

Games for Design Research and Education Workshop

E. Bayrak, P. Grogan, J. Luo, B. Mesmer, T. Pedro, Y. Ren, Z. Sha, M. Shergadwala, E. Starkey, A. Vasconcelos, B. Yan, and other players

Design Computing and Cognition Conference

Northwestern University, Evanston, IL (Jun. 25, 2016)

Agenda

Presentations (2:15pm - 4:00pm)

- *Paul Grogan* - Stevens Institute
- *Bowen Yan* - Singapore University of Technology and Design
- *Zhenghui Sha* - Northwestern University
- *Tiago Pedro* - Instituto Universitario de Lisboa
- *Maria Adriana Neroni* - University of Cambridge
- *Murtuza Shergad* - Purdue University
- Bryan Mesmer - University of Alabama, Huntsville

Please help by actually playing the games

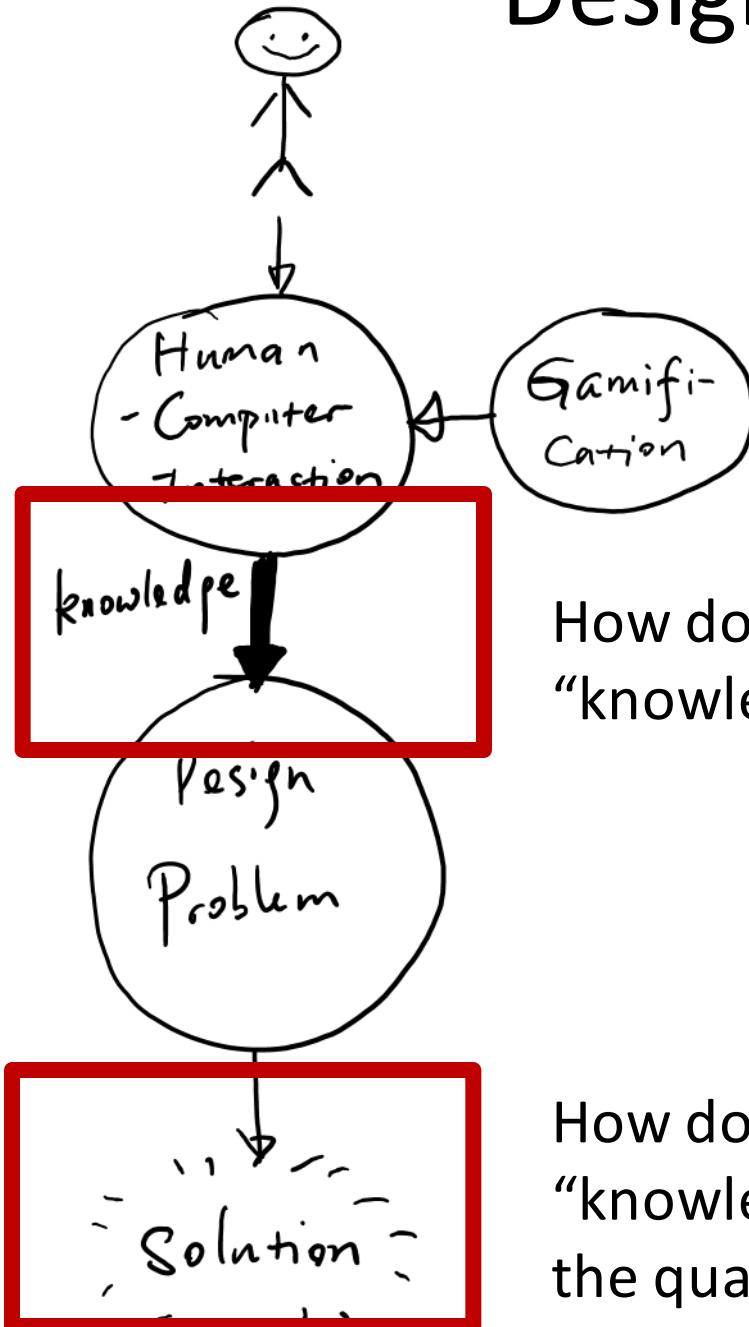
Group discussion (4:10pm - 4:55pm)

- What design challenges can get benefit from human “knowledge” and “creativity”?
- What human “knowledge” and “creativity” can be learned through game plays?
- How game mechanism affects human behavior and design results?
- How to document both successes and failures in the development of gamification?

Please think about these questions while you play the games.

