



Cognitive science predicts that thinking deeply promotes learning

Students answered either *traditional* or *challenge* questions within an assignment...

...with no penalty for being wrong

The challenge questions hindered learning

“GOOD HARD”

traditional

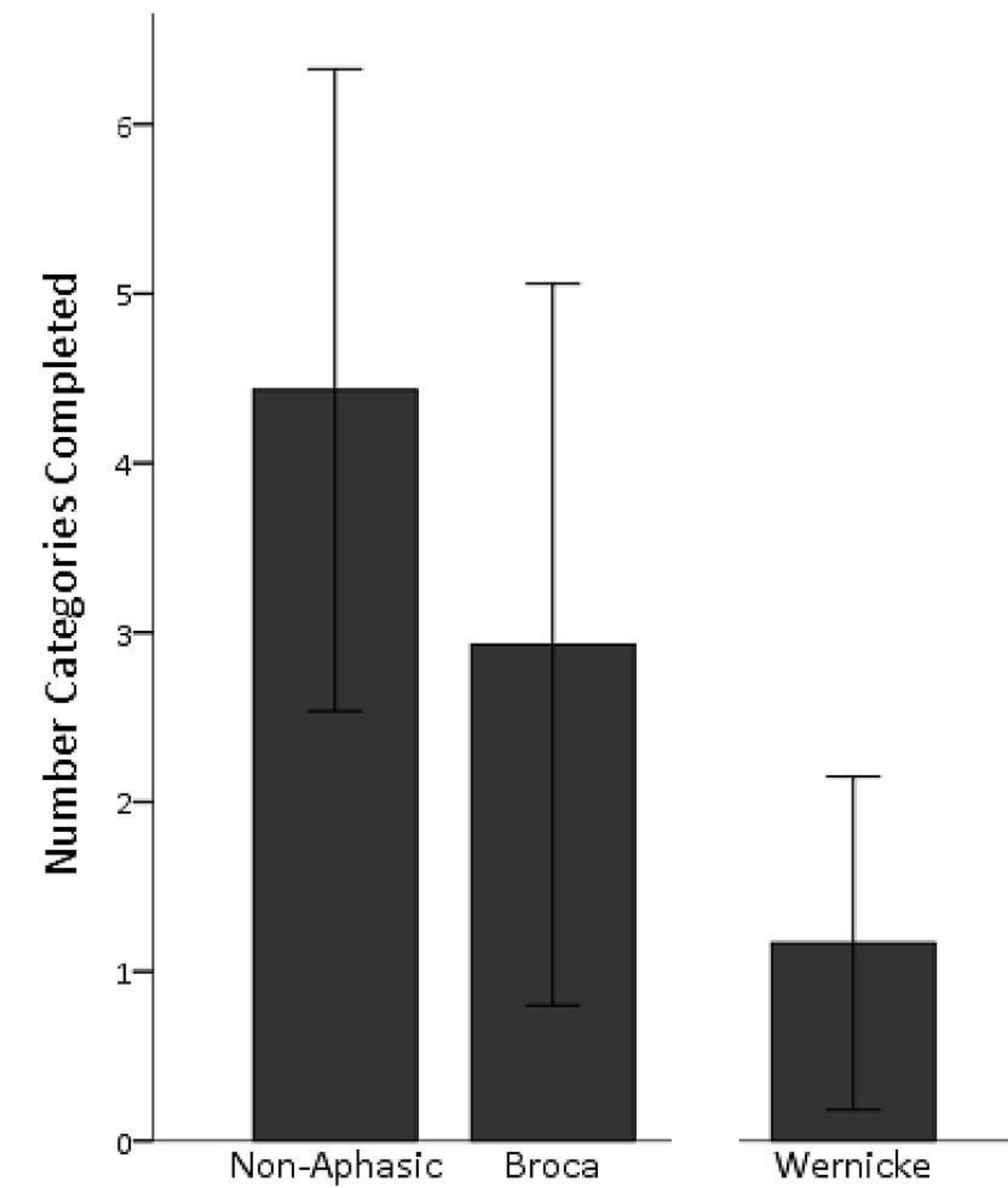
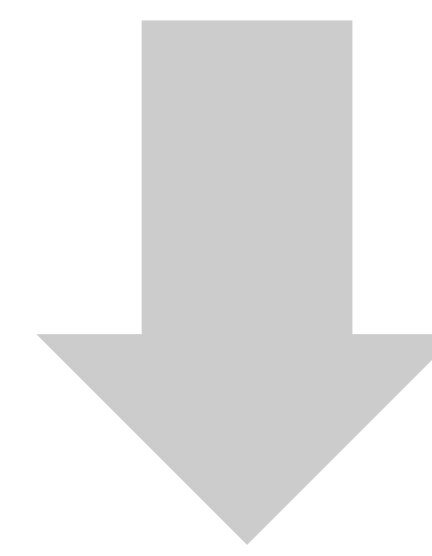
100%

