

Nurturing Creativity: Assemblages in HCI Design Practices

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Abstract

This paper investigates the emergence and nourishment of group creativity within human-computer interaction design (HCID). HCID practitioners are groomed within a scientific tradition and primarily perceive themselves as knowledge seekers, rather than creative makers of things. In an effort to add new value to HCID we refer to ‘assemblage of skills’ and ‘assemblage of design practices’ suggesting that practitioners acquire creativity when combining epistemology (finder) and ontology (maker). We do so by example from an advanced graduate course in HCID where the students were to design products to be exhibited in a well-visited and established annual fair at the university. This task required the presence of skills and practices of both ‘finder’ and ‘maker’. In the process of product making, the students were not allowed to rely exclusively on learned methods and approaches involving users and other stakeholders. Rather, they were to unleash their own creativity. The paper follows this process of emerging creativity through photo documentation, it provides lessons learned, and it discusses how design comes about through a relationship between finding and making.

Keywords

Human-Computer Interaction Design; Design Thinking, Creativity; Assemblages

Introduction

When reading Charles Owen’s paper *Design thinking: Notes on its nature and use* some time ago, the sentence “Design thinking is in many ways the obverse of scientific thinking” caught our attention (Owen, 2007, p. 17). The use of the word *obverse* was interesting in that it is archaic and not in common use any longer. It designates the side of a coin that bears the principal design. In using this word, Owen gestures toward the importance of design thinking. He further introduces classification of practitioners of science or design into ‘finders’ and ‘makers’ in our discussion. Makers are those who are creative and capable of synthesizing their knowledge into new constructs, patterns, concepts, etc. They can apply design thinking towards solving complex problems such as environmental risks, poverty, and health. They also design products and services, etc. Finders, on the other hand, work through science thinking, understanding phenomena and disseminating their findings through research papers.

Narrowing the focus to human computer interaction design (HCID) (traditionally situated within scientific thinking and practice), and interaction design (ID) (situated within design thinking and design practices), we position both HCID and ID as fields between science and design, in part belonging to both and in part, to neither, see Figure 1.

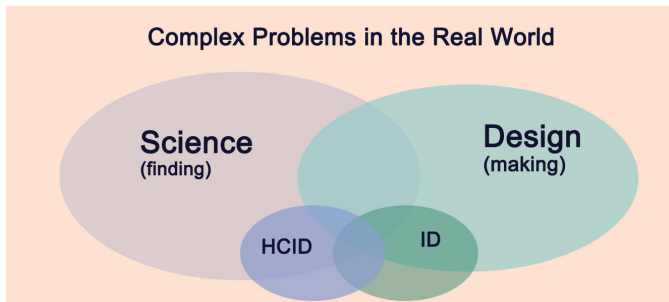


Figure 1: Placement of HCID and ID between science and design.

Drawing or breaking down boundaries between the fields of HCID and ID has been an ongoing debate. Diverse opinions have been put forward as to what the crucial similarities or differences between the two are. Some notable examples are the proposition to consider HCID a radically interdisciplinary dialogue (Wright, Blythe, & McCarthy, 2006), convergent-divergent questioning (Dym, Agogino, Eris, Frey, & Leifer, 2005), models, theories and frameworks toward a multidisciplinary science (Carroll, 2003), research by design, (Fallman, 2003; Forlizzi, Zimmerman, & Evenson, 2008; Zimmerman, Forlizzi, & Evenson, 2007; Zimmerman, Stolterman, & Forlizzi, 2010), or implementing (within HCI) designerly practices resonant with the everyday work of interaction designers (Goodman, Stolterman, & Wakkary, 2011). Faiola has proposed the use of HCID for design-oriented HCI and pedagogical models for HCI, which include understanding design, social context and business strategies in addition to computing (Faiola, 2007).

In this paper, we explore how both ‘finding’ and ‘making’ shape HCID practice and, specifically, how they affect the creative side of the work done by HCID practitioners. Traditionally trained in scientific thinking, HCID practitioners frequently use design thinking (Brown, 2009; Owen, 2007), ‘designerly’ practices (Goodman et al., 2011; Stolterman, McAtee, Royer, & Thandapani, 2009), and reflective practice (Schön, 1983, p. 49) in order to make technology-based products, interfaces, services and systems (Culén, Joshi, & Atif, 2013). HCID practitioners rarely work alone, but rely on teamwork and inclusion of users, through participatory and user-centered approaches. Yet, they often do not consider themselves to be ‘creative’ individuals; nor is creativity explicitly nourished and supported through HCID education.

