

IMPACT OF A CHANGE OF ENVIRONMENT ON AUTONOMY AND DESIGN EXPLORATION

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ABSTRACT

This research explored how a change of physical and social environment might affect a product design student's ability to learn new design skills and to explore new design ideas. To do this, we took a group of product design students away to the remote island of Tiree in the Hebrides of Scotland for a 6-day trip as part of the Tiree Tech Wave – 'A hands-on making and meeting event exploring the edges of technology'. We then compared the findings to theories about how environments can affect creativity, including design exploration. Overall the research trip highlighted that the relaxed and inspiring atmosphere created by the physical and social environment, together with the freedom and autonomy given to the students, resulted in students being extremely productive while there. However it also highlighted that this did not necessarily result in more design exploration. This was partially due to the constraints on the resources available but also because of freedom given to the students.

Key words: Design exploration, creativity, learning environments, autonomy, learning, curriculum, education

1 INTRODUCTION

The aim of this research work was to explore what effects the change of a physical and social environment might have on a product design student's ability to learn new design skills and to explore new design ideas. The exploration of new design ideas is a critical element in the early stages of the product design process [1][2].

As part of this research work, we took a group of undergraduate product design students away from their city-centre based university location to the remote island of Tiree in the Hebrides of Scotland for a 6-day trip as part of the Tiree Tech Wave – 'A hands-on making and meeting event exploring the edges of technology'. The aim of the Tiree Tech Wave was to allow participants to take time out 'to experiment and play with hardware and software', to discuss and learn about 'issues of our new digital maker culture' and to be 'stimulated by others'.

Research over the last few decades has shown that creative performance, including design exploration, is affected by many factors including the social and physical environment. Rhodes [3] suggested that there were four factors that affected creativity: the creative process, the product, the person and the environment. Csikszentmihalyi [4] and Amabile et al [5] explored these factors further in large-scale studies. Their research into the impact of the environment on a person's creativity emphasized the following points:

- The appropriateness of the place for learning, e.g. access to knowledge, access to necessary tools, and interaction with people from diverse backgrounds.
- The support "for immersion in concentrated activity".
- The support for autonomy, i.e. "freedom of action".
- Whether the environment suits the person's personality.
- An encouragement of creativity, i.e. risk taking and idea generation with a supportive evaluation rather than highly critical evaluation.
- The setting of challenging and interesting goals.

Groves et al. [6] also looked at how "creativity is fostered by the built and cultural environment" by studying twenty of the most innovative companies around the world. As a result they highlighted four important elements that creative spaces should have: spaces that stimulate; spaces for reflection; spaces for collaboration; and spaces for play.

The studio culture commonly used at universities to teach product design addresses many of the points above. There is access to knowledge and the necessary tools; there is the setting of challenging and interesting goals; and learning spaces are set out for collaboration, play and prototyping. Most courses encourage creativity and risk taking by setting formative assignments rather than purely summative assignments that might be classed as a highly critical evaluation. However it could be argued that there is not always full “freedom of action” (autonomy) due to the nature of course structures and assessment processes. In addition, the interaction with people from diverse backgrounds is somewhat limited as all the people in the studio environment are from a design background. Finally the studio based environment might not suit all personalities and therefore not support “immersion in concentrated activity”. Recent research by Atchley et al [7] has shown that immersion in nature, as well as a “disconnection from multi-media and technology”, increases creative performance. Work by Fockert et al [8] has also shown that remote rural environments promote better levels of concentration than urban ones. The Tiree Techwave therefore gave us an opportunity to explore how such a different physical and social environment affected the students’ abilities to learn new design skills and to explore new design ideas.