accuracy

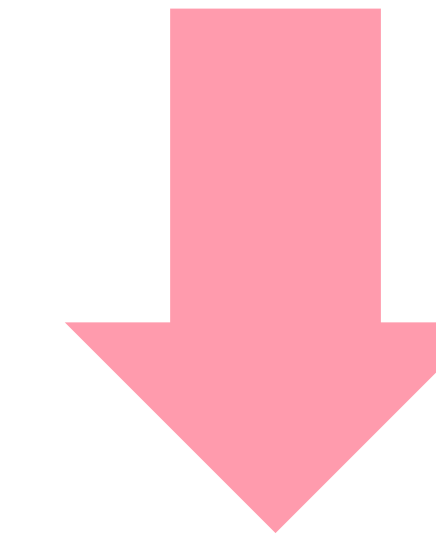
45%

challenge

*What* effect does having Broca's aphasia have on cognition? What about having Wernicke's aphasia?



*Why* do you think having Broca's and Wernicke's aphasias affect performance in the ways you see in the graph?



“BAD HARD”

*Recall probe: what* was the effect of having aphasia on performance?

traditional

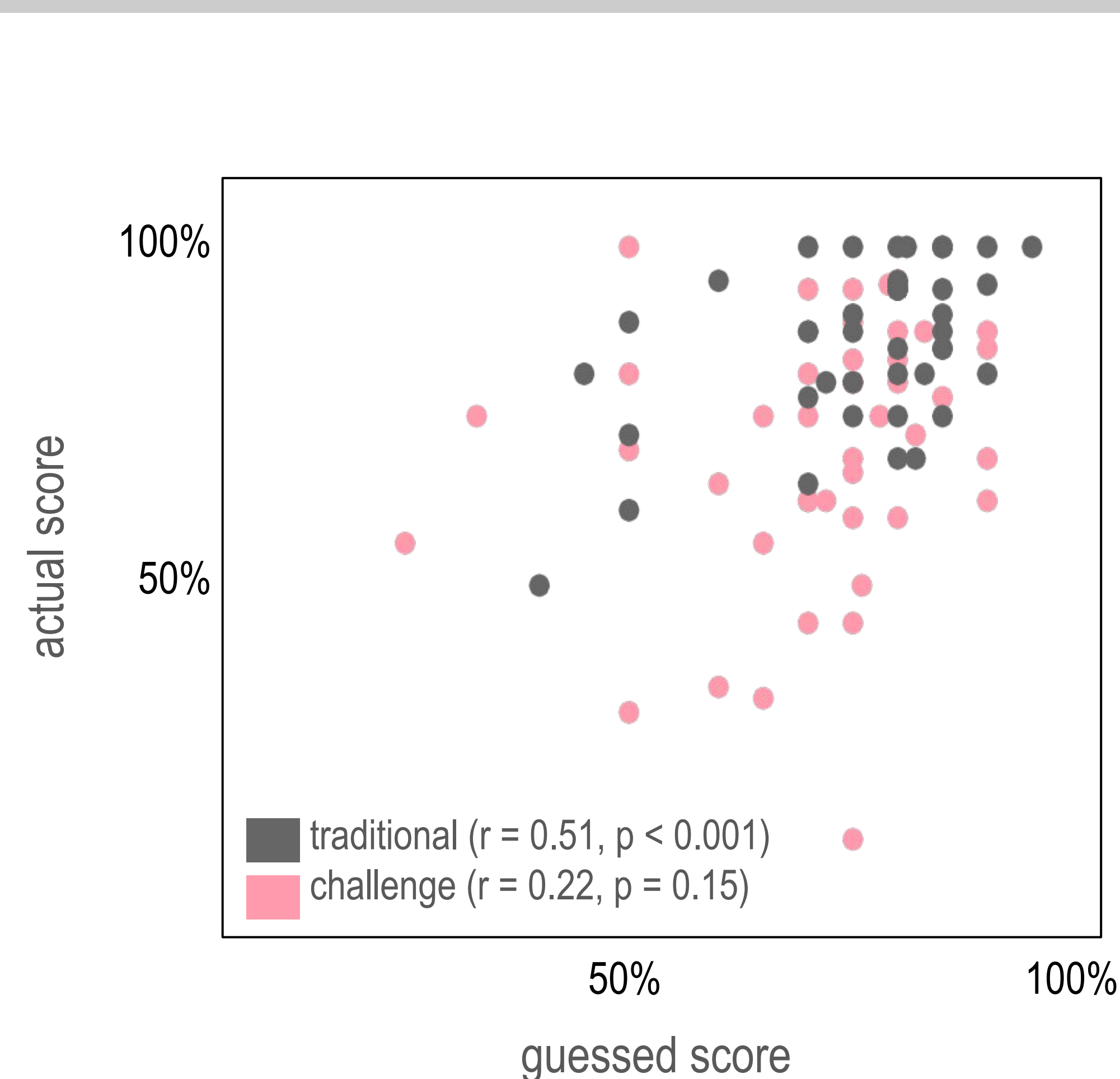
81%

accuracy

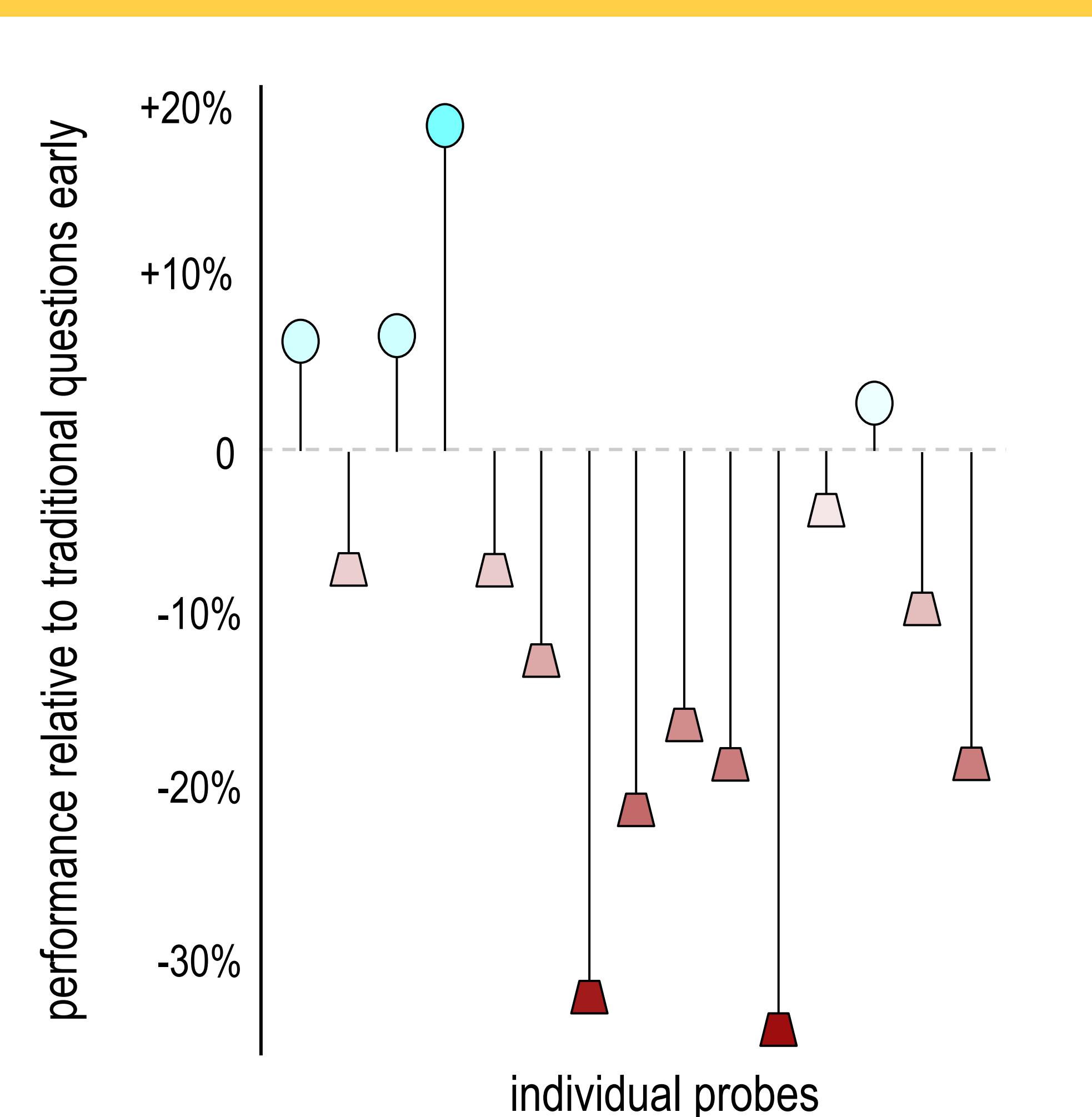
50%

challenge

