

When an automated vehicle gets stuck, should a remote operator choose a plan or draw one?

We investigate two planning-oriented remote assistance concepts using real-world driving stimuli in a lab-based operator workplace.

Choose a plan Collaborative Planning



Draw a path Trajectory guidance



Why remote assistance?

Remote assistance allows a human operator to provide **contextual guidance** while the AV remains responsible for validating and executing the maneuver. [1][2][3]

More automation support

Collaborative Planning [4][2]

- System generates feasible alternatives
- Constrained and potentially efficient
- Lower input complexity

More operator agency

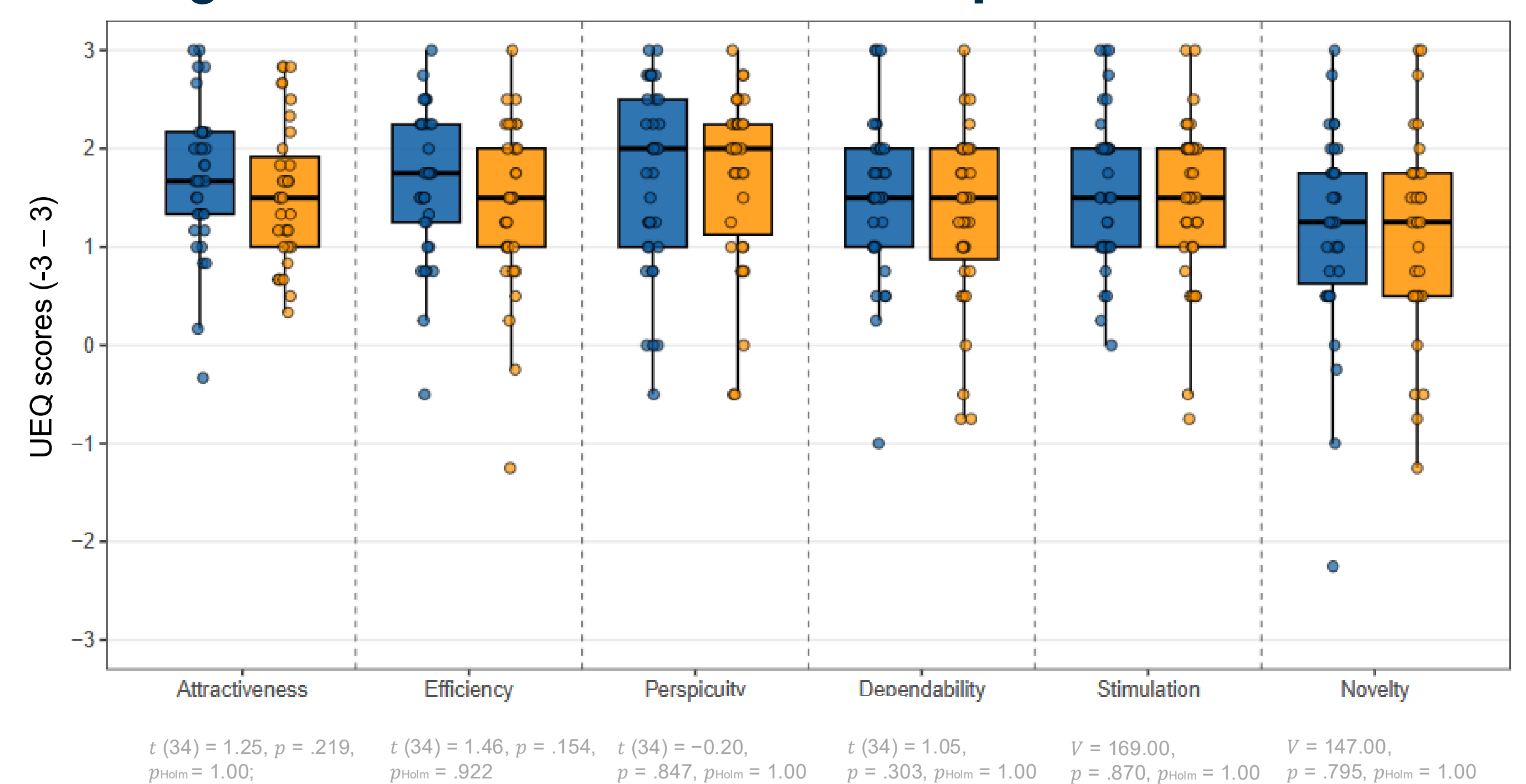
Trajectory Guidance [4][2]