2 THE TIREE TECH WAVE

The Tiree Tech Wave provided an opportunity for our students to learn about new technologies and to possibly help spark new design ideas and concepts. There were several key aspects of the trip that provided us with the opportunity to explore what impact the physical and social environment had on the students’ experience. For example:

- The people attending the Tiree Tech Wave were from a diverse range of backgrounds including computer science, electronics, product design, music technology and architecture. Most were either senior researchers or academic members of staff. Our students were encouraged to form teams with other attendees if they wished to do so.
- The Tiree Tech Wave was run in the Rural Centre in Tiree and had limited resources. We took along several Arduino kits (open-source electronic prototyping platforms) that can be used to build interactive prototypes (which the students up to that point had no experience of using) as well as a small range of model-making materials and tools. Our students are normally used to having easy access to comprehensive product design workshops back at the University.
- The Tiree Tech Wave was deliberately quite unstructured but did include some short talks, demos and ‘how to do it’ sessions. For example, one of the short talks was from a youth worker on the island explaining the challenges the youth face. Other talks were more related to the sharing of knowledge related to design, electronic prototyping and computer programming.
- The students were given the freedom to work on whatever topic they wanted and at their own pace. They were not set a particular challenge, however they were asked to consider if they wanted to develop ideas relevant to Tiree.
- Time was set aside every day to allow the students to explore the island to gain inspiration from the environment.
- Evenings included some organized group play activities.

The photos below give an insight to the social and physical environment during the trip.



Figure 1. Inside the Rural Centre



Figure 2. Limited resources available



Figure 3. Evening social activities



Figures 4. Exploration of the island

3 RESEARCH METHODOLOGY

We set out to study the effects the environment had on the students' ability to learn new design skills and to explore new design ideas. Our methodology involved observational research; semi-structured one-on-one interviews with the students at the start of the trip; semi-structured one-on-one interviews with the students at the end of the trip and a reflective group discussion with the students some weeks after the trip.

Questions on the first day included: what they wanted to gain from the trip; expectations of the trip; any fears or worries they had; initial thoughts and impressions; how they felt the trip related back to the University learning environment; and what their normal mode of working is and why.

Questions of the last day included: the impact of the environment; their views on the mix between work and play; and what they have learnt most.

The students were also asked to pick two words from the list below (or suggest others) that captured their feelings during the Tíree trip: relaxed, stressed, worried, happy, bored, focused, distracted, confused, engaged, intrigued, excited, lonely, overwhelmed, disappointed, fun.

4 FINDINGS

4.1 Comments from interviews on the first day

Below are some of the comments made by the students on the first day.

What they wanted to gain from the trip:

- "Opportunity to come to the Scottish islands"
- "New technology and electronics focus really appealed to me." "Good way to learn how to incorporate technology into my designs".
- To have "interesting conversations". To do "something new I haven't done before". "A chance to meet new people". "Learn from others". "Get to know the tutors better". "Having these experts in different fields to create new products". "Play about and experiment".

Fears or worries:

- "A bit nervous about the technology side of things". "Worried it would be over my head". "I would like to have a finished design".

Initial thoughts and reactions:

- "Quite surreal". "Amazing opportunity".
- "Didn't think it would be this cold". "It looked quite wild".
- "Like the mixture of people with different skills". "Good to get thoughts from others".
- "You feel more relaxed in this type of situation". "Talks have been really good".

How it relates back to the University learning environment:

- "Less structured". "Getting on with things". "I like the relaxed style ... suits my personality". "I do like a structure, but I also like the freedom". "Open ended structure quite good".

The students were also asked about their normal mode of working and why they preferred to work in that way.

- "I like working in groups, but then will work at home in quiet on my project". "I prefer to work at the University. I have all the facilities available. There are too many distractions at home". "I like a structured way of working". "When it is too broad it scares me a bit. When you find the project to focus on it is ok".

- “I listen to music at home when working – helps me to relax”. “I like to listen to music to relax”. “I do exercise to relax ... refreshes ideas”. “I need to exercise first – liven the body up”.

4.2 Observations

Some of the students were inspired by the talk by the youth worker on Day 1 and started to look at product design ideas that would address the needs raised by the youth worker. Others had personal projects they wanted to undertake. However they all spent the first day learning how to use the basic functions of the Arduino kits to create interactive prototypes.

Some of the other observations made during the time at the Tech Wave were that:

- The students explored the island and found resources and materials from the island to help them build their prototypes.
- The students did form teams to work on projects, but only amongst themselves rather than with other participants.
- Some of the students found learning the Arduino electronics platform quite difficult as they had limited experience in electronics and computer programming.
- Students only made limited use of knowledge from other participants when trying to tackle the challenges they set themselves.
- Some students switched from working on creating interactive prototypes using the Arduino platform after a day or so, even though they had not completed the projects they started, to work on written assignments that were part of their main university course.