We appreciate critical comments ☺

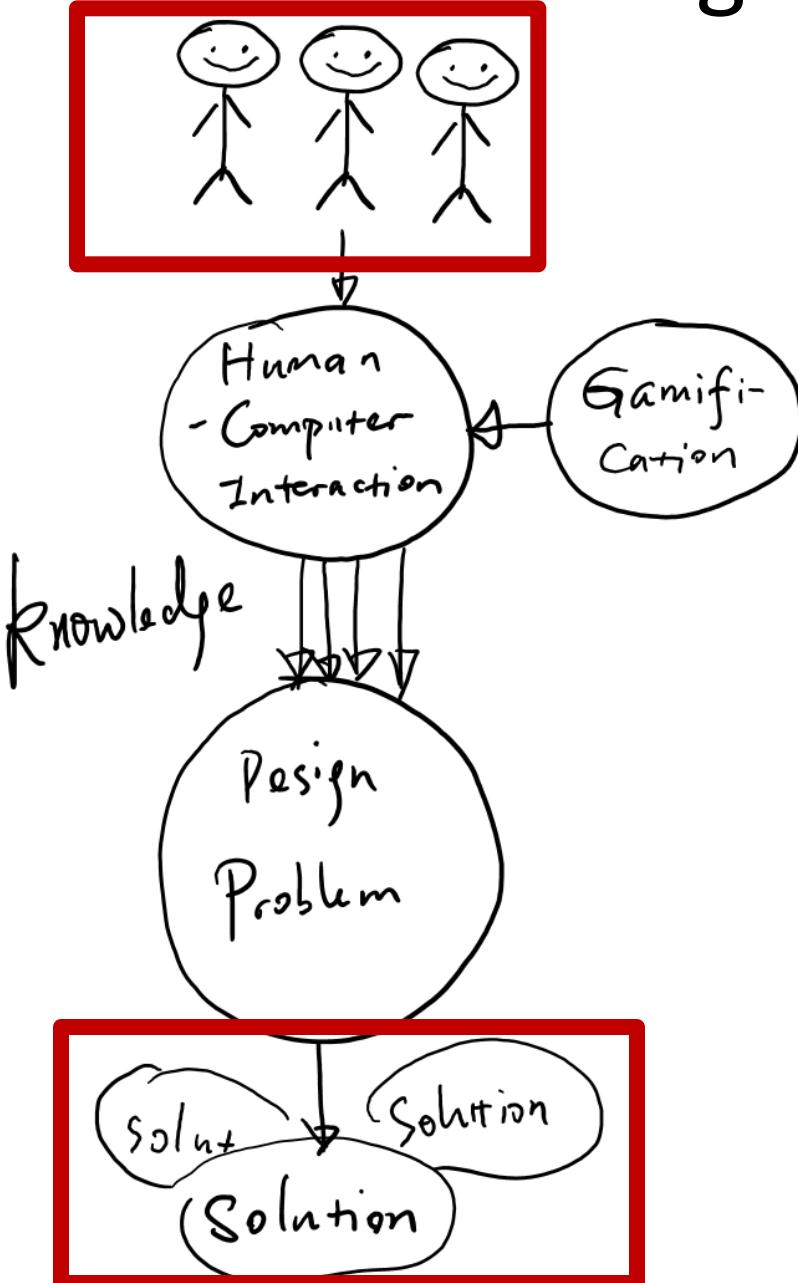
Design Gamification



How does gamification change the “knowledge” or “creativity”?

How does the change in “knowledge” or “creativity” change the quality of the solution?

