Constructing Racing Cars: Reducing Problem Complexity for the Fastest Car Ever Seen

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Fastest Cars for This/These Track(s)

Undergraduates often encounter problems with running their first empirical studies. This study investigated which kind of instruction works best for performing an analogue task of constructing racing cars for different racing tracks.

Corresponding to earlier studies (e.g., Burns & Volmeyer, 2002; Vollmeyer, Burns, & Holyoak, 1996), participants got either a specific instruction to construct a racing car for one specific track or they got the unspecific instruction to construct fastest cars for several tracks. The specific instruction should prepare participants best for the trained track, but not for any other tracks. In contrast, participants with unspecific instruction should be better prepared for unfamiliar tracks because of their *better understanding* of the underlying structures.

Alternatively, one could argue that specific instruction *reduces the problem space*. Given a restricted number of trials, participants who have to focus on aspects of problem space should perform better for both tasks if the aspects they focused on were relevant for both tasks.

Therefore, the *better understanding* hypothesis expects an interaction between instruction and task for performance. In contrast, the *reduced problem space* hypothesis expects a main effect of instruction only given that both task share important properties.

The Model

The ACT-R model for this task constructed "cars" using a numeric representation of tracks, parameters and performance. After each run, it memorized the outcome associated with the chosen set of parameters for the track. With unspecific instruction, it chose as the next trial either an unfamiliar track or a track with low performance in earlier races. For setting parameters, it either slightly modified the most successful setting for a known track or chose the most successful pattern for the most similar track. For the second competition, it most often chose the most successful pattern of the trained track / the first competition.

Methods

Twenty students of Chemnitz University of Technology took part in 2 web based experiments (www.tu-chemnitz.de/project/elearning/tutor for the German version) and were either instructed to construct the fastest car for one specific racing track or were instructed to construct fastest cars for 4 different tracks.

For six training trials, participants had to select first one out of four racing tracks, then to set parameters (brakes, engine, chassis, transmission, tires) for a car, and finally to watch this car running a virtual race against 3 opponents. After completing training trials, participants had to run two competition races.

Results

As expected, participants with specific instruction constructed faster cars than participants with unspecific instruction for the competition on the familiar racing track (see table 1), F (1, 18) = 6.54, p = .02, R^2 = .27. As expected by the *reduced problem space* hypothesis, participants with specific instruction also tended to construct faster cars than participants with unspecific instruction for the unfamiliar track (see table 1), F (1, 18) = 1.35, p = .26, R^2 = .07.

Table 1: Z standardized mean racing times (and SD) for cars constructed after specific vs. unspecific training task for 2 test competitions.

Competition	specific	unspecific
1. Familiar track	-.79 (.58)	.14 (1.0)
2. Unfamiliar track	-.20 (.36)	.57 (2.1)

Discussion

Results of this study on first look do not fit with comparable studies. Nevertheless, they can be interpreted accordingly if one takes into account complexity of task combined with a limited number of trials. A corresponding ACT-R model fits nicely with the data on a global level for the 2 competition races.

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References

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