- Operator specifies a spatial path
- Flexible and situation-specific
- Greater freedom of input

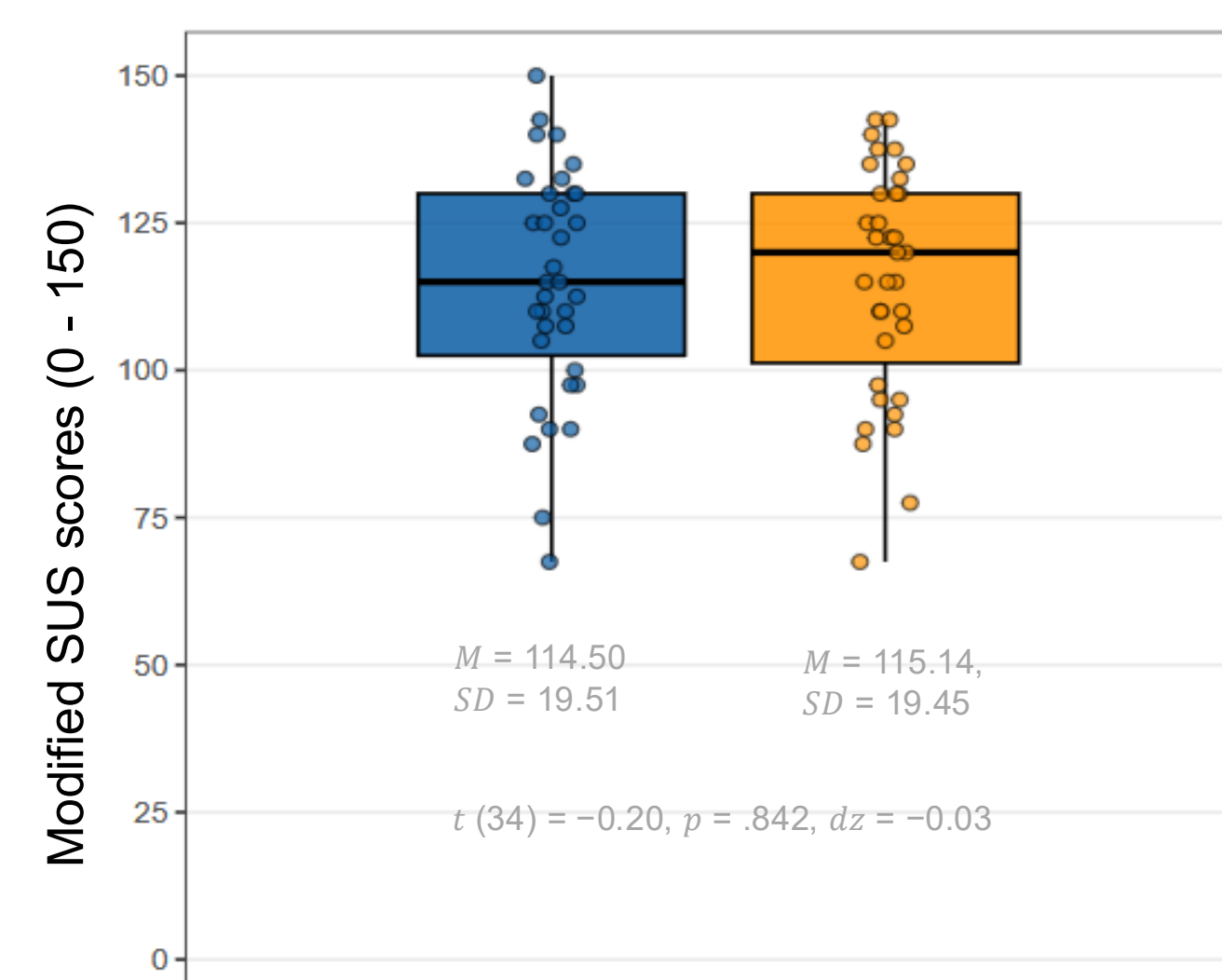


What did we find?

