CHALMERS

DESIGNING OUT WASTE

Exploring barriers for material recirculation

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Abstract

This doctoral thesis has investigated what hinders material recirculation in society, to later suggest possible ways to support material recirculation in the future. Since material recirculation is proposed as a way to use waste materials for new production, it was deemed relevant to investigate two separate case studies that enabled recirculation from production systems and waste management. These two case studies addressed the topics of designing with waste and sorting waste, presented in Topics 1 and 2, respectively. Additionally, a third topic was developed as a way of providing a broader context for the case studies. Given that it has been argued that waste is a design flaw and that there are many design strategies aimed at waste minimization, Topic 3 investigated specifically how design currently relates to material recirculation.

Designing with waste proved to be a difficult endeavour, mainly due to the lack of a clear design brief and reliable information about secondary materials. Topic 1 resulted in a process diagram for how to design with waste, based on generic design process models. This process diagram is complemented with two earlier steps needed to design with waste: 1) Collect and sort the discarded material in an adequate manner, 2) Investigate and test secondary material's properties.

Waste sorting is therefore a precondition to designing with waste. Improving the way waste materials are sorted and collected is a challenging task that has been broadly researched from several disciplines. It is a topic that couples behavioural and societal aspects that are difficult to explain, to complex technical solutions, resulting in a challenging complex socio-technical system. Topic 2 concludes that it is crucial to understand what service users deem as convenient infrastructure when designing waste collection systems. To better understand service users, user requirement elicitation methods that are commonly used in the design discipline might be useful to develop and improve waste sorting systems.

Topic 3 concludes that design currently does not sufficiently support material recirculation. Although designers see and describe the effect their profession has on resource use and waste generation, in practice only a third of the consulted designers had actively used EoL considerations in their latest project. In order to aid designers in recirculating materials, Topic 3 presents two models: 1) A resource recovery route model, based on recirculation to different life-cycle stages, and 2) A model of ways in which designers can address resource conservation.

The factors hindering material recirculation found in the three topics could be grouped into six main barriers. Material recirculation is complicated, it is a task with many steps, a variety of materials and several actors are involved. Since so many people are involved, acting by themselves, there is a lack of control over how materials flow through society. There is also a lack of communication among the different actors. As a result, the actions and responsibilities of the different actors are unclear. To know how to best use the discards, reliable information about the material properties is needed, but such information is often unavailable. Recirculating materials requires more time and effort than simply discarding them. These barriers seem to point to a lack of guidance and common vision around what material recirculation should mean for the different actors in society. To generate a common vision among the main stakeholders (i.e. producers, users and waste managers) policy regulations and collaborations that foster better understanding among the actors are suggested as possible ways forward.

Keywords: resource recovery, designing with waste, sustainable waste management, waste sorting.