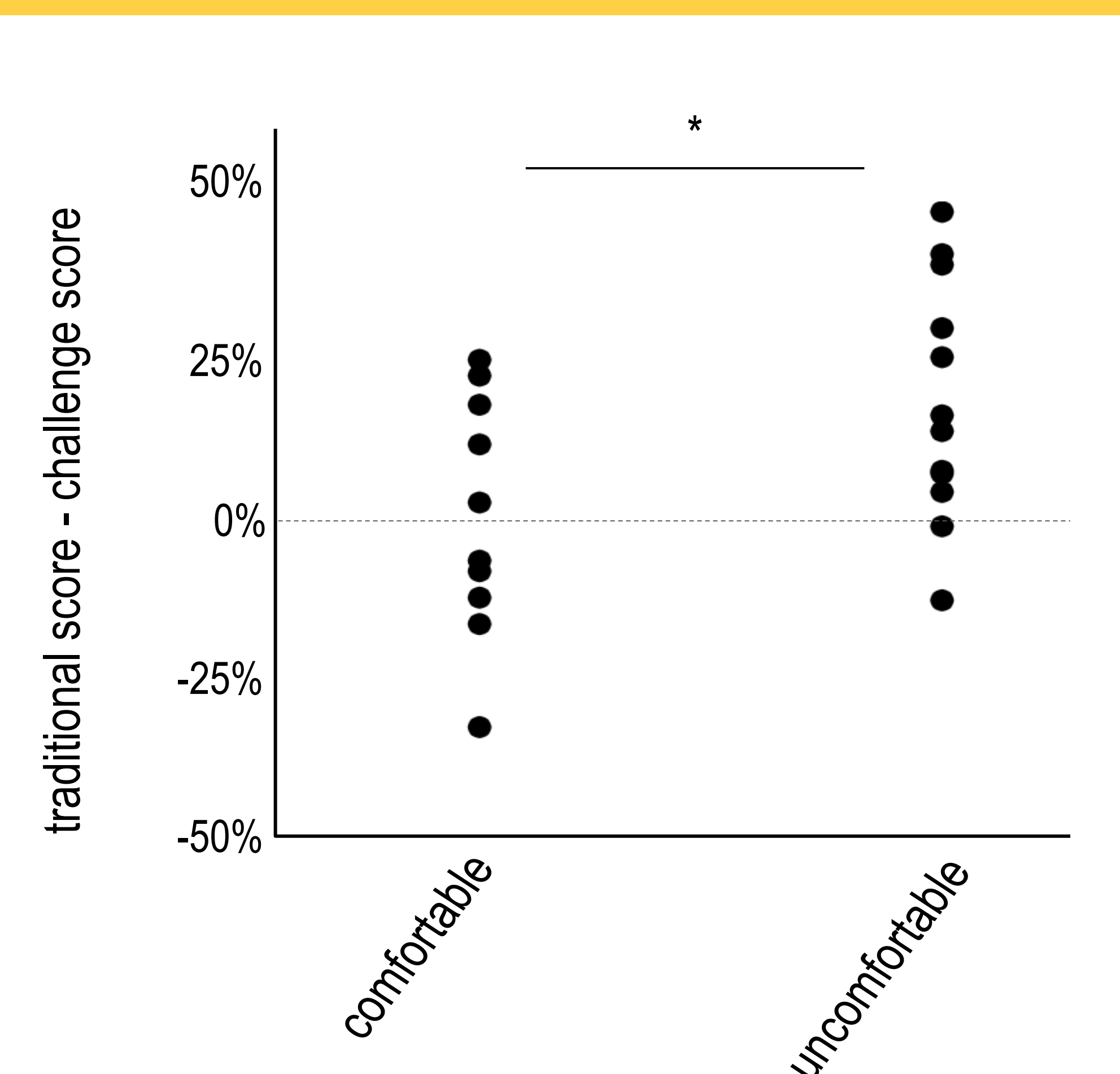
challenge questions reduced self-awareness



challenge questions hindered learning...



...especially when they made students uncomfortable



confidence only increased after traditional questions

