Does Simulation Fidelity Affect Training? A Lesson from a Brief Review of Literature

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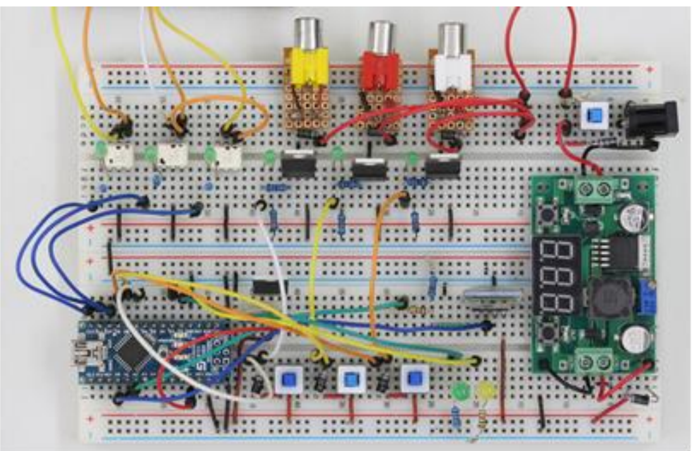
Introduction

- In training programs, fidelity of simulation is the level of surface realism of training materials [1].

Example: Troubleshooting electronic circuits

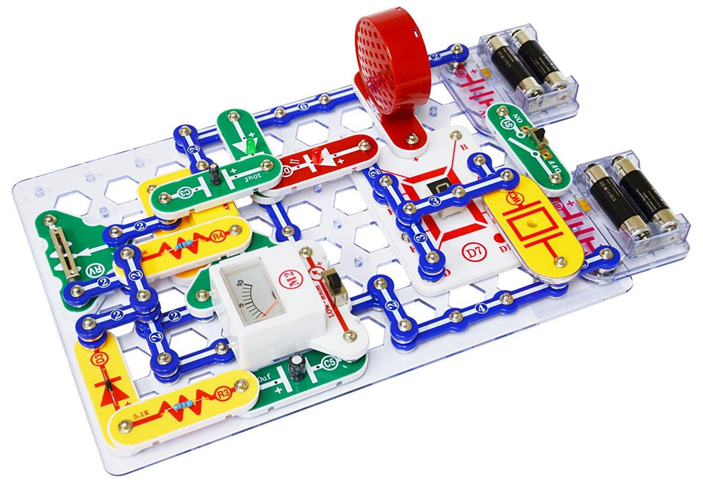
Fidelity

1



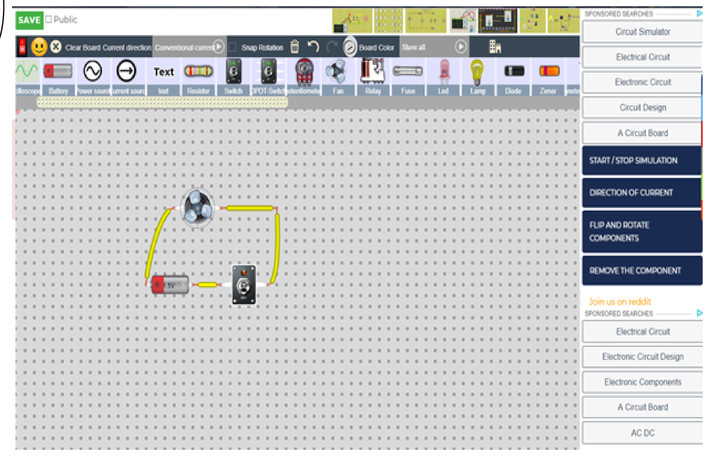
High-fidelity (breadboard)

2



Mid-fidelity (SnapCircuit)