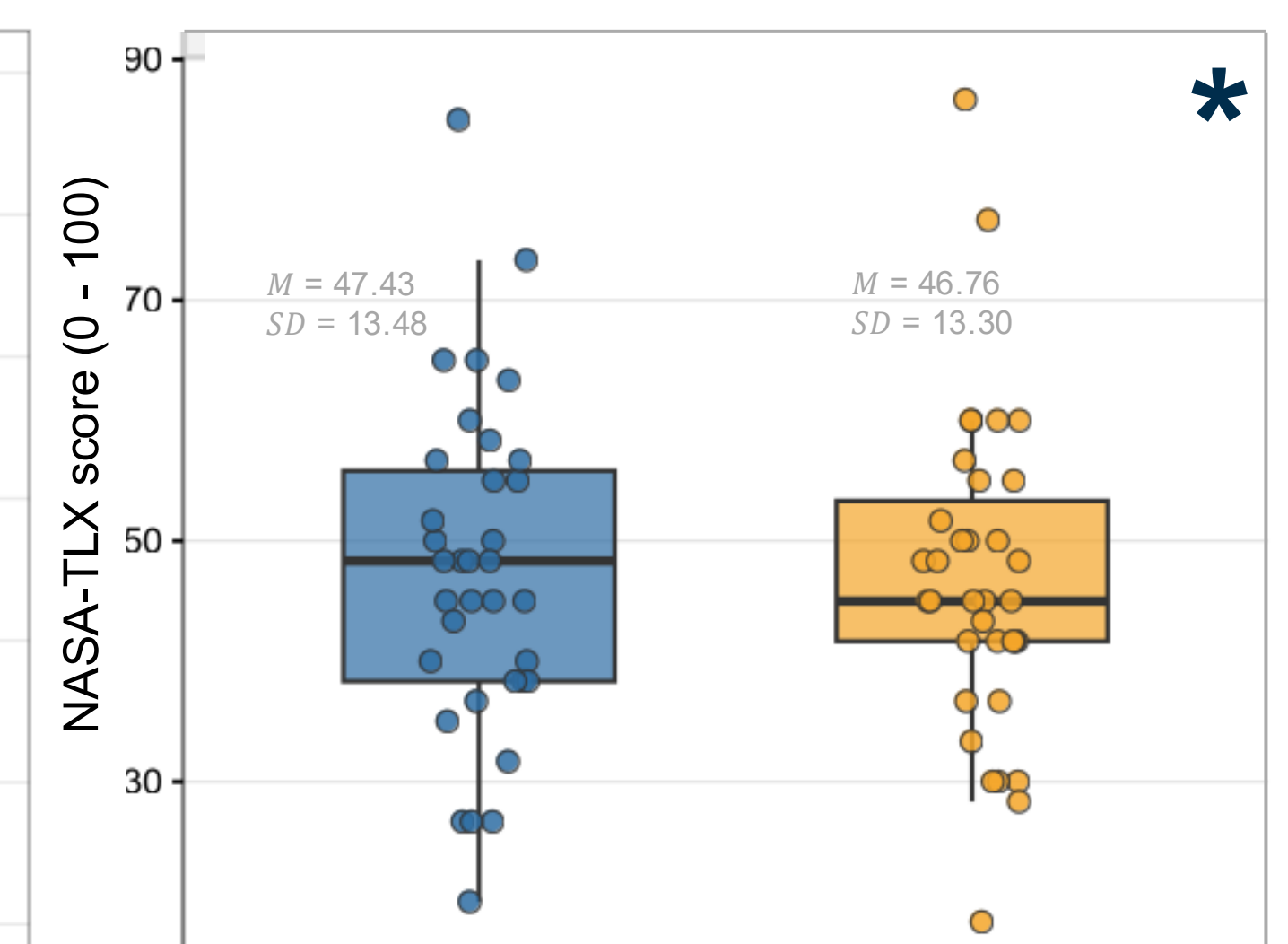
No significant difference in user experience



