

THE ELASTIC OCTOPUS: A CATALOGUE OF FAILURES FOR DISRUPTING DESIGN EDUCATION

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ABSTRACT

Elastic Octopus was inspired by a perceived increased reluctance in student attitudes towards taking risks and failure in design innovation. In particular, recent trends in funding and risk-aversion in earlier phases of education where failures are discouraged has limited the potential for ground breaking innovative thinking. This experimental design project was conceived to tackle the failure reluctance trend by developing a team based cross-disciplinary masters level design innovation studio module where students would succeed in relation to their capacity to demonstrate failure. Principally this involved creating a permission giving process where ambitious design experiments are developed in order to encourage the transgression of edges and boundaries. This was achieved by adapting a number of creative design methods including blue-sky thinking, back casting and design exorcisms to challenge and de-programme failure aversion. Succeeding through failure involved transitioning from meta-themes through to experimental contexts where failures could be attempted as a way of exploring the limits of technologies, structures, mental models, human engagement and other factors critical to success. We hope that insights gained from this disruptive educational module can offer unexpected benefits for students ranging from increased failure resilience, through to narrative generation and context forming skills while at the same time providing wider value in discussing how designers deal with failure.

Keywords: Design failure, permission giving, design thinking, innovation methods, and industrial design.

1 INTRODUCTION

If there is one thing holding us back from Innovation, it is the pressure to succeed that makes us fear the unknown, and to fear failure. Yet creative geniuses are experts at failure where their successes can be accounted for by the ability to see failures as stepping-stones on the road to success. However, much of the educational world programmes us to fear failures [1] and promotes the idea that only successes can deliver a positive learning outcome. Failure is explored in this paper through an educational teaching module and leads into discussions and insights with broader value to design thinking and innovation.

The enemy of design innovation is the moderate success, a project that fears failure and as a consequence pulls back from the cutting edge. Ken Robinson summed this up as ‘If you’re not prepared to be wrong, you’ll never come up with anything original [2]’. In the commercial world Thomas Edison is often quoted as a prolific innovator who was also a master of failure. Edison saw that as long as you can constructively learn from a failed experiment, this experiment was no longer a failure, but a route to success. He famously said the “real measure of success is the number of experiments that can be crowded into twenty-four hours” and “I have not failed. I found 10,000 ways that won’t work.” Other examples include Winston Churchill’s ‘Success is going from failure to failure without losing enthusiasm’ and the classic Beckett quote ‘Ever tried. Ever failed. No matter. Try again Fail again. Fail better.’ Edison’s statement is a classic example of recasting failure as a positive whereas Churchill’s deals with the psychological resilience necessary to cope with repeated failure when confronting profoundly challenging events. Beckett by contrast hints at the value that can be gained from failures and the iterative nature of improved experiments leading to eventual success.

Whilst failure is a very human trait, in educational terms it is generally still considered to be a negative aspect to be avoided by students and teachers alike. In engineering, structural and material failures are studied with a great deal of effort leading to ever increasing technical capabilities with equivalent

increases in confidence for safety margins. However engineers fear failure in the real world with good reason. Designers on the other hand also engage with failure [3] but often label things that don't work as 'experiments', a form of cognitive dissonance, a reaction identified by Festinger [4] that can hide the true nature of what has taken place and reduce the ability to reflect and learn. Syed [5] contrasts the enormous disparity between the aerospace and medical industries attitude to failure citing the 1 in 2,400,000 deaths per flight worldwide verses the 120,000 patients that die through medical errors in the USA per year in a recent Harvard University study. He traces this difference to the encouragement for pilots to report mistakes and failures so that others may learn, to the medical profession's rebranding of mistakes as 'complications' or 'unforeseen outcomes' and the lack of any automatic investigation when these situations arise. Pilots can happily report errors in an encouraging environment whereas medical staff and Doctors loose reputation and respect when failures occur. These disciplinary differences are profound, yet when we look at design it is difficult to find references to our 'failure characteristics', potentially as the field is so broad and encompasses so many forms of practice ranging from highly technical design engineering at one end to conceptual and speculative works at another. When reviewing the literature we find few references to reconceiving failure in design experiments as a positive outcome. However in this paper we hope to shed some light in beginning to explore this question of what benefits can be gained from repositioning creative failures as a positive learning experience for designers.