Figure 5 below shows one of the interactive prototypes built by two of the students using the Arduino electronics platform.



Figure 5. An interactive electronics prototype built by two of the students

4.3 Comments from interviews on the last day

On the last day on Tíree the students were asked another set of questions on their experiences. Below are some of their comments.

Impact of the environment:

- “I’m a lot more creative in a wilderness environment ... without stress of appointments, commitments”. “Liked how remote it was ... and the socialising in the evening”. “Relaxing environment”. “Focused here ... less focused back home ... so much more noise”.
- “Model making was awkward ... limited tools”.
- “A little intimidating in the group”.

How about the mix between work and play?

- “Really good”. “Focused on assignment – no distractions”. “Work and play didn’t help me that much ... need to get in the zone for model making and coding ... so too many distractions not so good ... might be more important for writing where the breaks are more important”.

What have you learnt most?

- “Learning new skills”. “Understanding how Arduino works”. “Programming side. Arduino has been the real benefit ... starting to build my own devices ... gained a head start.”
- “Balance between doing work and not doing work”. “Come back with a fresher mind.”

- “Would like to have an aim ... should have done more testing on wind turbine earlier on”.
- The most common words chosen by the students to capture their feelings during the Tiree trip were:
- Intrigued, focused, relaxed, fun, engaged, happy.

4.4 Comments from group discussion on return

Below are some of the main reflections from the focus group held with the students on return from Tiree:

- All students commented on how the physical environment on Tiree had provided inspiration for new design ideas.
- Students found the limited Internet access on Tiree difficult. There was only Internet access in the Rural Centre during the day, so it restricted how they could work.
- Some students commented on the lack of structure and open-ended nature of the Techwave quite difficult to manage initially. Some students suggested that if they had been given the challenge to create and demonstrate a new interactive prototype at the end of the Techwave that would have helped and provided a more focused challenge.
- Students commented on the social benefits of the trip and the importance of getting to know each other and the staff better.

5 DISCUSSION

Several points emerge when mapping back the findings from the trip to the theories by Fockert et al [8], Csikszentmihályi [4] and Amabile *et al.* [5] on the impact of the environment on creativity. Firstly, the students reported that they found the rural landscape in Tiree inspiring and that it had a positive effect on their creativity (“I’m a lot more creative in a wilderness environment”). Secondly, all the students highlighted that the social and physical environment at the Tiree Techwave provided support for “freedom of action” and “stimulus of ideas” and were all given the opportunity to work on any project they wished while there. As a result some students chose to use the time to work on assignments they had to do as part of their course while others chose to explore new areas such as how to rapidly prototype computer embedded products.

There was a supportive environment in place at the Techwave rather than a highly critical evaluation of work being produced by the students and this resulted in the students commenting that it was a relaxed work environment. The students also highlighted how having staff and other participants available to give support and guidance, as and when required, was extremely beneficial. That said, it is probably fair to say that the students didn’t fully maximise the benefits of interaction with other participants who had “diverse skills and perspectives” partly due to the fact that they felt somewhat intimidated by the other participants’ experience and knowledge.

Even though the physical environment within the Rural Centre was quite cramped the students commented that it allowed for “immersion in concentrated activity”. Most commented that there were no distractions and they could focus on their work. Most also enjoyed the mix of work and play but some found that it broke their flow of concentration (“need to get in the zone”).

There were a few areas where the environment did not fully support creativity and design exploration. One particular issue was the availability of resources. The theories by Csikszentmihályi [4] and Amabile [5] suggest it is very important that the necessary resources (time, training, tools) are available to support creativity. However during the Techwave resources were limited. Internet access was only available in the Rural Centre and there were only limited model making facilities available. In addition, there was limited time available to learn the electronic technologies that the students were exposed to.