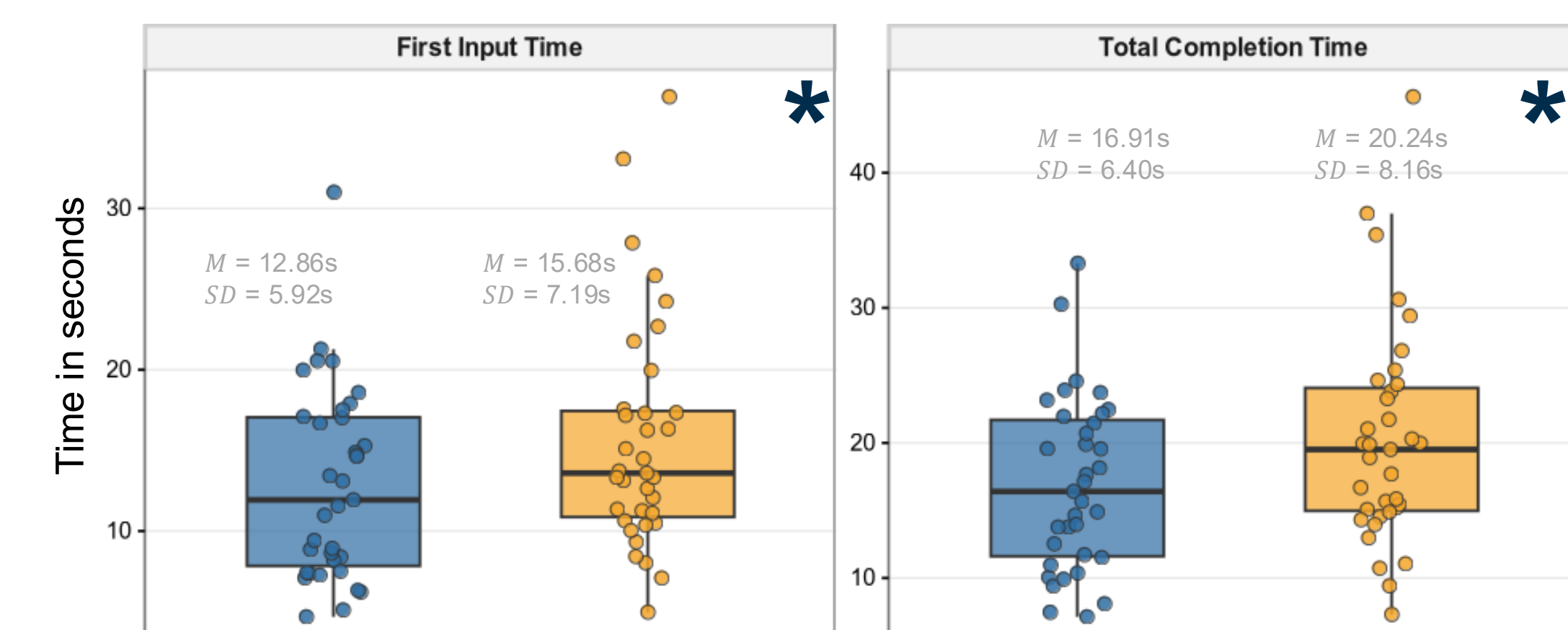
No significant difference in system usability



No significant difference in workload



Significant difference in interaction time



First input:

