PROGRESS CARDS AS A TOOL FOR SUPPORTING REFLECTION, MANAGEMENT AND ANALYSIS OF DESIGN STUDIO PROCESSES

Tomasz JASKIEWICZ and Aadjan van der HELM
Delft University of Technology, the Netherlands

ABSTRACT
This paper presents "progress cards" as a tool that supports design students in planning and reflecting on their design processes, while providing design studio coaches and design methods researchers with structured and in-depth insights into these processes. The progress card is a form that individual student designers or design teams typically fill at the end of each design studio workday. The form contains space for a visual and textual summary of the latest version of the designed experience and a summary of progress regarding the new knowledge generated in the design process. Introducing progress cards in our courses has been causing initial resistance from participating students due to perceived additional workload. However, over time, the format was improved and students developed routines of filling the progress cards, using them to document and reflect on their design processes, and starting to utilise the potential of the format to analyse and manage their own design process from a holistic perspective. The progress cards have also proven valuable in providing insights for the design coaches and design process researchers, both for assessing and guiding the work of students, as well as for comparison of design processes across multiple student teams. After three major revisions, tested by over 400 students, the progress card tool has reached maturity and can be confidently recommended for use in other design studios, while we are investigating further improvements to the tool and its applications for professional design situations.

Keywords: Design methods, design process assessment, creative process management.

1   INTRODUCTION

Design studio is a popular form of design education with long tradition in industrial design and architectural teaching [10]. Students engaged in design studios learn how to tackle ill-defined design problems [4] through project-based [1] and problem-based [11] learning. There is much variation in respect to how strictly design processes in design studios are organised. In some teaching contexts, students can be required to follow a predefined design process timeline and prescribed use of specific design methods and tools at each of its steps. This gives students little space to manage their own process, but helps them to learn the correct use of methods and workflow [5]. However, in many other design studio situations students engage in a process of "fluid improvisation" [9], where self-directed learning [12], social knowledge construction [3] and designer's personal development enabled by reflections in- and on actions [15] gain more prominence. In such unstructured design studio settings, students are also more likely to depart from approaching designing as an exclusively rational and linear problem solving process, towards processes where continuous co-evolution of design problems and design solutions takes place [7]. This resembles real-life design practice, where methods are used as "mind-sets" rather than procedures to be strictly followed [9], requiring students to improvise, adapt methods and be critical towards their own process. However, while learning how to manage one's own design process is an important learning objective in design studios, it is also a substantial challenge for students to do it on their own with little experience they have. On the other hand, design studio teaching staff, the "design coaches", are also constrained in their ability to support the students' design process organisation, as they can only obtain limited insights into students' own design processes during designated contact moments. In response to these challenges, this paper introduces and discusses a lightweight process documentation format called the "progress cards" that serves two

purposes. Progress cards can be used by students for self-capturing their own design processes, supporting reflection on their own actions and consequently supporting self-directed learning. Progress cards also provide design studio coaches with a tool to gain better insights and overview into the organisation, execution and dynamics of student design processes, and consequently help design coaches to better steer and support students' learning in design studio processes.

2   SELF-CAPTURING DESIGN ACTIVITY

While there are many research methods for capturing design activity [8], the ones most used in design process research, such as protocol analysis, are typically time-consuming and require participation of researchers external to the design process [14]. On the other hand, a diary is one of such methods that can be performed by designers alone. Since engineer's logbooks, designer diaries or architect's sketchbooks are traditionally established and accepted tools of documenting one's design and engineering process, this method feels right at home in the design studio context. There have been several attempts to use diaries for documenting and researching design activities performed over long periods of time. For example, Pedgey proposed and tested a format for handwritten documentation [14], and Daalsgaard a Halskow introduced a digital tool for "reflective design documentation" of design process events [6]. Nonetheless, there is little research on structured use of such tools in design studio education. While students may be generally motivated by their design coaches to keep track of their process using diaries, few of them do. Diaries are also often considered as private documentation, and don't involve a structured or systematic way to document and reflect on the design processes. In our inquiry of a group of master of science students in an industrial design and engineering design studio context (N=31), only few students indicated that they regularly use a diary or a logbook, and even those students didn't structurally use their diaries during coaching sessions or in design team discussions. Such state of affairs can be attributed to the open format of the diary and personal discipline required for its consistent use throughout a design project. What's more, data informally recorded in a diary through snippets of text and sketches is often highly fragmented and difficult to review by a person other than its author, such as a design coach or a design methods researcher.

3   PROGRESS CARD FORMAT

To support design students in reflecting on, planning, and receiving feedback on their design processes, we have developed a design process documentation format called the "progress cards". Progress cards take inspiration from design diary and engineer's logbook traditions, but highly simplify those formats and impose more structure on the performed documentation. Rather than providing a detailed chronological account of performed activities, the progress card format aims to create daily snapshots of student design processes and their intermediate outputs.