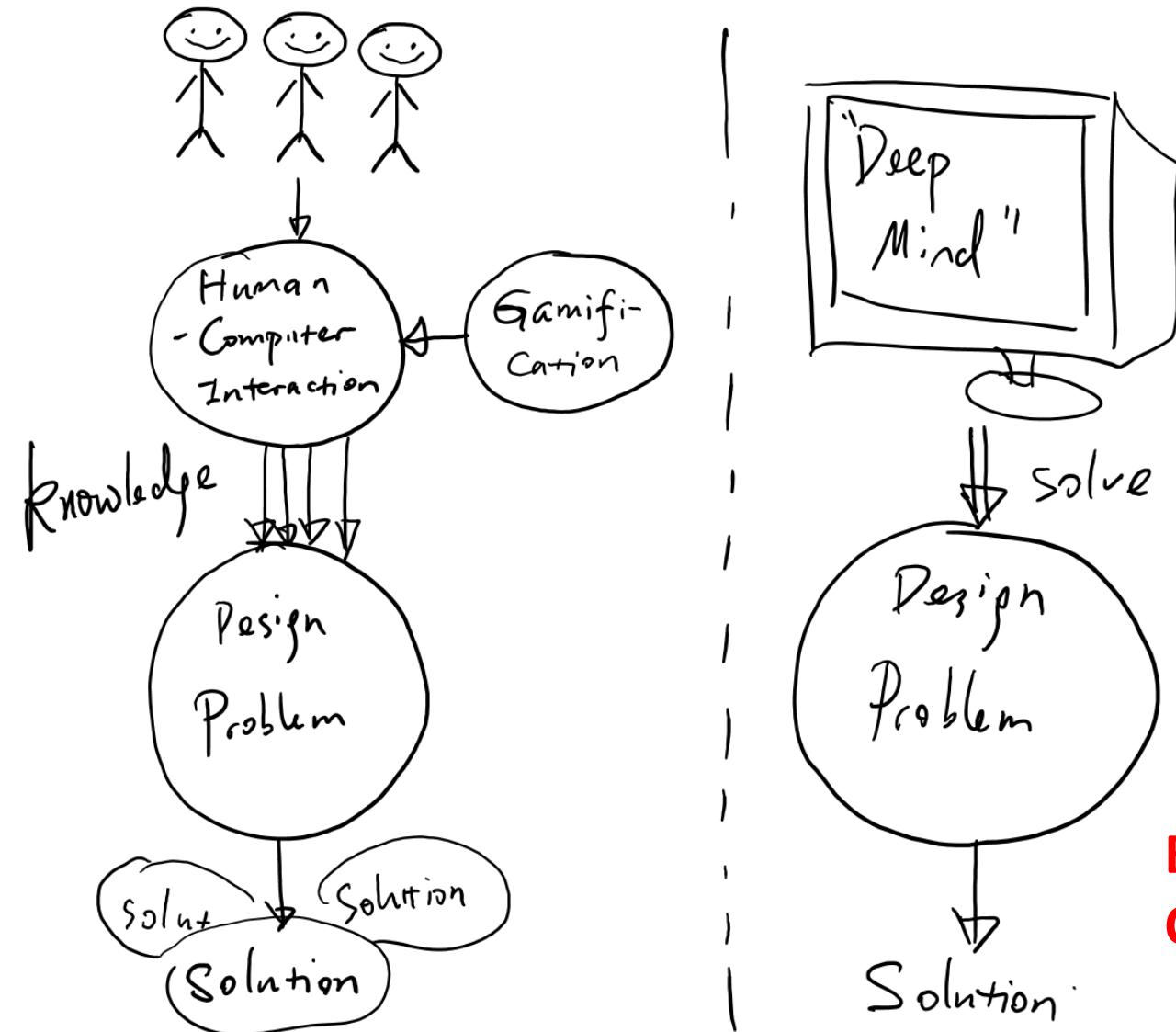
Design Gamification



How does gamification change the crowd?

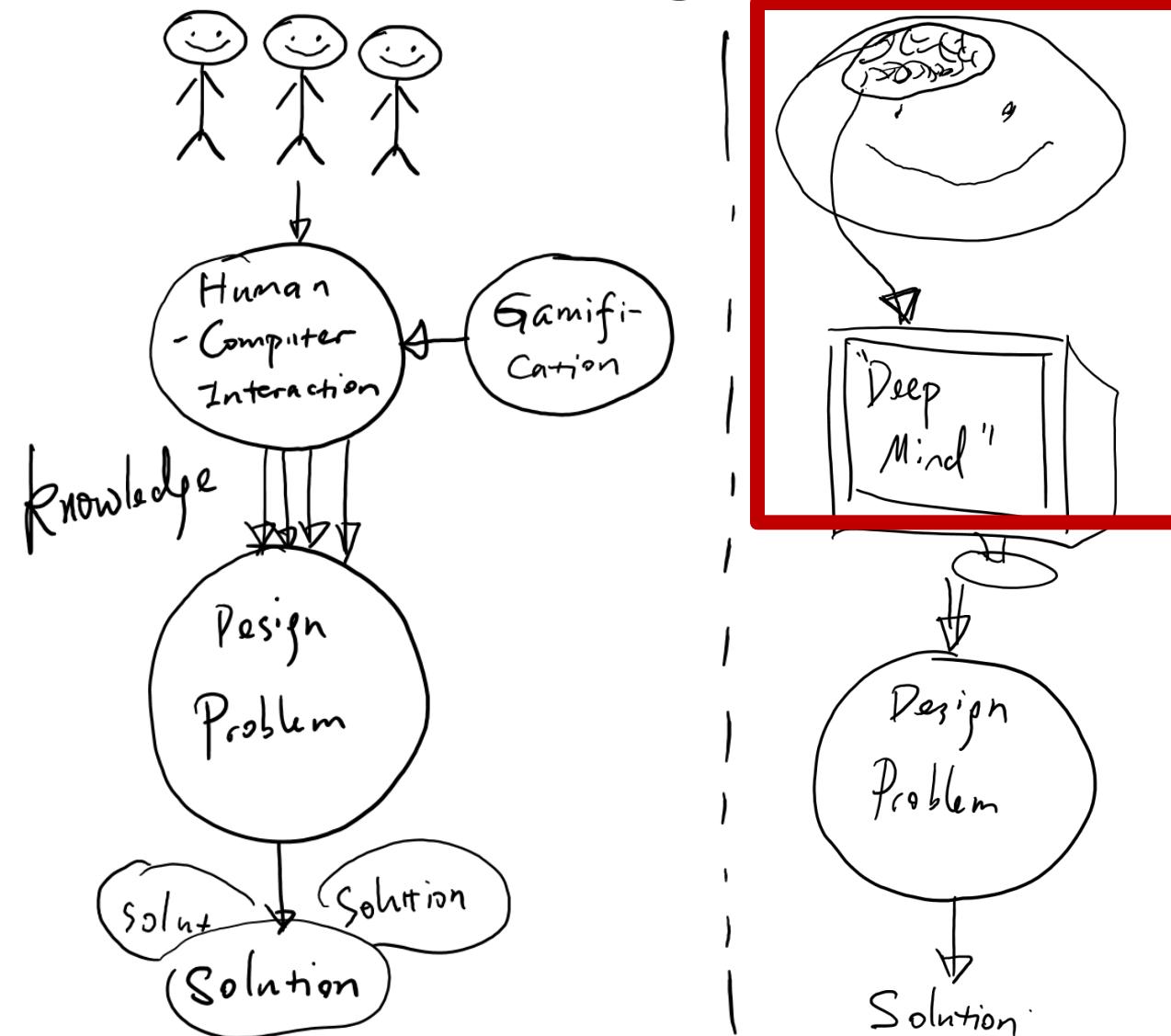
How does the change in the crowd change the quality of the solution?