2 FAILING TO SUCCEED

The educational environment for this study comprises engineers, designers and others from more diverse backgrounds including fine art, fashion, programming, business and humanities who work together in interdisciplinary group projects with members who often have significant differences in their relationships to the concept of failure. The motivation for developing this module came from an observation amongst several staff members that student's work was becoming more risk averse. We speculated that this may be due to a number of reasons including increased fees narrowing the range of students who wanted to study for a masters programme, that higher fees indicate more investment and reluctance to take a risk against the investment, that some scholarships insist on a 'B' or 'Good' average grade and this mitigates against risk and experimentation, and finally that many students entering the course had never experienced a significant educational failure. Many were high achievers who had always attained top grades and others from disciplines where failure was avoided. On this programme many would encounter failure on a fundamental level, often accompanied by deep questioning and uncertainty as to their abilities. The module was also influenced by author Laura Gordon's 'Elastic Octopus' research project undertaken as part of her MA in Visual Communication at the RCA that focussed on the relationships between creativity, fear of failure and risk in UK secondary education. The title is drawn from a workshop warm up task of sculpting plasticine octopi with closed eyes followed by a divergent thinking exercise of inventing 100 uses for an elastic band. In order to tackle all of these observations a decision was made to develop a failure project located early in the master's programme to address this, but also to allow the authors an opportunity to consider design failure on a wider level.

Elastic Octopus sits within Experimental design, one of the two learning strands of EXP (Experimental Design) and DMI (Disruptive Market Innovation) on the Royal College of Art and Imperial College Innovation Design Engineering Double Masters programme [6]. Experimental Design is a learning strand that sees the whole design process as an experiment [7]. Topics can vary from tackling wicked problems, new technologies, new product categories, new contexts for design, new materials, the future of making, healthcare, sustainability or new interaction platforms to name but a few. The strand is about exploring design driven innovations at a fundamental level with a route to market and a design discourse articulated as part of the output. Rigour in the design process and the formation of a hypothesis are important features so that students can develop a design discourse that makes an argument for the new innovation space they will occupy. In this module students were asked to develop a hypothesis, an early set of design experiments and a concluding design experiment. As part of this process they were asked to map their creative journey and decision making processes and for the final output to describe what type of leading edge boundaries they had transgressed in order to create their failure (for example technology limitations, material use, market acceptance, usability etc.). A range of different failure types were discussed at the briefing including mechanical, functional, conceptual, anticipated, unexpected etc. Students were asked to consider making intelligent

and useful failures that had the attributes of increasing scope, follow-on potential, were recoverable, being purposeful, inexpensive, safe and qualifiable. The briefing also covered blue sky thinking and back casting, an industrial design strategy aimed at going beyond state of the art in order to be able to 'cast' backwards to identify the edge for new innovation opportunities. Design exorcisms were also introduced as a technique to clear brains space but also to 'draw all the things in your head you were trying to ignore, thought were too bad to even consider or out of scope' and to see new creative opportunities in what had been consigned to the creative margins. Fourteen groups of students were formed out of a cohort of 46 and the module was broken down into two phases. In the first 3 day phase the students were given a permission giving failure exercise to allow them to test out design approaches and new creative thinking. This involved selecting a product from the following list and using the inevitable weakness of the material-function combination as permission to diverge creative thinking into a new space. Effectively practising failure strategies. The product-material challenges included: an inflatable anchor, chocolate teapot, paper bicycle and bed of nails. Following the completion of this initial activity they were given one of the meta-themes and experiment groups from the list below for the final 2 weeks of the project:

1. **Telepresence:** Experiment to fail with telepresence and the 6th sense in a business context, Experiment to fail with telepresence and the 6th sense for leisure scenarios, Experiment to fail with telepresence and the 6th Sense for transportation scenarios
2. **Camouflage:** Experiment to fail with camouflage on small-scale human centred products, Experiment to fail with the visible and data presence at the human scale, Experiment to fail with architectural and urban scale camouflage.
3. **Synaesthesia:** Experiment to fail with Synesthesia between character and colour, Experiment to fail with Synesthesia between proprioception and sound, Experiment to fail with synaesthesia between magnetoreception (perceiving magnetic fields) and time.