Creativity is something that both finders and makers need in their work. However, it is cultivated and expressed differently within practices of science and design. In the finders’ practices, the insight is often confused with ‘scientific’ creativity. Similarly, within makers’ practices, originality is frequently identified with creativity; we find such identification problematic, or worthy of further scrutiny. Both insight and originality come about rarely, while, we believe, creativity is something that may be learned and cultivated (Csikszentmihaly, 1997; Tan, 2013). As Csikszentmihaly points out, “It is easier to enhance creativity by changing conditions in the environment than by trying to make people think more creatively. And a genuine creative accomplishment is almost never the result of a sudden insight, a light bulb flashing in the dark, but comes after years of hard work” (Csikszentmihaly, 1997, p. 7).

The modern study of creativity has moved through three distinct phases (Sawyer & Sawyer 2012, p. 4). The first wave of creativity research, in the 1950s and 1960s, focused on personalities of exceptional creators. The second wave, in the 1970s and 1980s, investigated internal mental processes that occur when people are engaged in creative activities and behaviour. The third, current wave is concerned with socio-cultural, interdisciplinary approaches and relates to social systems and groups of people performing acts of creativity together. This research still has significant interest within the context of HCID and ID communities. Researchers such as Giaccardi and Fischer are

seeing an opportunity to capitalize on systems and group creativity through metadesign, defined as “an approach concerned with opening up solution spaces rather than complete solutions (hence the prefix meta-), and aimed at creating social and technical infrastructures in which new forms of collaborative design can take place” (Giaccardi & Fischer, 2008, p. 1).

Rather than following the path of metadesign, this paper is concerned with exploring the emergence of creativity among HCID practitioners when their usual participatory and user-centered tools and methodologies are taken away and they are prompted to follow alternative roads towards group creativity. Our inquiry is carried out in the context of a graduate course in HCID within the study programme ‘informatics: design, use and interaction’ (for a description of the teaching methodology of the class (Culén, Mansah & Finken, 2014)). The students enrolled in the class had previously attended courses on HCI, physical computing, experimental and participatory design, etc., and were well underway in writing their Masters and/or PhD theses. Here, we are interested in understanding how they approached and designed products that adequately reflect work done by faculty in the Design-group, - a research group teaching within the study programme ‘informatics: design, use and interaction’ at the Department of Informatics. The products made had to be finalized to such an extent that they could be shown in a well-visited and established annual fair at the university.

We draw on the notions *creativity* (Csikszentmihaly, 1997) and *assemblage* (Luckhurst, 2006) in an effort to show how creativity emerges from a hodgepodge or assembly of skills, through which the constituent categories ‘finder’ and ‘maker’ were nurtured and blended together, for the HCID students to use and draw on during their design processes. Further, we show how the students’ other existing skills (i.e. skills learned outside the university campus, such as knitting and sewing) came to play a crucial role for the very unfolding of creativity during the realization of their design ideas. This coming-together of skills is what we refer to as ‘*assemblage of skills*’ in design efforts. Another coming-together was facilitated and nurtured by the teaching staff. That is the ‘*assemblage of practices*,’ which entailed introducing the students to design practice, design thinking, makers’ practices, and reflective practice. Thus, through ‘assemblage of skills’ and ‘assemblage of design practices’ the students needed both ‘finding’ experiences (e.g. understanding new practices or the research interests of the Design-group), and ‘making’ experiences (e.g. producing both presentable and conceptually good physical representations).

Our contribution to the debate about creativity is thus based on empirical experiences gained by following three student teams, each designing a product. We address how the assemblages of skills and practices facilitated the emergence of creativity in ways that were new for these students. Further, we hope that through assemblage of similar empirical studies, emergence of creativity in group-work situations will be better understood.