Design Gamification



**Baseline for validation:
Computational solution**

Design Gamification

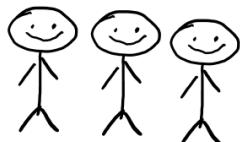


Knowledge and creativity are being studied and modeled

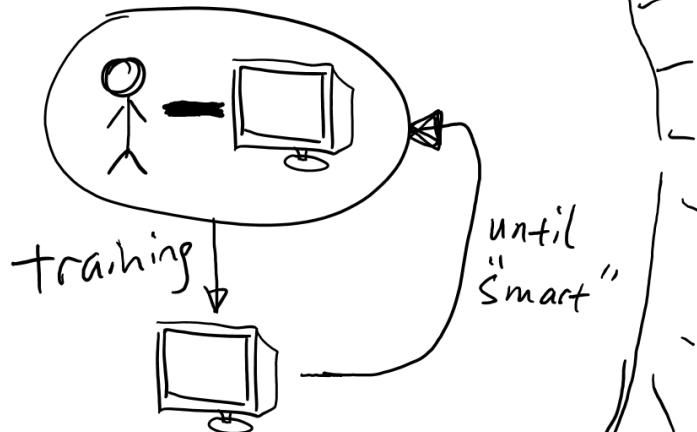
E.g., Dopamine release for human learning <-> reinforcement learning alg.

Visual cortex <-> Deep neural network

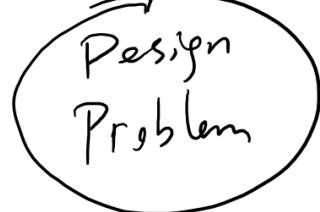
Design Gamification



Opinion: Human plays the role of helping a computer to get better at solving design problems

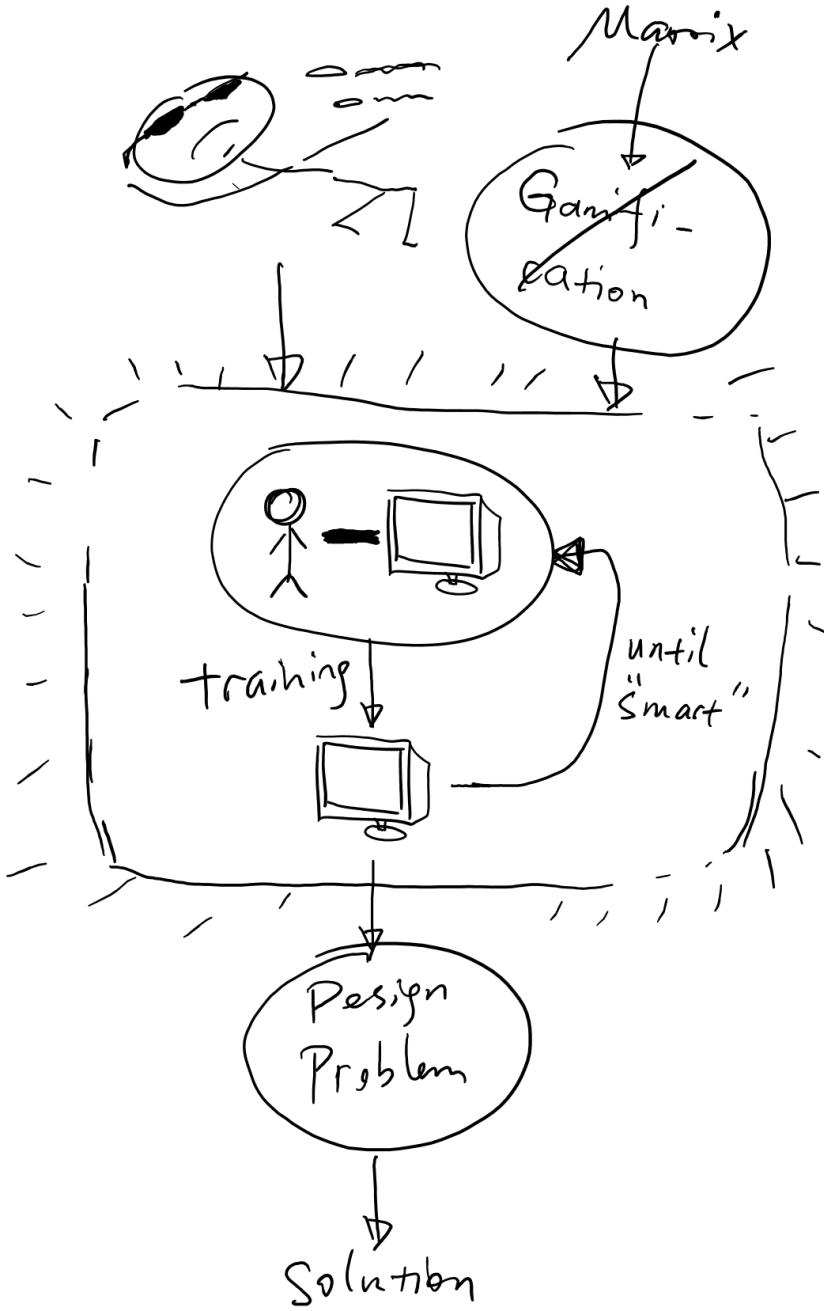


Gamification helps train the algorithm.