There were three deliverables for the module including: a diagram of the group's experimental process, failures and decision making; a catalogue of failures that showed the design discourse including what was added to the hypothesis, what edges or limitations the group exceeded and a final design failure experiment.

3 SUCCEEDING TO FAIL

The groups conducted between 7 and 31 design experiments each in the final two-week phase of the project. Although many of these were rudimentary in their nature and developed in a fast and dirty format it allowed the groups to proceed quickly and overcome many failures to arrive at more advanced experiments by the end. On the one hand it was clear that groups had encountered many failures en route and overcome them but on the other hand it was felt that there was a clear reluctance in some groups to end the project with a 'failure' and either a success was presented or a success couched in failure terms.

Notable results (Fig 1.) included Group 1 (telepresence for a business environment) who conducted 12 design experiments looking at transmitting emotions for humanising and personalising communications by producing a headset prototype that showed the user their own recent past interactions from out of body angles. The project was successful in developing new interaction perspectives but was less successful in how these could be brought into useful day-to-day life. Group 4 (telepresence transport) conducting a large amount of experiments and concluded their project by designing and building the Phantom Grandson, essentially a proximity sensor with inflating elements on the body that enhanced the feeling of proximity with others with the intention of evening out personal spaces on transportation networks to benefit the elderly. This project was successful conceptually in dealing with a well-known issue but unsuccessful in terms of usability and technical constraints some of which were quite significant. Group 7 (synaesthesia proprioception) began to look at disability and energy transference from strong to weaker limbs or body areas and produced a proof of concept indicating that legs (which have far stronger muscle than arms) could be used to augment weaker hands. The interesting by-product of this test is that it challenged proprioception in leg action powering hand movements that was both a success in term of proprioception, but also a weakness in terms of the disconnection of leg to brain coordination required by a user. Group 13 (urban camouflage) developed a simple yet innovative screen that when in tension allowed a clear view over Hyde Park but when relaxed allowed viewers to see the ghost image of Joseph Paxton's 1851 Crystal Palace that housed the great Exhibition on its original site. This project was highly effective and a

delightful use of the concept of urban camouflage. The group had conducted 31 experiments with 14 delivering a direct line of evolution to the final prototype. In many ways this result transcended the idea of ending with a final failure as the group had failed and had partial successes through the long train of experiments. This was in fact a noticeable trend that can also be perceived in varying degrees to Groups 1,4 and 7 alongside several other groups in the project. The concept of aiming for failure delivered strong permission giving in the design methods developed by the groups and challenged their navigational abilities in moving for example from Group 13's meta-theme of urban camouflage to the 1851 screen.

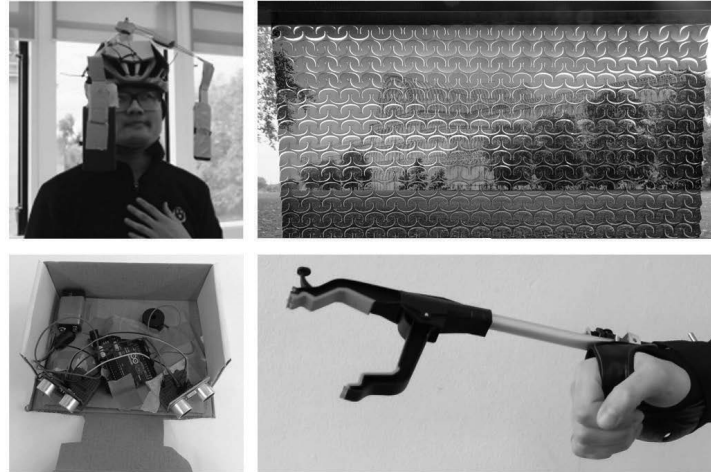


Figure 1. From Top L to R: Group: 1 Humanising telepresence, Group 13: 1851 exhibition Camo-urban Group 4: Phantom Grandson, Group 7: Transmax