Empirical setting and methods

The class took place in a design lab at the university where there is space to work practically with materials and technologies at hand, such as a sewing machine, computers, Arduino, scissors, glue, fabric, paper. The class was originally assigned to a traditional lecture hall, but the two in-house teachers decided to nurture creativity and making rather than the traditional ‘finder’ skills of our discipline. In this way the lab itself became a resource to enrich the process of creativity. The teaching team consisted of two in-house teachers and one external teacher from the local school of architecture and design. The external teacher’s role was to provide feedback on students’ projects about every three weeks.

In this paper we follow the class during the first eleven weeks (the remaining time of the class, the students worked with a new design project). The students were, initially, asked to brainstorm about the design brief: make products that illustrate well some aspects of the research done by the Design-group. The final concepts from this process were to be implemented in the design, thus the students had to work within constraints of their skills, knowledge, available materials, and the size of the exhibit space. A few rounds of concept sharing and critiquing took place before the students formed teams to work on implementing concepts that were chosen. The students were not to involve users, but rather employ skills and practices of 'finders' and 'makers'. In their endeavor, the students chose to work with three themes: privacy issues (materialized as a project based on a confession booth); sustainable design (expressed through use of energy generated while biking); and wearable technology (realized in a skirt for women suffering from dementia), see Figure 9.

In following and documenting the process of 'assemblages in HCI Design practices' we used different media such as photographs of situations and events in the class, and Post-it notes, which were used to jot down tips, ideas, issues to pursue, how, what, and aims, during the feedback sessions when students presented their projects. The Post-it notes were collected after being on the whiteboard for a week or so. Further, brief notes were occasionally taken during conversations with students about their projects, or when they presented their work. Also, the third author wrote summaries of activities that only students attended. Additionally, the students answered short, targeted questions, concerning creativity, either orally or in writing.

The photographic material, consisting of over 300 photographs, was generated throughout the project process. It is extensive and rich in that it captures a range of situations, from the feedback sessions and the students' presentations of projects (from paper-based ideas to prototypes in process), to working sessions outside scheduled class hours and the showpieces exhibited at the fair. Both teachers and students documented the process photographically and shared their images in Dropbox. The photos used in this paper are a collection of these shared images. Initially, the photographs primarily served the purpose of documenting (Crang & Cook, 2007) the process of creative enactment in class, from the first drafting of ideas to the final designs. In addition, the teaching team realized that the photographs were rich sources of information beyond documentation. So the teachers started using the photos as guidelines for understanding, experimenting, and refining ways of nurturing creativity. This resulted in other decisions. We altered the traditional lecture set-up to increase participation and involvement: everybody was invited to gather in a standing circle to see the projects and provide feedback. We fostered the inclusion of different skills (e.g. sewing, collaging), things (e.g. wood, art design), and games (such as dancing and designing dance moves). And we introduced ways of exploring the world (Smith, 2008) by going outside the class to find and experience sources of inspiration, e.g. diverse interactive installations in the city.

The authors of this article are the two in-house teachers and one of the attending students. All students were invited to participate in writing this article from the very beginning of the class, and we are happy that one decided to participate.

Becoming creative together. The process

The first day of class was August 19th. After a guest lecture with a renowned New York based interaction designer, we sat down with the students who wanted to take the class, gave an overall introduction to the course (what, how, why), and asked each of the students to share with us their creative sides, or, rather, what creative skills they brought to class. An interesting moment transpired when the students, one by one, said that they thought they did not have any special creative skills. Prompted further, they began mentioning their experiences of baking, knitting, sewing, using software like Photoshop,

and similar skills. It was just as valuable for us all to learn how the students perceive creativity, as it was to know what kind of skills they brought with them to the class.

Enactments of finders

The initial phase of the class was challenging, for both teachers and students. The teachers were seeking ways to best convey design thinking/practices and foster the unfolding of making. The students seemed to cling to their 'finder' skills. It was as if they anticipated something well known. At a certain point frustrations were at the forefront from both ends. Teachers complained, students complained. Conversations took place and both parties made new efforts.

On one occasion, in the process of uploading photos to Dropbox, it became apparent to the teachers that the class was cut into two parts. Rather than having one standing collaborative activity going on around the whiteboard, most of the students were sitting at the table not participating in the critique and idea generation. The whiteboard had cut the circle in half and worked as a gate that excluded the project teams that were not presenting their work (Figure 2 to the left). In realizing how the materiality of the artefact had an effect on the activities taking place, the teachers opted for furthering inclusion. On the last feedback session, before the exhibition in October, a circle formed around the confession booth when one of the teachers sat down in it. The booth, in this sense, became part of the circle, and a good discussion unfolded about how to showcase the confession booth at the exhibit (see Figure 2 to the right).