Solution

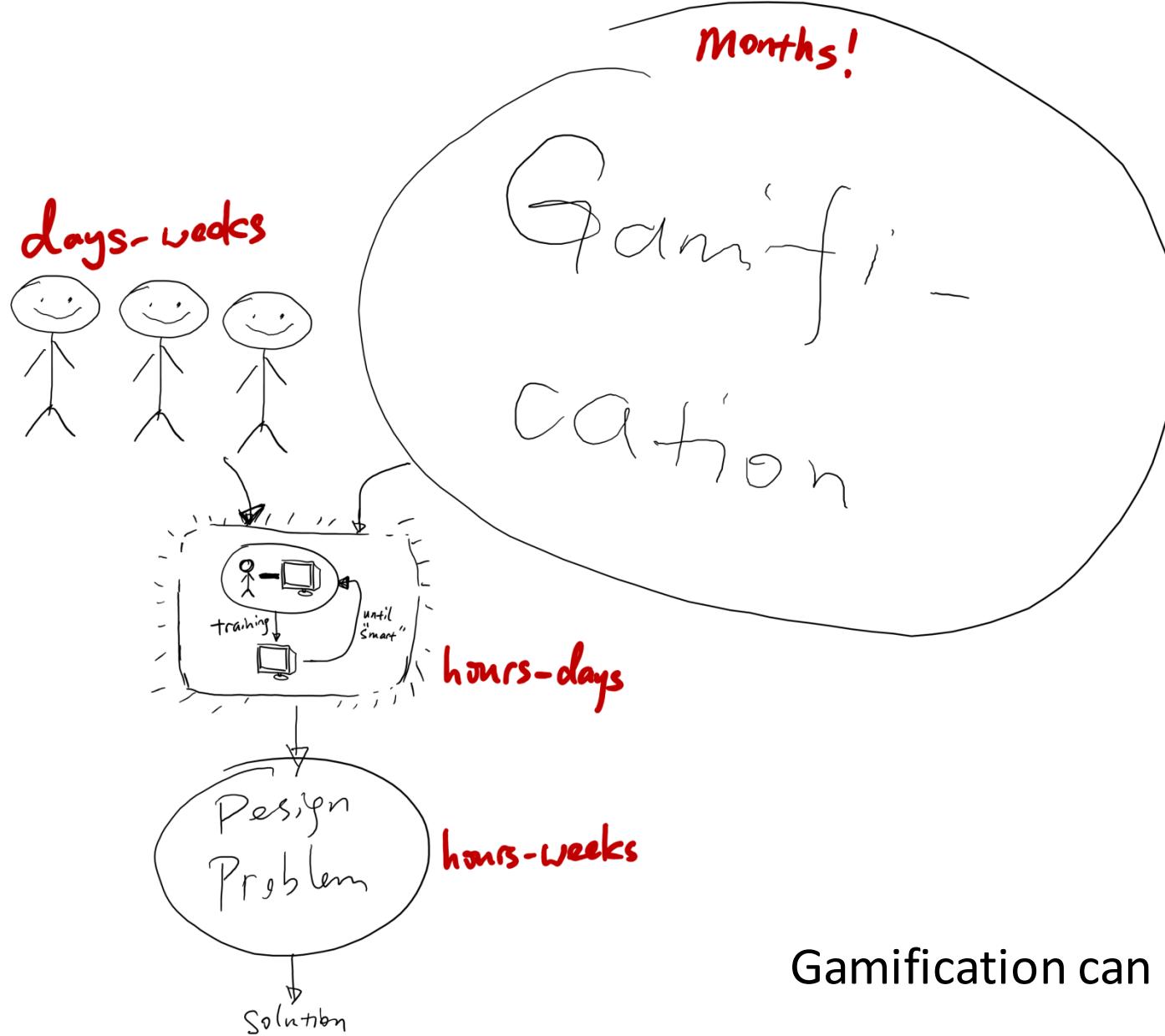
Design Gamification



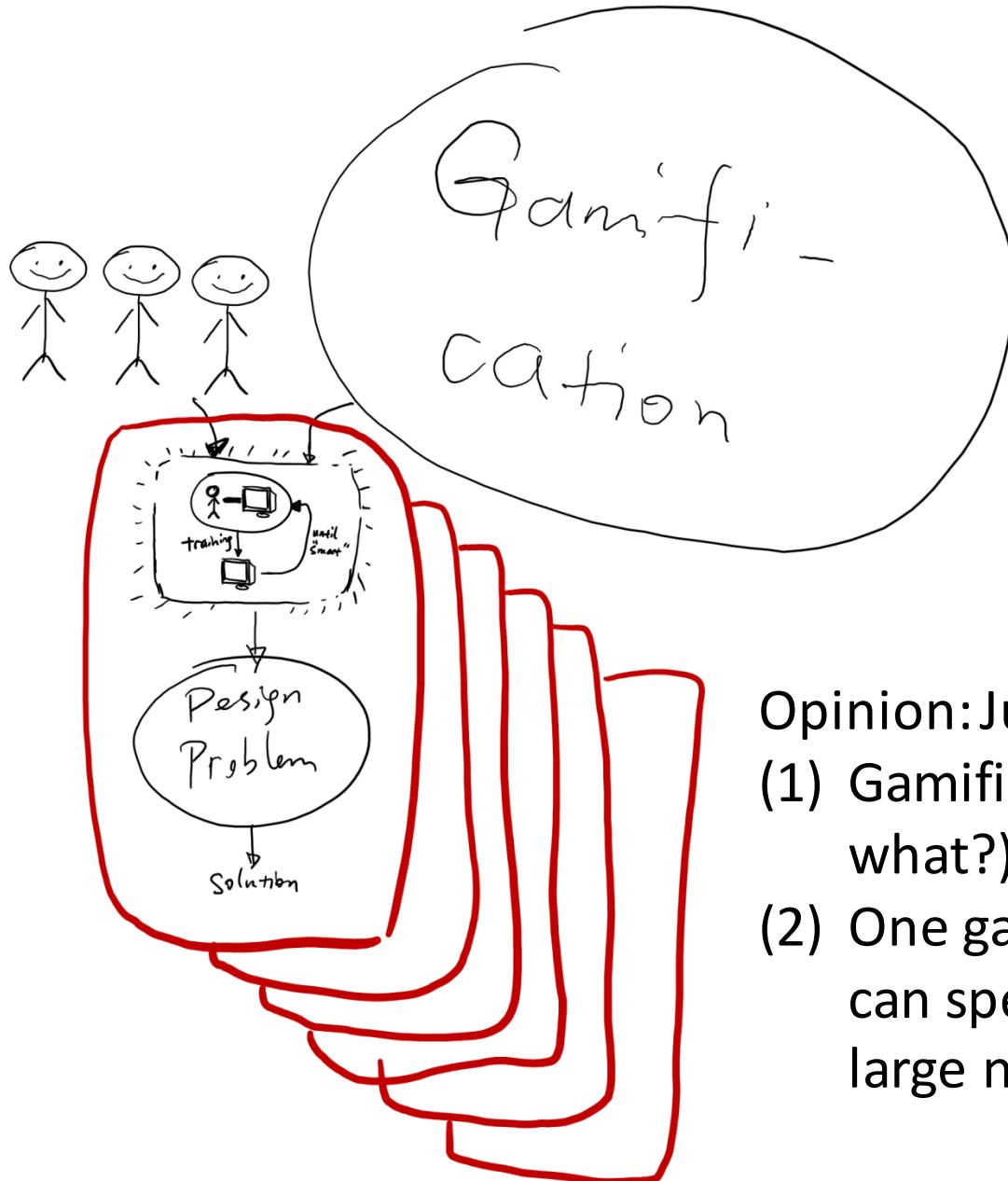
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Design Gamification



Design Gamification

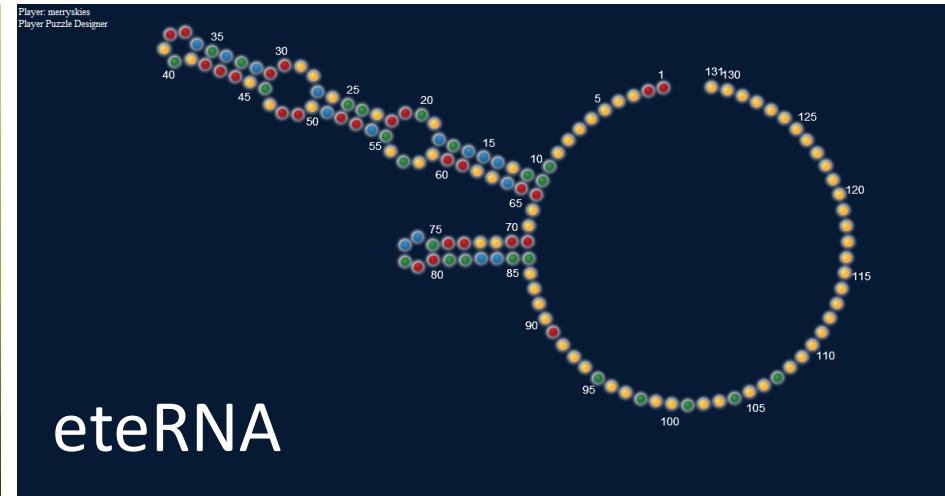
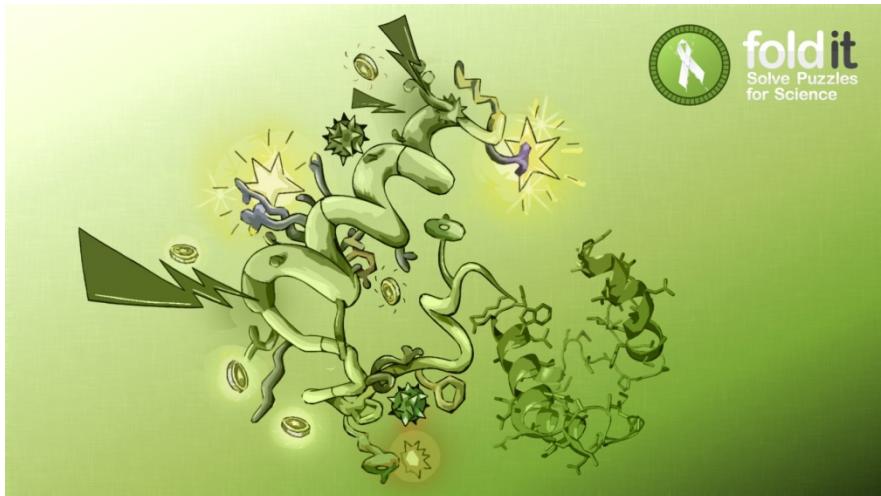


Opinion: Justification of gamification:

- (1) Gamification is necessary (for what?)
- (2) One gamification implementation can speed up algorithms for a large number of problems

My Gamification Experience

Can human beings achieve higher convergence rate in solving NP problems than a computer solver?