4 DISCUSSING FAILURE

Although there were useful physical outputs from the module in terms of experiments, the greater value came from the learning embedded in the projects and in particular discussion and ideas around failures and how they catalysed thinking across the diverse range of students.. Once they had time to digest the learning's from the module students were invited to record their thoughts, a selection of which are discussed below. One of the interesting features is that several students sent in their reflections 3-4 months later having realised that their initial opinions had been transformed over time after having experienced additional design projects and seeing the value appear over time.

The student transformation from problem-solution to more open ended design thinking was captured thus: 'I also struggled to see the comparisons to the famous examples, such as Edison - which did have a very clear goal in mind and then used the experimentation as a way of reaching that goal. I thought the difference was, that we did not have a clear goal in mind, but used experimentation as a way of finding one'. The Same student added: 'it was confusing in a good way because over time we got quite comfortable with dealing with the unknown, which in my opinion is one of the most important skills in creative work.' This suggests that narrative and direction forming are key aspects of design learning and that the capacity of failures to radically redirect a design project has significant learning value. This general feeling was reinforced by a second student who stated: 'We didn't know what we were trying to look for. It felt wrong to be running "experiments" in a manner where any conclusions we drew would not be statistically valid, and for the members of our team who were from scientific/engineering backgrounds, this was troubling... However, I now realise that I was getting used to working in a more uncertain way.' These comments describe clearly the move from a quantitative environment governed by clear processes and practices towards a qualitative one that needs strong narrative and process generation skills when working towards unclear goals and in uncertain environments.

The use of the word failure was raised as a significant issue with a number of respondents: 'The confusion created by the word failure. Although a great permission giver in many cases it also acted as a comforting fall back that reduced productivity and engagement.' Followed by a second student who questioned the term: I have purposely avoided the use of the word failure as I am not sure it is the right term to use throughout the module. It is very helpful to introduce in the beginning of the project so as to address the emotional and self defining attributes we often contribute to the outcome of our work.'

A third respondent described failure as: I thought the emphasis of "failure" was counterproductive. I think that we could gain the same skills (confidence working without specific direction, and confidence changing direction) by placing the emphasis on being "risky," "reckless," "dangerous," or "adventurous." And finally: I enjoyed the discussions in the end of the module, as they showed, that everyone thought failure was actually the wrong word but no one had a better suggestion. The overall purpose of the module, presented a whole side-challenge of translation.' While the first two quotes could be ascribed to a form of cognitive dissonance where the students felt that contrary to the requirements of the module they felt the only acceptable final result for themselves was in fact a success. The last two opinions address this in a different way and suggest that the name could be changed to alter the psychological perception of the students and provide a different form of creative permission giving. These opinions raised an interesting discussion from project tutors who felt that although in practice there were a diverse set of responses to the project, that in fact the word failure was essential for its absolute power in showing new ways forwards, and that clear action was needed in order to cope with an expected or unexpected failure.