3



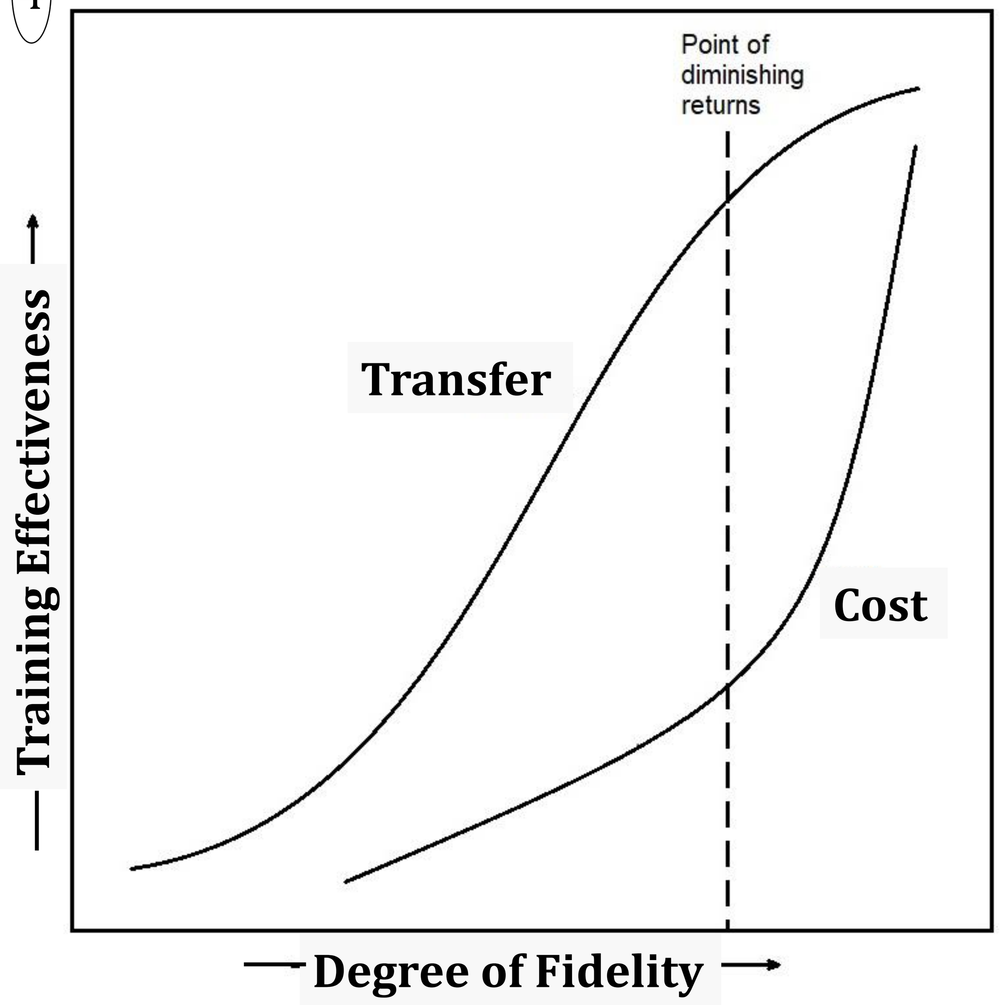
Low-fidelity (software)

- Traditional assumption: simulators with higher fidelity are more effective in training than those with lower fidelity [2, 3].
- Recent findings question this assumption. In many cases, low-fidelity systems were more effective in training than high-fidelity systems [4, 5].
- This has caused problems as designers do not know what level of fidelity is suitable for training systems [6].

Our goal is to review the literature to see the effect of fidelity on training in various domains.

Traditional assumption

4



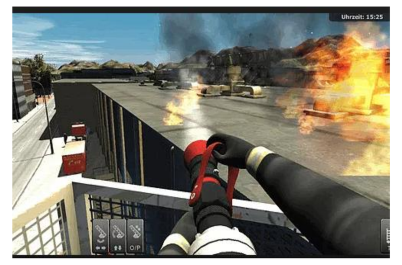
Challenging findings

Low-fi High-fi

5 Healthcare

6 Flight training

7 Firefighting



Lower fidelity resulted in equal or better training.

Review

We categorized major domains that use training systems:

1 Healthcare

In healthcare and medical training, although the belief in the traditional theory still strongly exists, recent studies has challenged the widespread trend towards high-fidelity simulation [6, 7].

2 Flight training

Despite the established practice of using expensive high-fidelity flight training systems [3], Dahlstrom et al. [8] showed that high-fidelity flight-training simulation does not necessarily lead to better performances in target environments.

3 Maintenance and troubleshooting

Rouse [9] showed that, unlike high-fidelity systems, low-fidelity training simulators could train skills that could be transferred to a wide variety of tasks.

4 Other areas

Similar results were found in firefighting [10], route-learning [11], and some other areas.

Conclusion

- In many cases, low-fidelity systems are more effective in training than high-fidelity systems.
- So, fidelity is not a reliable construct in design.
- The remaining question is how to design training systems now?
- The future needs theories of design that focus on human elements of the training cycle (novices and experts) as a resource for designing training systems.

Note. A comprehensive review on the same topic is in preparation. If you are interested to see the incoming review, please write down your email address and name.

Acknowledgement. We thank members of the Applied Cognitive Science Lab in Penn State for their comments during the preparation of this poster. Sponsored by ONR N00014-18-C-7015.

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Conflict of Interest Statement. Frank Ritter is required by the Pennsylvania State University Conflict of Interest Program to include this paragraph [sic]: "I have financial interest with Charles River Analytics Inc., a company in which I provide consulting services and could potentially benefit from the results of this research. The interest has been reviewed and is being managed by the Pennsylvania State University in accordance with its individual Conflict of Interest policy, for the purpose of maintaining the objectivity of research at the Pennsylvania State University."