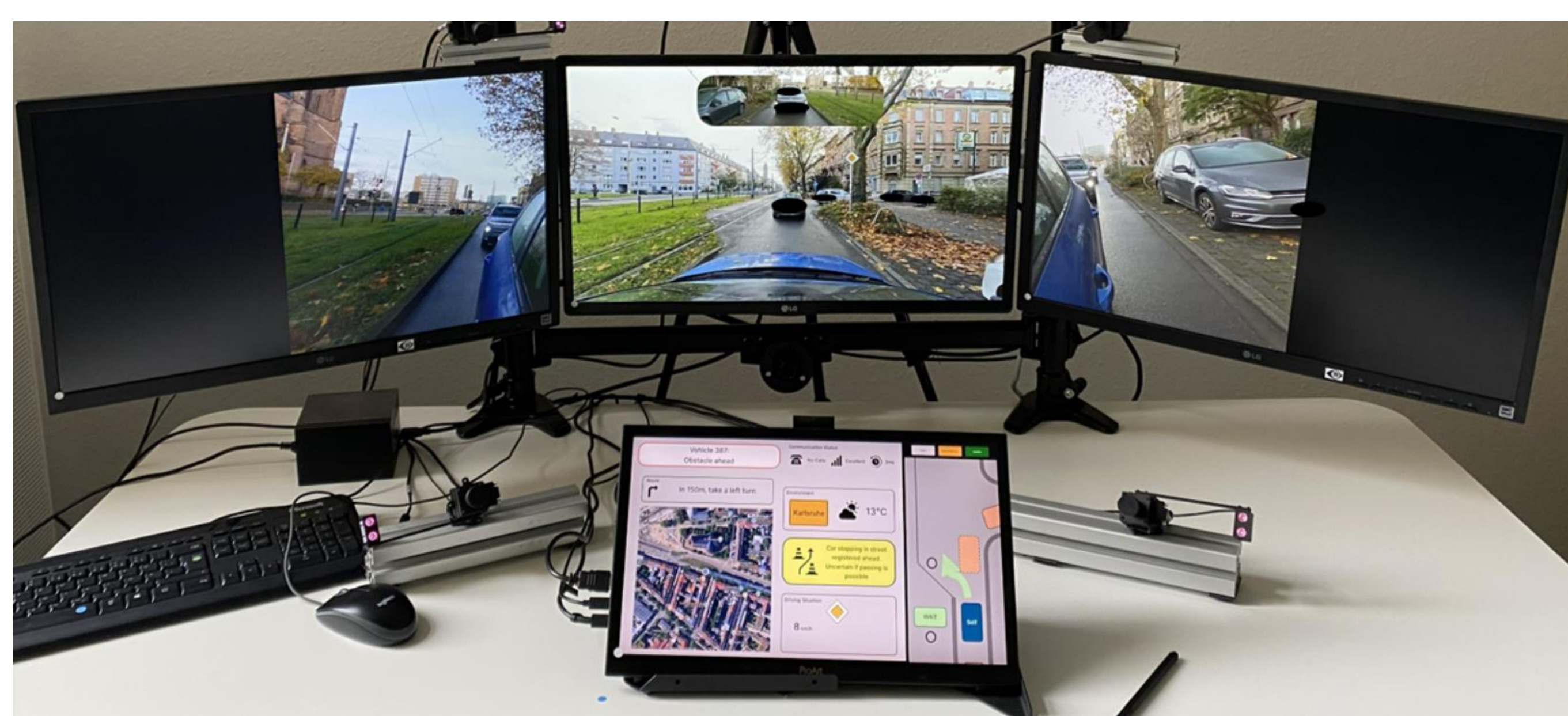
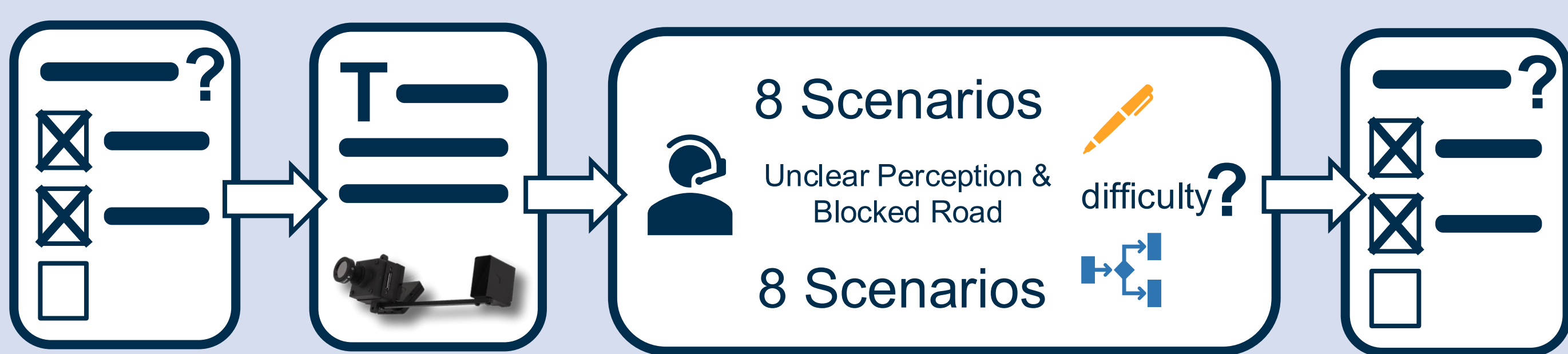
one-sided
 $t(34) = -2.00, p = .027, d_z = 0.34$

Total completion:

one-sided
 $t(34) = -2.31, p = .013, d_z = 0.39$

* Not included in the publication results

How did we compare them?



$N = 35$
11 ♀ 24 ♂
88.6% students

$M_{age} = 24.1$
 $M_{ATI} = 4.23$

$SD_{age} = 6.3$
 $SD_{ATI} = 1.04$

Design for the situation, not for a single interaction method

Future Work

- Systematic investigation of scenario characteristics & impact on remote assistance
- Inclusion of additional measures, e.g., confidence, perceived safety, responsibility, & decision quality

Outlook

- Use of system-generated plans to provide alternatives
- Trajectory input when spatial flexibility is required
- Development towards adaptive and hybrid remote assistance interfaces

Remote assistance should combine several interaction methods

