete each of the following tasks: **Ring Transfer**, **Cannulation**, **Cobra Rope**. Performance was based on the number of rings transferred, the number of pipe cleaners threaded through a tube, or the amount of rope travelled by the graspers.



Ring Transfer Task



Cobra Rope Task



Cannulation Task

## Method

### Participants and Equipment

Forty-three undergraduates from an introductory psychology course performed tasks using a Stryker 888 Endoscope, a Stryker Quantum 300 light source, a Stryker 888 zero-degree 10mm camera and two Maryland dissectors.

### Conditions

- P+R (prospective + retrospective) – participants rated predicted workload, performed tasks then rated experienced workload.
- R (retrospective only) – participants performed tasks and rated experienced workload only.

## Trials

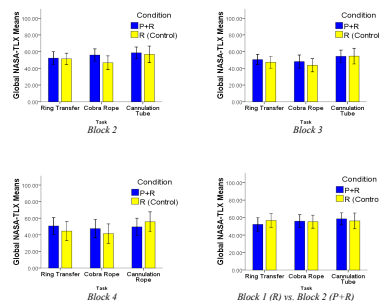
Trials lasted 90 seconds and were presented in a block design in random order. After completing or imagining the trial, participants used the NASA-TLX to assess their perceived or predicted workload.

## Results

### Reactivity Analysis

Does predicting task difficulty change retrospective judgments?

A 2(condition) x 3(task) x 3(Block) mixed-factor ANOVA found no evidence of reactivity (main effects or interactions with condition) ( $F(2, 82) = .629, p = .42$ , partial  $\eta^2 = .021$ ).

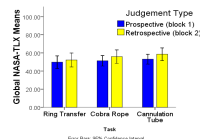


### Validity Analysis

How accurate are workload predictions?

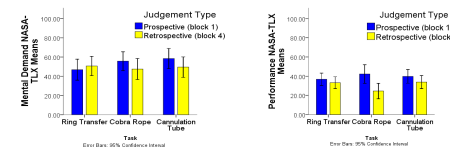
### Prediction vs. First Performance

A repeated-measures ANOVA of ratings in P+R condition found a main effect of **task** for **mental** and **temporal demand**, and a main effect of **judgment type** was found for **physical demand**. No interactions were found. Thus, while physical demand was underestimated, overall the relative difficulty of the three tasks did not vary significantly as a function of judgment type.



### Prediction vs. Practiced Performance

A repeated-measures ANOVA of ratings in the P+R condition found a main effect of task for temporal demand and a main effect of judgment type for performance and frustration. An interaction between judgment type and task were found for both mental demand and performance. The task participants expected to be the most difficult turned out to be the easiest after modest practice.



## Conclusions and Implications

- No evidence that the act of predicting workload affected post-performance workload judgments.
- Excluding physical demand (which was underestimated), participants appeared to be able to predict workload judgments of first-task performance.
- After modest practice, predicted workload dissociated from experienced workload, especially mental demand and performance.
- Future research should consider how participants predict task difficulty when practice is a factor, what strategies participants use to predict difficulty and how expertise develops over time.

## References

- Hart, S. G., & Staveland, L. E. (1988). Development of NASA-TLX (Task Load Index): Results of empirical and theoretical research. In P. A. Hancock & N. Meshkati (Eds.), *Human Mental Workload*. Amsterdam: North Holland Press.
- Sublette, M., Carswell, C. M., Grant, R., Klein, M., Seales, W. B., & Clark, D. (2009). *Anticipated vs. experienced workload: How accurately can people predict task demand?* Paper presented at the Human Factors and Ergonomics Society 53rd Annual Meeting, San Antonio, TX.