There was one other main issue related to the importance of setting of challenging and interesting goals to support creativity. As the students were given the freedom and autonomy to choose what to focus on and not asked to showcase their work at the end of the Techwave, some lost motivation on the projects they set themselves (this was exacerbated by the limited resources available and the difficult technical challenges of their projects). On reflection, the students might have benefited from being told to produce an interactive prototype that they have to demonstrate at the end of the Techwave - but have the freedom to choose what project to do. In other words the freedom and lack of structure both nurtured and restricted creativity.

6 CONCLUSIONS

Overall the research work highlighted how the change of a physical and social environment can affect a product design student's ability to learn new design skills and to explore new design ideas. The relaxed and inspiring atmosphere created by the physical and social environment at the Tiree Tech Wave resulted in students being extremely productive while there. However it also highlighted that this did not necessarily result in more design exploration. To support design exploration, additional key elements must be provided. These include access to the necessary resources (including time, training and tools) and the setting of challenging goals.

The overall findings from the study support the theories highlighted by Csikszentmihályi [4] and Amabile et al. [5] as well as the studies by Atchley et al [7] and Fockert et al [8]. It also builds on the findings of the authors' previous studies [9] that have explored the relationship between play, the 'state of being' of a person, the environment and creativity.

The studio culture commonly used at universities to teach product design provides a stimulating environment for design exploration through play, prototyping and collaboration, i.e. spaces that stimulate; spaces for collaboration; and spaces for play (as described by Groves et al [6]). However there is also a need to recognise that other physical environments (such as being in nature) can also enhance a student's creativity and help in the exploration of new design ideas, i.e. spaces for reflection [6]. Students can also benefit from interaction with people from diverse backgrounds to spark their design ideas and help in their design exploration as the students experienced at the Tech Wave. With respect to providing more autonomy for students to improve their creativity and design exploration, the findings from this research support previous research findings [10],[11],[12] that autonomy has a positive impact on enjoyment, motivation and levels of productivity. However this needs to be balanced with some level of constraint, e.g. time constraint and deliverable, as highlighted by the students' own feedback and supported by previous research [1],[2].

One challenge moving forward is make sure that we provide a design curriculum that builds on the studio focused culture to support design exploration, and recognizes the importance of the physical environment on creativity including spaces for reflection; the importance of interaction with people from diverse backgrounds; and the importance of autonomy and self-directed study.

REFERENCES

- [1] Kelley, T. and Littman, J. *The Art of Innovation*, 2002, Profile Books.
- [2] Ulrich, K. and Eppinger, S. *Product Design and Development*, Fifth Edition, 2011, McGraw-Hill Higher Education.
- [3] Rhodes, M. An Analysis of Creativity, *The Phi Delta Kappan*, Vol. 42, No. 7, April, 1961, pp. 305-310.
- [4] Csikszentmihályi, M. *Creativity: Flow and the Psychology of Discovery and Invention*, 1996, New York: Harper Collins.
- [5] Amabile, T.M., Conti, R., Coon, H., Lazenby, J. and Herron, M. Assessing the Work Environment for Creativity, *The Academy of Management Journal*, Vol. 39, No. 5, October, 1996, pp. 1154-1184.
- [6] Groves, K., Knight, W. and Denison, E. *I Wish I Worked There!* 2010, John Wiley & Sons.
- [7] Atchley, R.A., Strayer, D.L. and Atchley, P. Creativity in the Wild: Improving Creative Reasoning through Immersion in Natural Settings. *PLoS ONE*, 7(12), 2012.
- [8] Fockert, J.W. de, Caparos, S., Linnell, K and Davidoff, J.B. Reduced Distractibility in a Remote Culture. *PLoS ONE*, 6(10), 2011.
- [9] Loudon, G.H., Deininger, G.M. and Wilgeroth, P. The importance of play and creativity in the design curriculum, *International Conference on Engineering and Product Design Education*, Antwerp, Antwerp, 2012.
- [10] Deci, E.L. and Ryan, R.M. *Intrinsic motivation and self determination in human behaviour*. 1985, Plenum Press: New York.
- [11] Pink, D.H. *Drive: The surprising truth about what motivates us*, 2009, Riverhead Books, New York.
- [12] Amabile, T.M. *Creativity in Context*, 1996, Westview Press.