Figure 2. At left, the first feedback session, September 9th, 2013. At right, the last feedback session, October 28th, 2013. Photos by Finken.

Alongside the effect of the artefacts (whiteboard and confession booth), we read the situation portrayed in Figure 2 as an instance of the enactment of a more predominantly scientific way of engagement, which prevailed in the early days/weeks of the class. This initial attitude toward new approaches to design contrasts with the attitude at the end of the design process, when the students had gained practical experience with design thinking through their effort with making.

In the following excerpt, written by the student-author in a reflection-note concerning creativity and its role during the process, we see how the 'finder' is present and how this 'finder' strives with moving from epistemology to ontology:

"At the beginning of the course the teachers asked about my creative skills. I replied that using technology was a way to solve problems and that I perceived this as creative. Initially, when the work with the projects started, I felt quite lost. Seeking inspiration, I used websites, books, and articles to find some viable ways to be creative. On the other hand,

one of the points from the two-three first lectures was about going out of the HCI thinking and changing my path of designing.”

The issue raised in this excerpt, about creativity and how it becomes manifest through books, websites and articles, was a predominant practice in the beginning of the class. It is mirrored in the photos from the first phase (Figure 3) where the initial ideas are presented through cut/past/gluing onto paper.



Figure 3. Feedback session on September 9th, 2013. Photos by Finken and Culén.

In Figure 3 we see students presenting their ideas in class at the first feedback session. If we take a close look at the photos, we see much cutting and pasting of images that had been found on the Internet. We also see ideas that had been grabbed from elsewhere, e.g. *facesinplaces* (see also (Smith, 2008)), and refrigerator letterings, which were put together in new ways to form basis for their future designs. In this manner, drawing on skills of the 'finder' to convey ideas for future designs was the students' *modus operandi* in the beginning of the class.

What we cannot see in the photos is the feedback, provided by the teachers, jotted down on the Post-it notes that are glued to the whiteboard (Figure 3 to the left). One of these notes says: "what is required to make it? resources, space, people, technologies, things, etc." Another Post-it note says "how to exhibit + purpose of projects?" Yet another simply concerns the aim of the projects, "AIM?" it says with capital letters followed by a big question mark. Other Post-it notes fall along this line of logic by pointing to the very justification of the projects presented: "justification do not need to be actual/logical/perfect -> you need to show the process", and "think, reason & show our projects. prototyping". These comments advocate for mixing the skills of finders and makers in collective creative efforts in HCIDesign work. Simultaneously, they instantiate the introducing lines of this paper: that creativity is a skill to be learned (Csikszentmihaly, 1997; Tan, 2013). The comments on the Post-it notes were considered to be important for the students, helping them to incorporate the feedback and to bring the process further along. Taken together, the comments form an advocacy for the assemblage of skills and practices.

Finders greet Makers' skills

We then moved on to the second round of feedback, where the students presented the first prototypes of their chosen ideas. In Figures 4 - 6 below we see how the students began to get into a 'making' frame of mind by exploring materials, making low-fidelity prototypes, using wood, fabric, yarn, etc. This is a different approach compared to the one used during the phase of idea-development as shown in Figure 3. In contrast to Figure 3, where we see a lot of cut and paste from Internet searches that are adapted to show ideas, an assemblage of skills is beginning to manifest itself by way of including the creative skills of making.

In relation to the emergence of such an assemblage, the student-author writes the following in his reflection-note on creativity and its role during the design process:

“During this period, I realized that some of my basic creative skills were there from the beginning, while others had to be reactivated and used in new ways. This was mandatory in order to refurbish ideas and merge them with previous ones. Working with our design project required many iterations, but also, equally important, we had to keep the best and correct parts in the design process. Some of the ideas we had with the initial ‘Relaxation box’ - such as light and music - were further developed and brought into the ‘Match box’ (for meeting a sweetheart), and then, finally, some of these ideas survived in the final design, the ‘Confession booth’.”

