Pedagogical experimentation on design method for repurposing products and systems: Reuse Function Analysis

Pierre de La Morinerie[1], Olivier Cardin[1] and Florent Laroche[1]

[1]Nantes Université, École Centrale Nantes, CNRS, LS2N, UMR 6004, F-44000 Nantes, France
pierre.de-la-morinerie@univ-nantes.fr

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1 Context and scientific proposition

Our research focuses on the sustainable systems design, particularly the repurposing process which emerges as a low-cost, low-effort solution to decreasing lifespan of products (Bakker et al., 2014) and evolving needs and technologies, considering the recent awareness on the necessity to reach balance between business and sustainability,. It consists in using a discarded product or its parts in a new product with different function (Bag et al., 2021). A method has been defined to help product and system designers in matching functions of new products to knowledge extracted from discarded or outdated systems or subassemblies. The Reuse Function Analysis (ReFA) methodology, based notably on the TRIZ theory (Altshuller, 1984) and the Reconciled functional basis (Hirtz et al., 2002) has been successfully tested on few case studies, however it should be validated on a larger scale, to be used by industrial practitioners. The research question addressed in this paper is then the following: are designers trained to functional analysis able to understand and exploit the ReFA methodology for repurposing discarded products?

2 Pedagogical Experimentation

The testing protocol is planned to be executed with 108 students in first year of Mechanical Engineering Bachelor (BUT GMP), split in two-person teams. It is assumed they have been initiated to functional analysis and have basic knowledge on mechanical design tools and processes. They will also have advanced knowledge on systems they have disassembled, drawn and performed analysis on during one semester (one different per two-person group). They will be asked to apply ReFA to their systems and complete a database with the reuse functions they will have found. Some of the pairs will be split in order to form a test group, given no specific methodology.

3 Results and discussion

The testing protocol is planned to be executed in the beginning of January 2025, and results will be made available including a completed database of reuse functions and quantitative data on the methodology efficiency.

Conclusions and internal validation of the test (Cronbach's alpha) should then be drawn.
As any testing protocol, the results that will be obtained through this experimentation will be according to certain assumptions and hypothesis. These hypotheses yet have to be fully developed.

One of the leads for improving the robustness of the study would be testing on a different public, including expert industrial practitioners and/or more experienced students in order to compare the conclusions of the tests.

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