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SUSTAINABILITY LITERACY FOR INDUSTRIAL DESIGNERS THROUGH ACTION RESEARCH

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ABSTRACT
By changing behaviours to more sustainable practices it is possible to greatly reduce the environmental impact of the individual. This paper illustrates industrial designers need to understand behavioural change for sustainable design. It proposes action research as suitable tool for designers to engage with behavioural change, and discusses the implications for teaching action research to industrial design students.

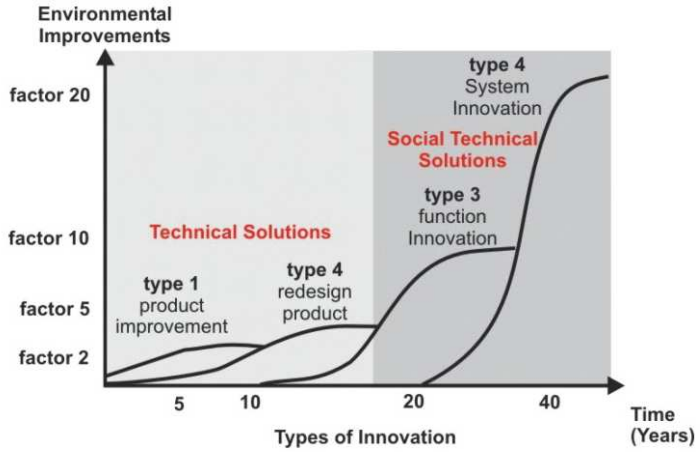
1 BEHAVIOURAL CHANGE FOR SUSTAINABLE DESIGN

The origins of Industrial Design are closely linked to the rise of the consumer society, led by the design of the desirable and streamlined products of the 1930s. Increasing consumption through design was an economic strategy successful in leading the USA out of the great depression [1]. While this strategy was fantastic from an economic perspective, the environmental impact of rising consumption is a core issue with regard to ecological unsustainability.

Industrial design education has traditionally focussed on the immediate practical concerns of developing material product solutions that best serve requirements and criteria set by a client. Design innovation within this framework commonly results in shortened product lifecycles, which ultimately support the net escalation of resource consumption and waste. [2]

Design's role in the net escalation of resource consumption is unacceptable when future sustainability is considered. In order to move towards a long term sustainable society, it is proposed that a reduction of resources in the order of 90-95% is required [3-5]. It is proposed that such reduction will take place by making products from less resource intensive materials (technical solutions) as well as by changing the resource intensive behaviours of our everyday life (social solutions)[5].

Han Brezet suggests that there are four types of innovation (see figure 1) moving from technical solutions in making products more efficient from less damaging materials i.e. hybrid cars, to socio-technical solutions that address consumption and the social context in which they are used, such as walking school bus, car pooling and public transport [6, 7]. To date most of the improvements in minimizing the ecological impact of products have been within the technical solutions of product redesign where only limited gains can be made.



Product Improvement:. The improvement of existing products with regards to pollution prevention and environmental care, i.e. Products are made compliant. **Product Redesign:** The product concept stays the same, 'but parts of the product are developed further or replaced by others.' Typical aims being: "increased reuse of spare parts and raw materials, or minimizing the energy use at several stages in the product lifecycle." **Function Innovation:** This involves changing the way in which the function is fulfilled. Examples include, a move from 'paper-based information exchange to E-mail, or from private cars to car sharing.' **System Innovation:** in which new products and services arise, requiring changes in the related infrastructure and organisations. A change over in agriculture to industry-based food production, or changes in organisation, transportation and labour based on information technology, belong to this type of innovation.'

Figure 1 Brezets 4 types of innovation [3, 8]

Figure 1 suggests a significant passage of time would be a prerequisite for functional and systems innovation. Leapfrogging to functional and systems innovation today however, would be far more desirable.

In order to achieve functional and systems innovation as proposed by Brezet social change is required. The social role for the designer has largely been neglected, 'there has been little theorizing about a model of product design for social need' [9]. Margolin suggests the potential of the social designer is similar to the social worker who collaborates to intervene in unacceptable situation. Viewing sustainability in this light is favorable. Consuming excessive resources can be considered unacceptable social behaviour which requires positive intervention by the designer who is responsible for creating products and services that facilitate this consumption.