In Figure 4 we see visual expressions of the confession booth, which developed further into the project iCONFESS (see (Culén, Finken, & Gasparini, 2014)). This design builds on previous ideas, presented during the first feedback session: a relaxbox for students to go release stress, and matchmaking for meeting a sweetheart. At this point in time the team had moved on to working with the idea in physical form - a wooden box – and mixes social media with a social arena.

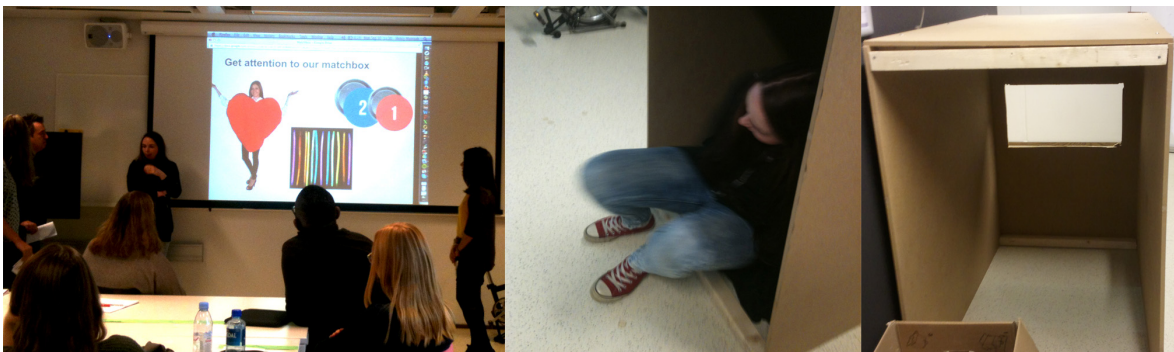


Figure 4. Photos from and around the feedback session September 30th, 2013. Photos by Finken and Heggelund.

Similarly, the two other project teams brought in materials other than paper. The students had started working outside digital media and brought along tangible materials to exemplify their ideas as presented in the slide shows. One group working on an idea for people suffering from dementia (in the project ‘Skirts with meaning’ concerning wearable technologies) brought along items such as skirts and clothespins to showcase their ideas (see Figure 5). This project also continued further, expanding beyond the class, (see (Culén & Finken, 2014)).



Figure 5. “Skirts with meaning” for people suffering from dementia is taking form. Feedback session, September 30th, 2013. Photos by Culén and Finken.

Another group working on an idea within the area of sustainable design brought along samples of fabric and knitted patches when showcasing their idea. This project concerns how interacting with your own energy (in this case when biking) can provide warmth during cold winters. To exemplify their idea this team also brought along a bicycle and a prototype of a hand warmer, a knitted glove, which could be attached to the handlebars on a bicycle. The glove is to be warmed up via a plug-in to a small dynamo when pedalling (see Figure 6).



Figure 6. Feedback session, September 30th, 2013. Photos by Finken.

What we see in Figures 4 - 6 is how ‘making’ is slowly starting to affect the creative side of these HCID students, *and* how they try hard to assemble epistemology and ontology in their practice.

Creativity in HCIDesign

In the above we have looked at assemblages of skills and practices and how they have been facilitated in an effort to nurture the emergence of creativity in ways that were new for these ten HCID students. Further, it has been a new experience for the students to work without methodological strands of participatory design in which users are involved in the process of design. Here we take a closer look at creativity as assemblages of skills and practices, and how working from such a standpoint affected the students’ view of creativity.

In the beginning of the semester we sat down to watch the film *Design&Thinking* (“Design & Thinking - a documentary on design thinking,” 2012.), and a lecture by Klemmer, (Creating and Comparing Alternatives, 2012) as an example of design in HCI. The main message of the lecture video was that it is better to start with many different ideas than to be attached to any particular one. This is important in that participants in a team can let go of ‘my idea won’-mentality, which is often present in group situations. The in-house teachers aimed at taking a lead with this approach by including the students in critiquing, developing, and furthering ideas, which should then materialize in the designs to be exhibited at the fair. When working without user-participants (whose views are important for HCIDesigners in order to find and formalize opportunities for iterative improvements in typical design cycles) the students needed new ways of refining designing ideas in ways that are self-driven.

