

Design for Physics

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Abstract. Design for Physics is a joint project between a physics department and a design institute, aiming at engaging students that feel uncomfortable with scientific disciplines in the exploration of science. Students at IED were asked to design, produce and test low cost and easy to make apparatus for physics experiments, to be used in schools for teaching. We report about the project organisation, results and about the studies we conducted observing the students. We also tested the resulting products with a group of physics teachers, whose impressions are reported. Prototypes were exposed at important fairs, attracting a lot of interest.

The project

Design for Physics is a project born from the partnership between Istituto Europeo di Design (IED) in Rome and the Physics Department of Sapienza Università di Roma, which proposes new educational tools for secondary schools, designed to improve physics learning.

A class of students at IED were shortly trained about what is needed to perform a series of physics experiments with the help of a smartphone, and was then asked to design the tools to be used in performing them. After a few iterations, each following a meeting with a physicist, students finalised the projects and produced a number of prototypes to be tested.

The project was awarded the “Maker of Merit” prize at the European MakerFaire 2024.

Aims of the project

The aims of this project were multiple. First, inspired by other works [1,2], we wanted to experiment with a change of paradigm in physics teaching, that includes “beauty” and “creativity” within the keywords for engagement in the design of an experiment (adopting the “embracing change together” claim of the conference). The experiment provides a good, almost unique, opportunity to design a preliminary study about how students in non-scientific fields respond to physics, without any formal training on it.

Another aim was to produce low-cost, yet effective and beautiful apparatus to perform physics experiments, intended for large-scale production or self-production directly in schools, which are increasingly equipped with digital fabrication labs.

Finally, we wanted to test their effectiveness as tools for teaching, by inviting a number of physics teachers to use them, without being previously instructed about how to use the tools. Teachers are then asked to respond to a questionnaire, and some were interviewed.

Characteristics of the prototypes

Prototypes were based on simple geometries and bright color combinations (Fig. 1). Their shapes evoke the radical style that characterised the Italian design in the 1960s and 1970s, repurposing a provocative and revolutionary vision that foregrounds creativity and design identity.

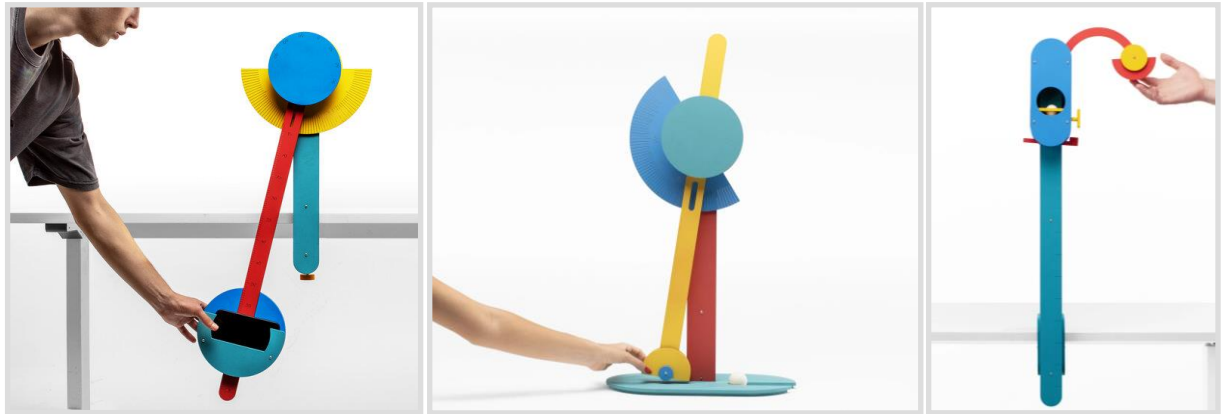


Fig. 1. Some of the tools developed during the project.

The instructions and all the information about how to produce the tools will be made available and distributed with a Creative Commons License. The tools include instruments to perform a number of experiments in the domain of kinematics and dynamics: many different laws of physics can be studied through the tools of Design for Physics, which, in order to stimulate interdisciplinary connections, uses a line of unusual and colourful shapes designed to inspire creative associations between art and scientific disciplines.



Fig. 2. Some of the tools developed during the project.

Summary

The analysis of the questionnaires and the commissioning of the apparatus are ongoing. At the conference we report about the results of both. We describe a few examples of their usage in a physics classroom, too.

- [1] J. Bobroff, Reimagining physics, *Nature Nanotech* **12** (2017) 496.
- [2] G. Camuffo and F. Bombardi, *Le macchine del maestro Paolini. Sussidi didattici autocostruiti 1955-1980*, Lazy Dog, Milano, 2023.