The progress card in an A4-sized document that students are requested to fill at the end of a design studio day and subsequently submit it digitally to an online repository. The central place on the progress card page is occupied by a representation of the latest concept generated by the students and a brief description of the experience that students intend for prospective users of the designed artefact or service. Students are encouraged to feature a photo of a prototype with one or more people enacting its intended use. If prototype is not available, a sketch of designed concept in use can take its place. If multiple concepts had been developed in parallel, either the best one can be selected to be featured, or multiple progress cards can be created. The representation and brief description of the concept can then be further annotated by designers. We have explored a variety of forms of such annotation across 8 different design studio courses and workshops accumulating over 500 student participants over a 2-year period.

The progress cards were initially introduced in interaction design studio courses where students work in teams, where only very general design process structure was imposed on the students in form of intermediate deadlines, where students are actively encouraged to perform multiple design iterations and where building and testing of prototypes of various fidelity is strongly encouraged throughout the entire process. In this context, progress cards were aimed at leveraging the role that prototypes and other manifestations of designed solutions play in design processes, where they help in converging insights, framing problems, generating new creative ideas, effectively communicating them within and outside of the design team, and instilling new concept and research directions [2, 13].

4   PROGRESS CARD VERSIONS
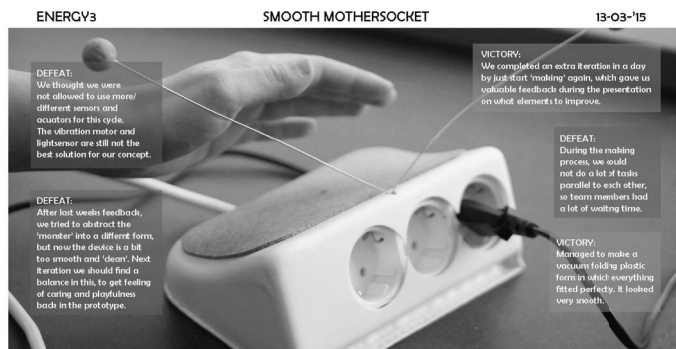
4.1 Free annotations version

The initial, "free annotation" version of the progress card format, as shown on the left in figure 1, used a landscape format, on which the photo or drawing of a designed solution in use would take most of the page, while annotations were made on top of that picture. In this format, the students were instructed to label annotations as "victories" and "defeats" to signify their subjective evaluation. Such format was applied in the course of a large design studio with 108 participants consisting of 20 work days spread over a 5-month period in the spring of 2015 and an intensive interaction design workshop with over 50 participants, consisting of 10 consecutive workdays, in the summer of 2015.

4.2. Structured annotations version

The "structured annotation" format of the progress card had portrait orientation, giving students more space for annotations, and reducing the need for graphical editing, that was observed to take too much time to perform with the previous version. Additionally, students were instructed to organise their annotations in four categories, namely "understanding context", "ideating", "implementing", and "communicating", to stimulate annotations belonging to the first two groups, which were underrepresented in the free-annotation version of progress cards. This version of the progress card format was tested in an interdisciplinary design studio accumulating over 50 work days and 28 participants in the fall of 2015, and in an interaction design studio of 20 work days with 98 participants in the spring of 2016, both stretching over the full semester. In the first case, students worked in the design studio for several days each week, and the requirement for progress cards was reduced to one per-week.

4.3. Digital form version

The third version of the progress card has been created as a digital pdf form that used text fields, drop-down multi-selection menus and an image upload prompt. These changes were introduced to facilitate filling the form, to ensure uniformity of forms submitted by students and to facilitate collection and analysis of data. This version included two variants. In the first variant all annotations were labelled with activity categories and victory/defeat qualification, similar to the earlier structured annotation progress card version. The second variant removed the victory and defeat distinction and provided new categories suggesting a specific type of intermediate design process output rather than activity. For example, "idea" replaced "ideating", suggesting that the merit of an idea should be described in the field, not the process of generating it. To compensate, a separate field was added to provide an opportunity for reflection on activities and teamwork, such that those descriptions would not be mixed up with documentation of process outputs. The first version of this format was evaluated in a design studio of 50 work days and 27 participants in the fall of 2016, and the second version in the spring of 2017, with 102 participants.

ENERGY3   SMOOTH MOTHERSOCKET   13-03-'15

DEFEAT:
We thought we were
not allowed to use more/
different sensors and
acuators for this cycle.
The vibration motor and
lightsensor are still not the
best solution for our concept.

DEFEAT:
After last weeks feedback,
we tried to abstract the
'monster' into a different form,
but now the device is a bit
too smooth and 'clean'. Next
iteration we should find a
balance in this, to get feeling
of caring and playfulness
back in the prototype.