This process of working with re-formulating/re-designing their ideas came to have an effect on their orientation towards creativity. Such effects are articulated by the student-author in his reflection-note on creativity:

“Another learning experience, which I really appreciated, was how we were prompted, during the design process, to accept that some of your own good ideas had to be discarded. I think this was a turning point for my creativity, since it required that I would be even more pro-active in searching for motivation outside of myself, that is, in the surroundings. A final observation, which concerns my use of technology and its role in this project, was the ubiquitous and somehow invisible role it had. In concluding my experience about creativity in this first project, I can state that I reached my design goals thanks to a desire to create, an increase in challenge spirit, a cultivation of my inborn curiosity, and also a new understanding about how good design requires hard work.”

With this we could say that the students had (finally) started to gather and work on their projects regularly on their own. This is atypical for HCI students, who do not have much experience with making and working in studios and labs. For images of work taking place outside scheduled class hours see (Figure 7).



Figure 7. Lilypad and programming on the left. Fabrics, paint, electronics (lights) on the right. Photos taken on different occasions during October. Photos by Risvik and Heggelund.

At the last feedback session, just before the exhibit, the students had had a few months of experiences with making – and with incorporating their academic skills and the skills they had acquired elsewhere into such process of making. In Figure 8 we see details of different materials and skills (e.g. sewing, knitting, painting, programming, academic knowledge) that were involved in the process of making these designs.

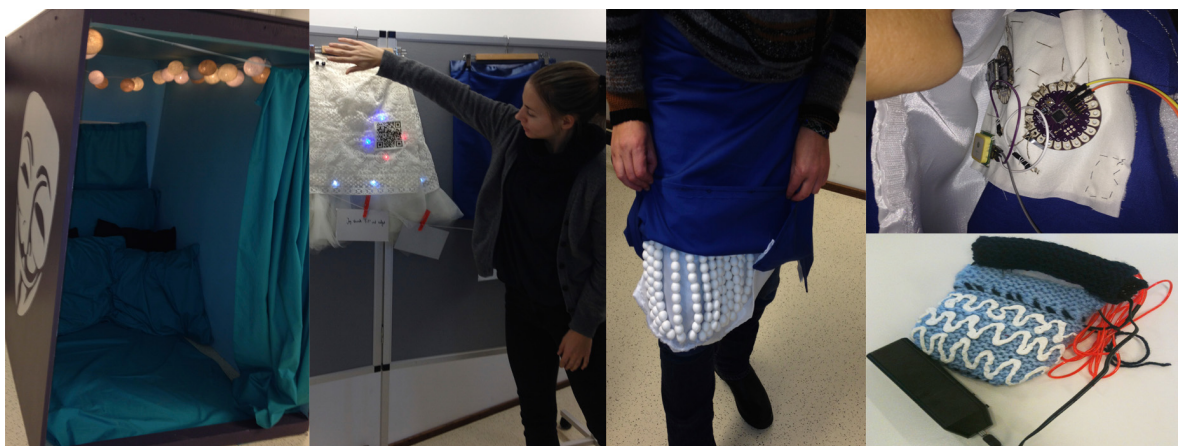


Figure 8. Feedback session October 21st, 2013. Photos by Finken and Culén.

In the morning of the last feedback session the students were busy with finalizing their projects; some were still waiting for electronics to arrive in the mail. They had prepared the lab with their designs and were ready to showcase and present.

After the feedback session we asked the students to write out their answers to three questions relating to creativity: a) Describe your creative skills; b) Have you noticed any changes in your attitude towards creativity?; and c) Would it be easier to engage in creative processes now? In asking the students these questions we were interested in understanding how they perceive creativity after having been through this process, and whether they had learned new skills to be used in future design processes. One of the students, in his/her replies to the last question, wrote: “Yes, to be creative is not just a matter of being good at drawing. It is also a matter of thinking. You have to learn to think differently through action [doing] and experience.” (Translated from Norwegian by the authors). Another student replying to the same question said, “What we have been doing in this course inspired me to do more practical stuff, that is not digital! I actually did some painting at home the other day. It’s fun to make physical things and it’s easier to start this process now.” In a reply to the second question a student said, “Yes, lowered threshold, easier to just do it instead of just thinking about it. Have started to paint and sew, have made a cover/case for my Mac book Pro.” In general the students responded positively to the questions and seemed to have pushed both their creative boundaries and their effort with such work. Among the seven replies we received there is one student who stands out in the sense that he/she writes, “the creative skill has not changed.”