The behavior of the end user has largely escaped discussion in industrial design literature. Results from research conducted within the University of Western Sydney (UWS) industrial design program showed that industrial design students struggle to conceptualize system-wide solutions that can incorporate technical design and social actions. The inability to design for behavioural change affects the ability of designers to design for the higher targets of resource reduction set by the sustainable literature [3-5]. This suggests a gap exists between the theory of sustainability, and the practical application of theory into design solutions.

The adoption of sustainable designs often depends upon the user making a conscious decision to move towards a particular behaviour. If we acknowledge the dependency on behavioural change for the successes of sustainable designs then it is worthwhile for design to explore effective ways to contribute to positive behavioural change.

Doug McKenzie-Mohr [10] proposes that behavioural change is best addressed at the level of local community. Action research from the social sciences has been successful as a strategy to enable behavioural change at the localised level. Mohr's "community based social marketing" closely resembles the framework of participatory action research; a situation is analysed and clear prescriptions for change are proposed, implemented and reflected upon with the assistance of those involved. In this way, positive action is taken to alter existing behaviours and the complexity of habits, processes and product environments that sustain them. The localised collaborative approach gels well with the core concept of sustainability in encouraging diverse local solutions. While abstract in the first instance the parallels between action research and the design process are substantial and provide a framework that can address behavioural change.

2 PARTICIPATORY ACTION RESEARCH FOR BEHAVIOURAL CHANGE

Design is an action based discipline priding itself on its creative problem solving ability. Participatory Action Research (PAR) is potentially a sustainable design tool to assist in the move towards a sustainable society. Borrowed from the social sciences action research's similarities to the industrial design process have already been identified by Swann as illustrated by Figure 2 Action Research v the Design Process.

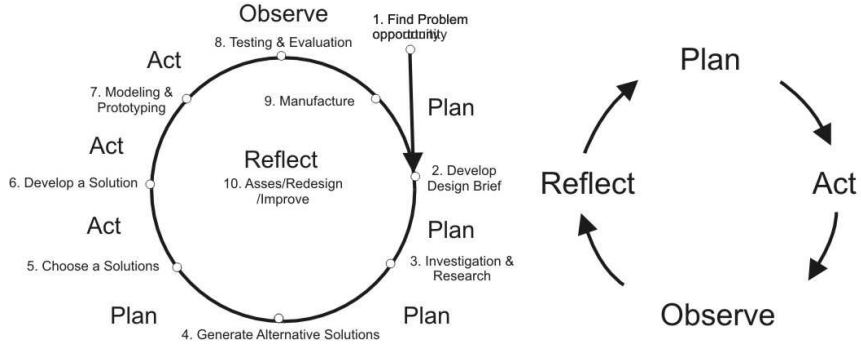


Figure 2 Action Research Similarities to the design process. amended from Swann

Kemmis'[11] four step model of action research; Plan, Act, Observe, Reflect can easily be overlaid on the generic design process. The initial stages of the design process in identifying problem opportunities, developing the design brief and initial investigation fall within the planning stage. The action stage consists of selecting concepts through to prototyping. Testing and evaluation is largely an observation activity and once the design is manufactured the process is reflected upon in theory and the cycle starts again. The areas where industrial design practice lags behind PAR is in the collaborative nature of PAR in which reflection plays a key role [12]. It is clear however that collaboration and reflection are key strategies for effective sustainable design.

2.1 Collaboration to Address Behavioral Change

The collaborative nature of action research parallels the ideas of progressive sustainability theorists such as Ezio Manzini [4] and Doug McKenzie-Mohr [10] who suggest that sustainability can only be achieved by collaboratively engaging with stakeholders at the community level.

