

# PRODUCT EVOLUTION USING AFFORDANCES

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## Affordances in Engineering Design

Affordances describe the interactions between products and users, meaning users are capable of assessing the quality of the affordances of a product. Optimization tools, such as Genetic Algorithms (GA), can be used to evolve products by having users assess their affordances.

## Motivation

Ways to use user input in the design process are needed to improve product acceptance. This can be accomplished by manufacturing physical prototypes of the design concepts. The challenge is that prototyping is expensive. Computational tools can help us create virtual prototypes while making it easy to reach end users.

Designers can explore more design solutions based on the assessments of the users.

## Web Application

A web application (figure 1) has been developed that allows designers to set up design problems so that users can access it and assess the affordances of products.

A design problem, the design of a steering wheel, has been carried out with 5 users. Results (figure 2) show that products can be evolved toward better solutions (as perceived by users, figure 3).

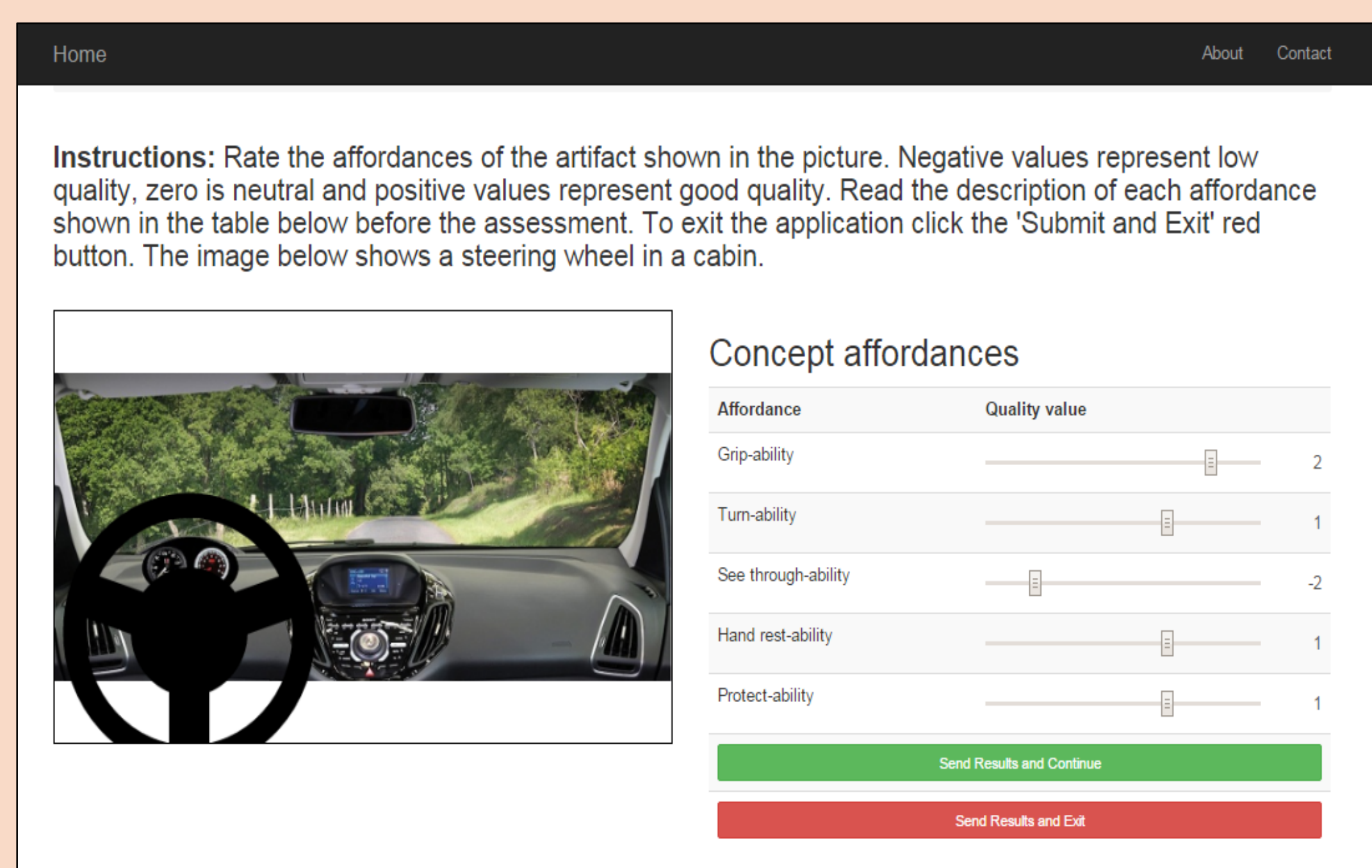


Fig. 1 User evaluation interface

## Research Impact

- Parallel user evaluation of solutions of an Interactive Genetic Algorithm (IGA). This significantly reduces the evaluation time of IGAs.
- Creation of a platform to reach large crowds of end users. Crowdsourcing would be possible using the tool.
- Product evolution: Designers can explore more design solutions based on user input.

## Research Plan

- Replication: The steering wheel problem will be solved two more times to check the reliability of the results.
- Solving more design problems. Design of a camera, design of a glass of wine.