In coming to an end of this paper we want to emphasize that during the process, in which the teaching team advocated and facilitated an assemblage of skills and practices, the students worked hard to push the boundaries of their skills, which is valuable. In Figure 9 we see the outcomes of their hard work. Here we have arrived at the exhibit day and see (from left): the preparation of the stand and gifts to those “confessing”; showing the work at the fair; actively recruiting people for the stand; showing the features of the bike. In the bottom right corner, an anonymous person is using the booth to confess. The mask, which is both worn by the students and displayed on the side of the confession booth, is a Guy Fawkes mask, which is ‘a global symbol of protest and anonymity’ (Taylor, 2013).

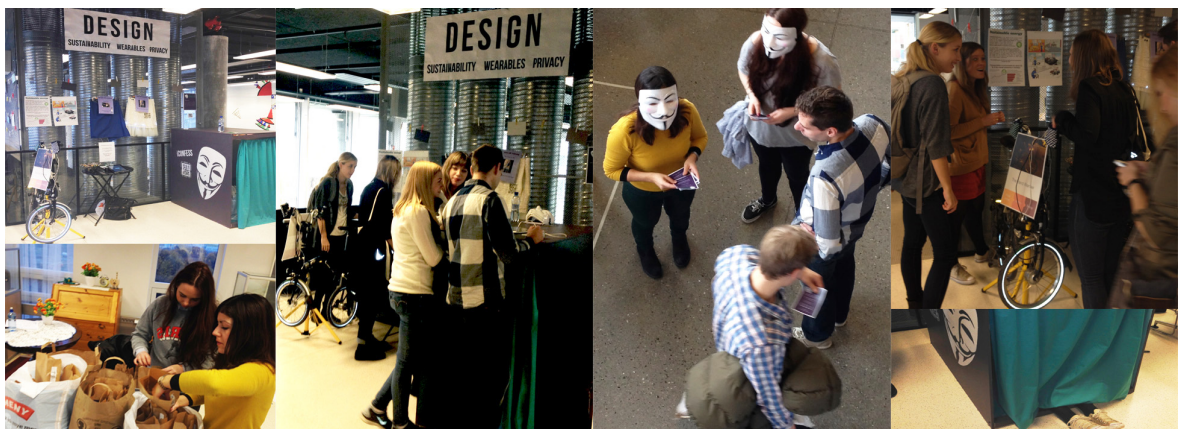


Figure 9. Exhibit day, October 31st, 2013. Photos by Culén.

In summarizing the process, we provide the following table of diverse practices with which we, the teachers, sought to nudge the students’ creativity. This may be repeated as a format for others wishing to try a similar approach. Ours extended the course of eleven weeks (including the first guest lecture, which is not part of the table) with feedback sessions approximately every third week. As the main tool, serving both teachers and students, we include photo documentation that was used during the entire length of the

project process and exhibit. The photographs have been important in guiding us, teachers, in understanding challenges; in being more creative in our teaching (e.g. by involving the body by dancing), and in prompting our direction of assembling finders and makers practices and skills. In the table, divergent thinking (purple) is used interchangeably with convergent thinking, as shown in row 2. The light turquoise color in the 'weeks 1-3' column signifies something we tried to encourage the students to do, but we did not see the effects until much later in the semester.