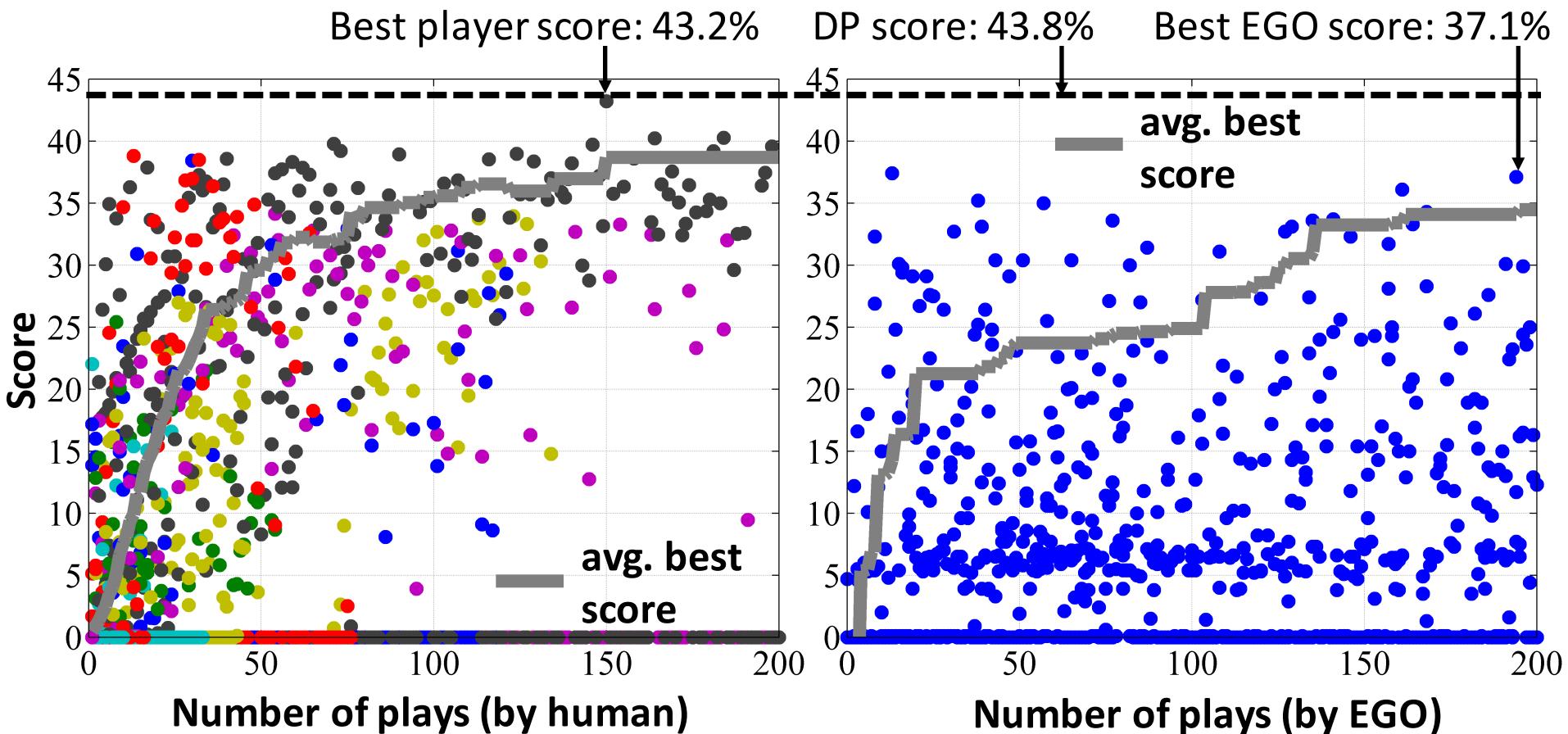


ecoracer.herokuapp.com



My Gamification Experience

Can human beings achieve higher convergence rate in solving NP problems than a computer solver?