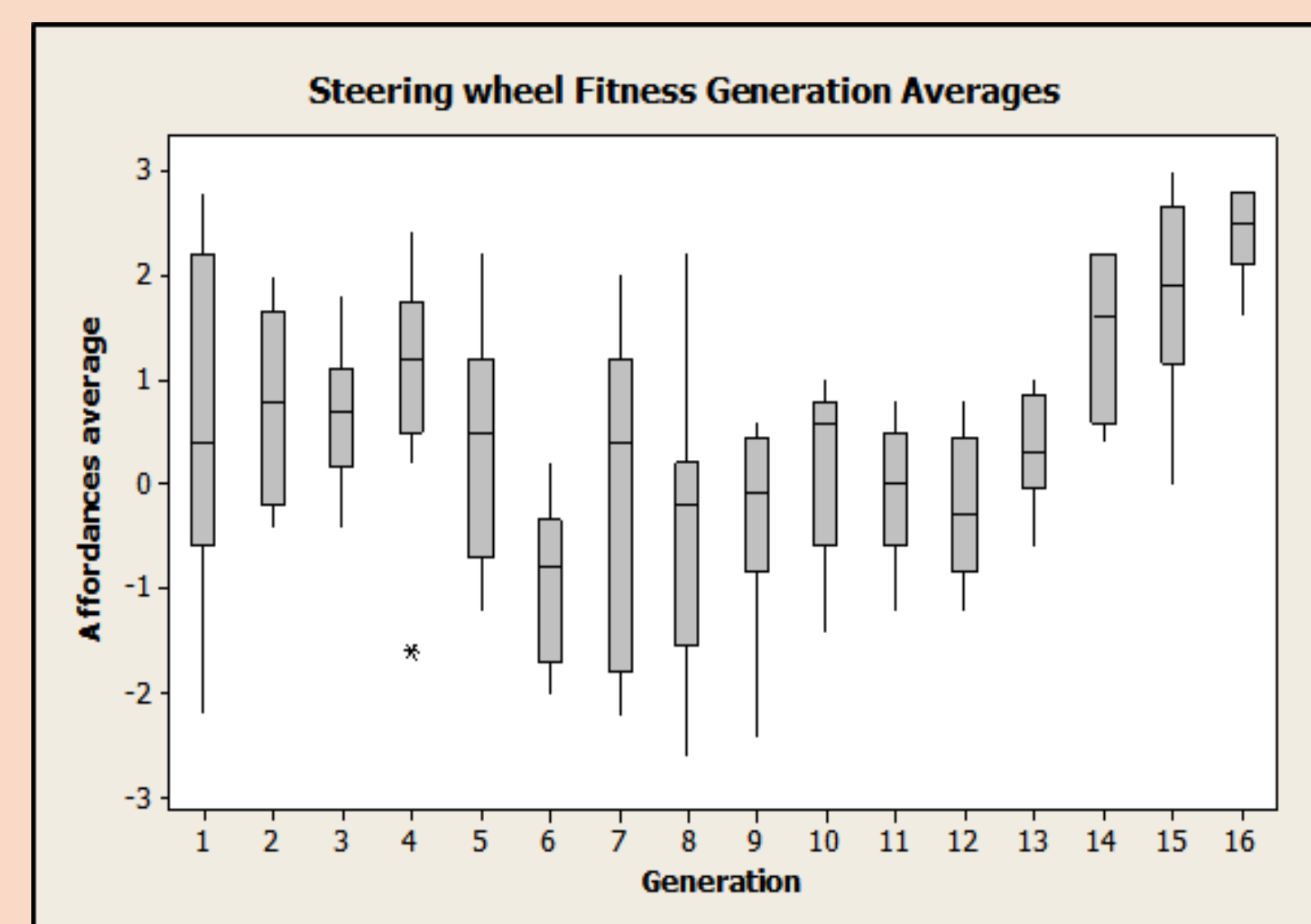


Fig. 2 Concepts avg. fitness across generations

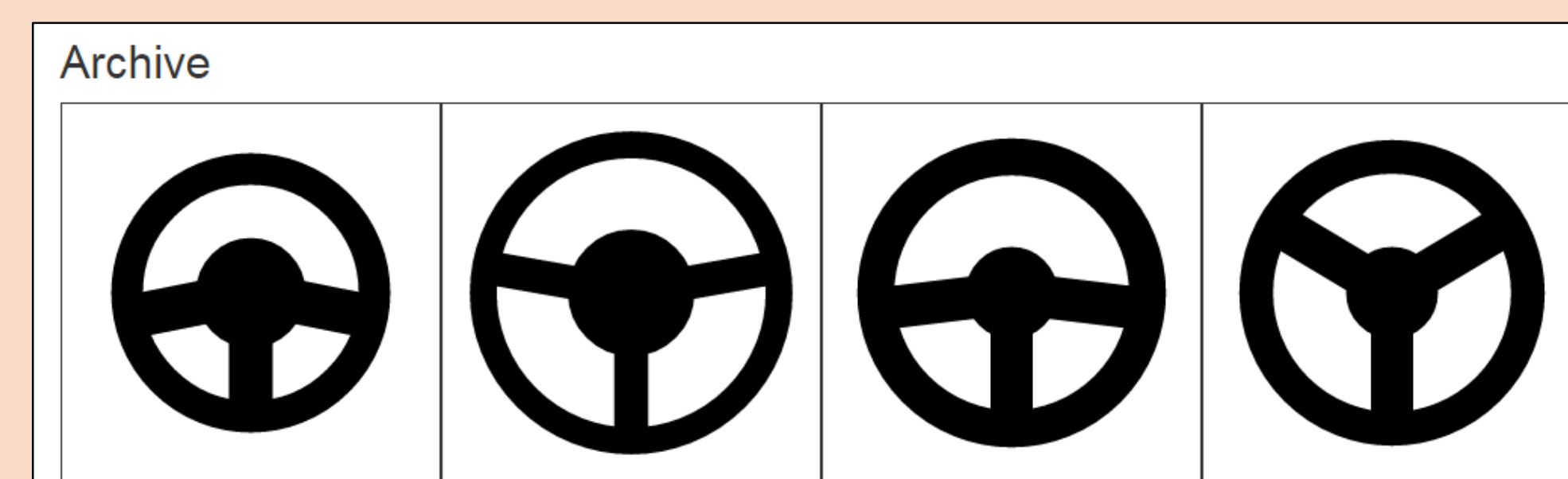


Fig. 3 Subset of best solutions

## Conclusions

As long as affordances can be assessed through visual representations of the product, product evolution might be possible by having users assess the quality of the product's affordances. More experiments need to be performed to check that the initial results can be replicated.