The following example illustrates the need for collaboration to address behavioural change. A redesign workshop was held with a group of secondary school students to redesign the school back pack. The empty backpack weighs 3kg with a volume of 40L and an estimated ecological rucksack 22kg (abiotic and biotic). Within the redesign exercise a multitude of solutions to reduce the material intensity of the backpack occurred; including appropriate selection of materials and the immediate re-use of locally available materials. Redesigning the bag to lessen the environmental impact was achievable. However, when looking to dematerialise the bag to reduce resource use by 90-95% it was discovered that teachers may need to change the delivery of homework so the backpack is not required. Parents and the school may have to rethink how the school lunch is delivered. The schoolchildren's use of the backpack needs to be understood so the function of the backpack may be met in alternative ways. The dematerialisation of the backpack cannot be achieved without collaboration with relevant stakeholders in both the design process and in the implementation of solutions.
Robinson highlighted that as complexity increases in the move beyond the product to functional or systems innovation collaboration is required [13]. The framework of PAR can assist in such collaboration, empowering the participants to share their learning on how change can happen.

2.2 Reflection over Time

Sustainable design cannot be embodied in a one-off solution, it has to succeed and adapt over time with continual reflection in what Manzini describes as 'social learning'. [14] Sharing the reflections on sustainable design (both successes and failures) is required to build knowledge as we can 'only become more sustainable, but never become fully sustainable'.[1]
Sustainable design removes the finishing point in the existing 'make - waste' cycle. The existing paradigm of manufacturing in which most products are designed to be landfill in the shortest time possible, is no longer acceptable in light of contemporary circumstances. Design issues emerge across the entire life cycle of the product and industrial concepts such as extended producer responsibility (EPR), Extended designer responsibility (EDR) and industrial ecology, reflect the change to a cradle to cradle perspective.
Considering the product (or service) across its entire lifespan and the impact that it may have from cradle to cradle [15] presents new challenges. To engage in the complexity of sustainability, flexibility is required. The management of resources embodied within products over time has to adapt to changing environments as new solutions are found and opportunities are presented.
Sharing of discourse on sustainable design by reflection will assist in the knowledge generation of sustainable design. Stand alone solutions, even system based ones must be tested by collaborative involvement and reflection. John Ehrenfield has been critical of case studies of sustainable design in presenting brilliant concepts in theory that are inadequate in real life. Openness and transparency can only assist the learning process for sustainable design [16].

3 EDUCATION FOR PARTICIPATORY ACTION RESEARCH

The assumption that problems are overcome through the delivery of technical product based solutions is the core issue preventing the adoption of PAR within Industrial Design education.

Further concerns relate to the structure of academic institutions where standard assessment techniques leave 'little time for reflection in a timely fashion' [17]. Within the design studio, designs are rarely resolved beyond the conceptual stage, nor are they implemented. Therefore design is assessed prematurely and theoretically, which could be contributing to the lack of meaningful reflection within industry.

3.1 Improving Reflection and Collaboration in Industrial Design Students

Within the UWS Industrial Design curriculum, current units of study are being redesigned to encourage reflection and collaboration as valued outcomes and key skills required in designing for system-wide change.

To encourage reflection, submissions from one unit of study are analysed in teams as empirical evidence in the following unit of study, completing the PAR cycle. The key to developing reflective learners is developing a repertoire of reflective questions and providing opportunities to practice them [18]. Exploring the submission of previous units and the underlying assumptions they hold encourages such reflection.

To encourage collaboration the community within the student body is acknowledged. Projects where students have life experience are selected, allowing student to move between the role of participant and designer. Student teams are directed through the PAR cycle to identify and overcome barriers to sustainable modes of behaviour. The creative skills of the Industrial Designers assist greatly in this process.

The future direction for UWS is to expand our relationship with local council and industry partners to trial collaborative projects over time at the level of local community. The published results and reflection from one year would inform practice for the following year, allowing for ongoing projects over time that can increase in complexity.

4 CONCLUSION

It is proposed that Participatory Action Research can be adopted as a tool for enhancing both sustainable design, and sustainable design education. It potentially offers a mature discipline that could be adopted as a sustainable design tool without the need to develop a new suite of methods. Through the use of Participatory Action Research it is envisaged that industrial design students can begin to design for behavioural change leading towards long term sustainable solutions, moving beyond the incremental, product-focussed improvements of what we have today. It is hoped that if successful through education this framework may continue into the workforce.

The possibilities for design at the community level are viewed as additional entrepreneurial opportunities for industrial design students as opposed to client responsive product design.

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