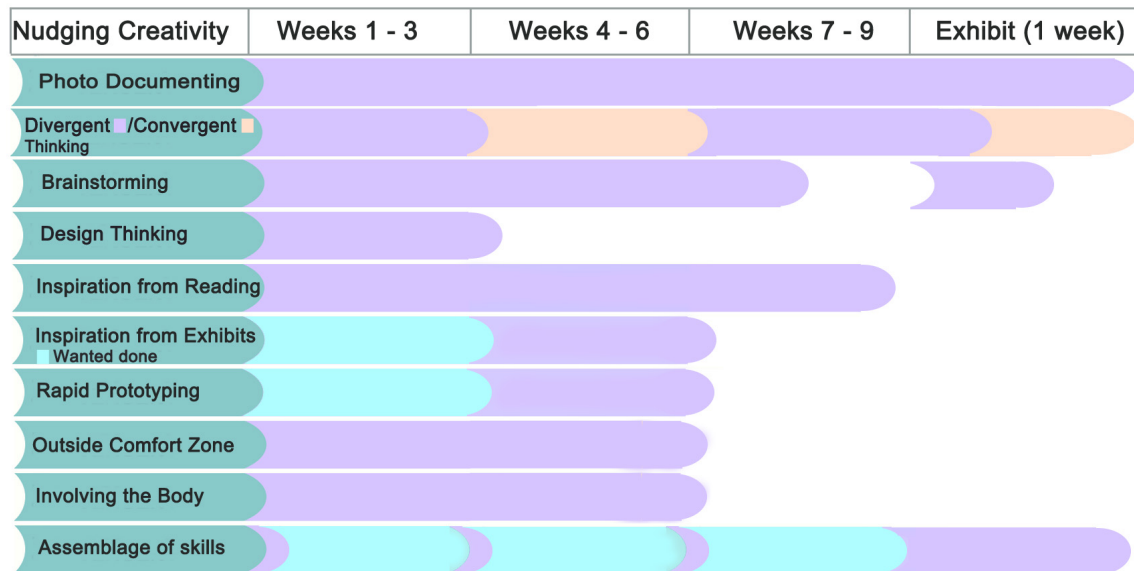


Table 1. Nudging creativity over a period of ten weeks.

Conclusion

The aim of this paper has been to inquire into the emergence of creativity through channels that stand out as alternative in comparison to the ones traditionally used by HCID practitioners. The setting for such an inquiry has been a course on advanced interaction design in which a group of graduate students, already having practical knowledge of HCI, were enrolled. This setting turned out to be well-suited for this kind of inductive and experimental research and teaching involving design practices and creativity. We have used the concepts of assemblages of skills and practices in an effort to reflect on behaviours and activities that unfolded throughout the design process. The students have shifted their perspective somewhat, from a predominantly scientific orientation in the beginning, to a more designerly orientation through their endeavours of making. Working in this way, the students have experienced a shift in the perception of their own, individual creativity, although all of the work was happening within a team.

Descriptions of such assemblages of skills and practices with evidence of achieved results could be a good way to start building group creativity, and, thus, contribute to the third wave of creativity research related to socio-cultural approaches.

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Sisse serves as Researcher in the Design-group at the Department of Informatics, University of Oslo, where she has worked since 2007. She teaches two graduate level courses on ‘Qualitative Research Methods’ and ‘Advanced Interaction Design’. At present she conducts research in a smart home for senior citizens, with a specific focus on care and care technologies. In this setting she is interested in understanding the effects that care technologies have on everyday living and working; that is, more generally, she is interested in understating relationships between practices of design and use. Her research is influenced by work in the traditions of social anthropology, science and technology studies, computer supported cooperative work, participatory design, and design research. She finds visual methods, such as photography, inspiring in the conduct of her work.

Alma Leora Culén

Alma is an Associate professor at the Institute of Informatics, University of Oslo. For the past 11 years, she worked in the fields of human-computer interaction and interaction design, teaching these subjects at both undergraduate and graduate levels. In 2003, she started a professional study program in Interaction Design, in collaboration with Oslo Academy of Art and the School of Architecture and Design. The program was replaced in 2010 by the current program Informatics: Design, Use and Interaction. Alma’s research includes interaction design for and with children, elderly and young adults. Her research has been applied and implemented in diverse projects, e.g., exhibits for Oslo Children’s museum, change by design in academic library, design of cool technology for young, chronically ill patients, and design of personal technologies for elderly.

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Andrea is a senior engineer in the Department of Digital Services at the University of Oslo Library, where he has worked for the past 14 years. His work involves trying and adapting new technologies for the use in the library, as well as the development and operation of library's digital services. In 2011, Andrea completed his master degree studies in interaction design. His master thesis project involved the use of tablet PCs in education and learning. Continuing to work with interaction design, Andrea has shifted his focus to design of new library services. At present, he is a doctoral student, focusing on the processes of innovation and how design thinking supports innovation processes in the Academic Library.