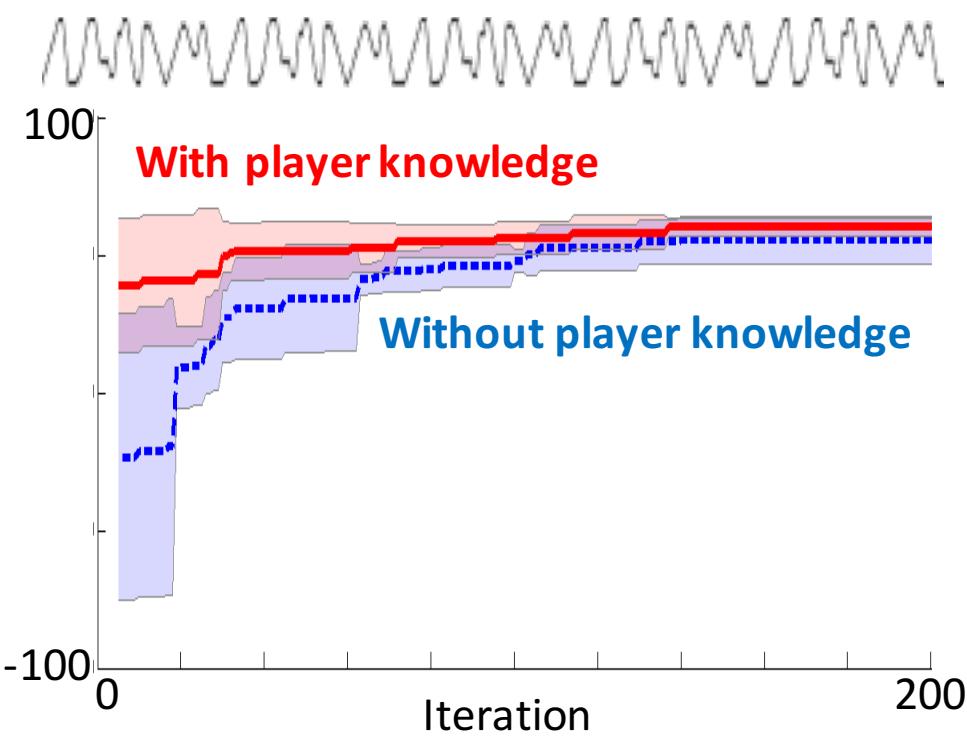


My Gamification Experience

Can human beings achieve higher convergence rate in solving NP problems than a computer solver? – No

Can human beings help to improve the algorithm?

Performance comparison on a longer track



Algorithm search **only within** the region of predicted successful plays lead to **earlier good** solutions on a variety of track settings

Ren, Y., Bayrak, A., & Papalambros, P. Y. (2016). Ecoracer: Optimal Design and Control of Electric Vehicles Using Human Game Players. *Journal of Mechanical Design*, 138, 061407. (Best paper in design automation, IDETC2015)

My Gamification Experience

*Can human beings achieve higher convergence rate in solving NP problems than a computer solver? – **Not really***

Can human beings help to improve the algorithm?

- *Yes...but human plays also take time!*
- *The computer can teach itself equally well after enough plays.*
- *There is a sweet spot along the time line when gamification is useful.*

My Gamification Experience

- **Current research:** Models and algorithms to enable the integration of human knowledge in searching for solutions and the computational power.

Human teaches the strategy of solving problems



Computer picks up the knowledge and solves the problem



Current Development

Guess what this is?



Current Development

Guess what this is?

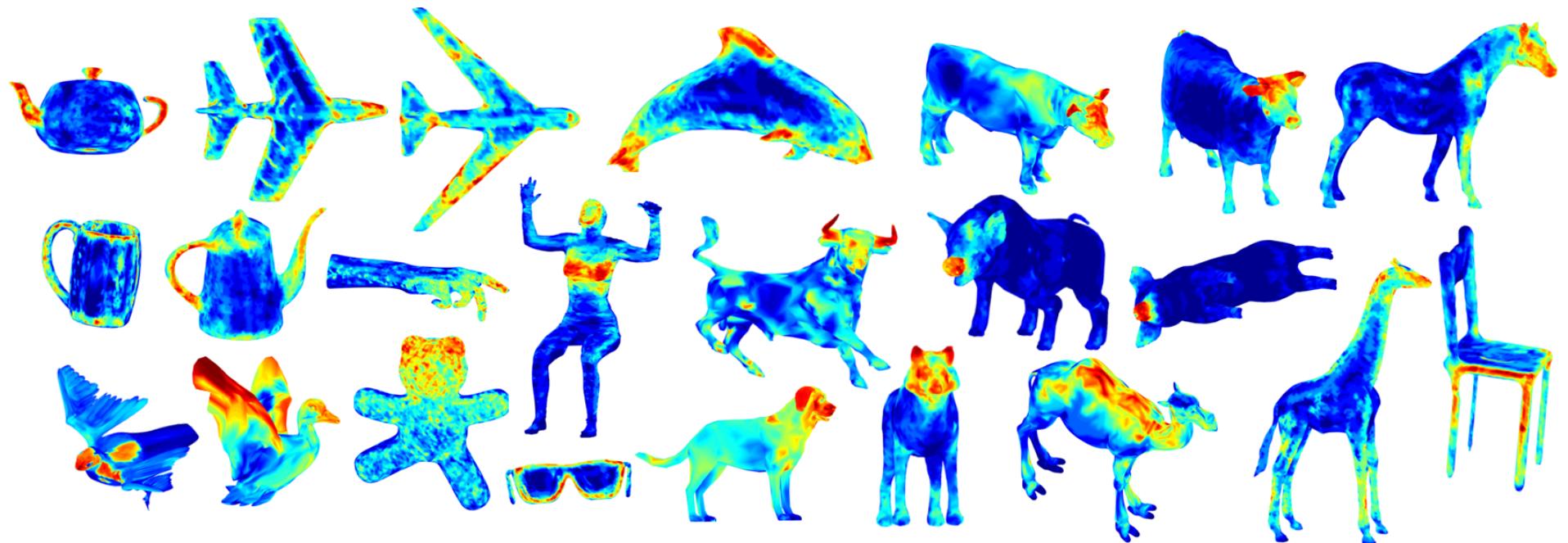


Current Development

Guess what this is?



Current Development



Current project: Use shape saliency to improve recognition accuracy of RGBD data

Current Development: Urban Planning