The benefits of learning to cope with failure head-on were very clearly described by one student who stated: 'Discovering new modes of resilience and coping mechanisms when hitting dead-ends that allow you to progress... The module provided valuable tools for a designer to build up modes of resilience. It helps the designer create a toolkit of response mechanisms to the frustrating dead-ends of the creative process.' It was felt that this was one of the core values of this module in enabling students to cope with failure head-on and to learn to find routes to circumvent failures in developing significant design innovations. In this respect the comment added weight to continue using the word failure rather than 'experiment', 'trial' or 'adventurous' which all mitigate or side-step failure in one way or another. As many students commented, and as discussed by tutors in the initial presentation, the word failure throws up some inevitable issues. In some capacity 'failure' determines an outcome as much as 'success'. As suggested by students, the word 'experimental' may be more apt, but the instinct remains that the word 'experimental' in the context of a design programme does not prompt the same level of interrogation or self-reflection. In addition the word 'experiment' promises the possibility of success whereas a failure does not. Perhaps there is a new potential vocabulary of 'risk' that is both more quantifiable and more provocative? Although a blunt tool, the word 'failure' still holds merit. It is simplistic and crude (in contrast to a lot of the carefully honed language in design academia) and has to be confronted head on. Throughout the project it was felt that this was a good tool for starting first year conversations about the misconception that there may be a 'right' or 'wrong' way to approach a project, and the subsequent 'tutor pleasing' implied by this. We observed that the most inventive and original groups were those who pushed past the success-failure binary language and used this uncertain space as permission to push towards a more sophisticated reading of the project. Perhaps these group results offer guidance on how we should position 'successful' failure - as a part of the process, not the outcome of learning. This is something that can be seen by the large number of 'successes' that were seen at the end of the project. More than half of the groups delivered a partial or fully successful result even if they had overcome many failures on the way.

Ultimately the word failure became a bridge to give permission to work in problem spaces where navigation becomes uncertain, results are often subjective and the result is indefinable ahead of the initiation of the design process. For example when dealing with the more intractable complex and 'wicked problems' as defined by Rittel [8] and Buchanan [9]. What emerged, as the core requirement in terms of the design process was 'failure resilience' a term identified in one of the student feedbacks discussed earlier. Considering failure at a more strategic level this module has allowed us to see different categories of design failure and to understand them in relation to resilience. For example the table below divides failures into two categories of recoverable and irrecoverable and sub categories in each of expected and unexpected. This is followed by a description of the level of resilience that one would expect is necessary to overcome the different types of design failure. For example an irrecoverable unexpected failure would leave the designer exposed as they would not have foreseen the failure and planned accordingly and would have a low level of resilience to continuing along the expected path. Apart from resilience, foresight emerges as a strong requirement through the failure forecast, something that is essential when designing experiments of all types and one of the key ingredients enabling higher levels of resilience.

Table 1. Diagnosing and Recovering from Design Failures to Encourage Resilience

Failure mode	IRRECOVERABLE		RECOVERABLE	
Failure forecast	EXPECTED	UNEXPECTED	UNEXPECTED	EXPECTED
Resilience level	Low to High Resilience (Depending on motivation)	Low Resilience	Medium Resilience	High Resilience
Recovery Strategy	Unlikely this route would be selected deliberately unless it was for proving a design route had no potential or that unexpected value from the failure could support other future design strategies	Major challenge for design process navigation. Questions as to original design experiment motivations and knowledge of context	Major project re-planning, reversal back to previous decisions or whole new approach required	Strong likelihood that the designer has resilience options in place for continuing the project

5 CONCLUSIONS

Two strong aspects of design failures surfaced during this research. The first concerned the resistance to the use of the term failure, whether this was down to cognitive dissonance [4] or more subtle efforts to shift the psychological value of learning from unexpected results to gain value for the design process is still unclear. For those from non-design backgrounds confronting failure head-on was valuable as a discussion tool for introducing design methods for working in grey or uncertain fuzzy contexts. Finding contexts from meta-themes was a route to testing experimental failures but also resulted in pushing students to recognise that navigation and narrative are essential when working in uncertain scenarios and that these structures form arguments and decision chains that help develop projects. The second value in terms of design process was gained from highlighting the term ‘failure resilience’. This acted as a powerful concept for students to incorporate unexpected results into their design process and to consider the ways in which they could regroup and continue with their goals. Initially we were disappointed that over half the groups seemed to have failed to fail and had in fact failed by succeeding with a design innovation. However with more reflection we realised that all of these groups had failed multiple times and what had driven their design to succeed in the end was a mixture of ambition to succeed as much as any psychological difficulties they had in labelling an end result as a failure. The intention is to use these reflections to develop and refine this module in the future with more emphasis on going through failures rather than finishing the project with a failure and improving the discussion and presentation of outcomes that transgressed boundaries of different types.

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