VICTORY:
We completed an extra iteration in a day
by just start 'making' again, which gave us
valuable feedback during the presentation
on what elements to improve.

DEFEAT:
During the making
process, we could
not do a lot of tasks
parallel to each other,
so team members had
a lot of waiting time.

VICTORY:
Managed to make a
vacuum folding plastic
form in which everything
fitted perfectly. It looked
very smooth.

SMOOTH MOTHERSOCKET is a powersocket in the form of an abstracted insect that will keep you aware
of the fact that you have stuff plugged in, which in some cases might be unnecessary energy waste. If
some devices are plugged in, it will start to get agitated (vibration of antennas)after a while to remind
you of using his energy. Giving it a little attention and a stroke on the back will make him calm for some
time again, as you give the feedback that the plugs are still efficient power use.

Future scenario summary:
People care about their health but at the same time want to work in an efficient and productive way.
It is important that they find a balance between all their needs & responsibilities. In the future,
objects in their home will be able to detect their physiological state & make recommendations.

Prototype experience photo:

Process outputs:
insight   about   technology

In our future scenario, we have determined that objects can sense people's moods and vital signals
(heart rate, sweat, etc.) & respond accordingly. For our prototype, we want to make the 'desk of the
future,' which will be sensing and communicating with the user to keep them productive & healthy.

idea   about   technology & people

We want to make use of multi sensory elements such as alerting the user to eat with the smell of
food, urging them to call their family members or friends with a photo, indicating them to go to the
restroom with a water sound.

recipe   about   people

It is ok for people to work at whatever time makes them most productive but we want them to make
time for themselves. People need to be aware of their work / life patterns to improve and create
better balance between the two.

Teamwork:
We had some trouble coming up with our next idea but, through some creative brainstorming and
inspiration from outter sources (the Sims), we improved our last concept and grew enthusiastic
about it.

07/04/2017   real life sims, work 1

Figure 1. The pdf-form version of the progress card (right) stimulates students to document intermediate outcomes of their processes in a structured way, as opposed to the initial free annotation format, where students mainly reflected on design activities (left)

5   EVALUATION AND DISCUSSION

Each of the versions of the progress card format has been evaluated directly after its use in the design studio and incrementally improved afterwards. The information reported in the progress cards by students has been coded based on the content depicted in the image, categories and text of the annotations, and analysed in conjunction with notes collected throughout coaching sessions. Unstructured interviews about the use of progress cards have been performed with students and design coaches during and after the courses where progress cards were used. Further, the digital form version of the progress card format has been evaluated by students in a survey performed after design studio completion (N=15).

Analysis of all versions of the progress card format has revealed a tendency among students to favour documenting team activities over documenting the outputs of these activities. For example, when not actively reminded to adhere to the prescribed convention, students would commonly feature photos of themselves at work, instead of their design manifestations. To give another example, in the first version of the format featuring no constraints of annotation, students mainly wrote annotations addressing teamwork-related issues, written in the first person, while the technical performance of prototypes was second most common theme. Other topics such as user research insights, new concept ideas, or design problem redefinitions were almost entirely missing from annotations, although they constituted substantial part of students' work, as revealed in coaching interviews. The interviews accompanying coaching sessions have further revealed that much of the insights or ideas generated during student design processes remained tacit, and that students had trouble in their written articulation, especially when under time pressure. The later versions of the format addressed this problem by providing more rigid structure and vocabulary to articulate various forms of knowledge generated by students, and less emphasis on indicating design activities. For example, descriptive knowledge could be indicated by choosing "insights" from a drop-down menu, abductive reasoning by "ideas' and prescriptive knowledge by "recipes", with a possibility of further indicating areas that this knowledge dealt with, such as "people", "organisation" or "technology". This revision of the format has significantly improved the documentation of process outputs in progress cards.

Further, low motivation to fill in the progress cards was observed among many student groups, characterised by increasing percentage of students stopping to submit progress cards when not actively reminded of the requirement. The observed retention was much lower in the situation of the intensive design studio, where progress cards were submitted on a weekly, not daily basis, which can be attributed to the lack of routine. Following the termination of the course, unstructured interviews with selected participants have revealed that students saw progress cards during the process as an

"additional task", which took "time (they) would have preferred to spend on design activities". None of the teams used progress cards to reflect back on their process, while in retrospect most students agreed that doing this would have benefited their learning process, in one case blaming the design coaches that they didn't enforce such reflection, only suggested it. Notably, the final version of the progress cards, as featured in figure 1 on the right, has been met with the most positive reception from students to date, with the majority of participating groups reporting to use the format in internal discussions, and not requiring reminders to maintain using the format.

Figure 2. Progress card format enabled design coaches to get an overview of student design processes, compare them to each other and understand design process dynamics throughout the course and after its completion, in a time-efficient manner

While the progress card format was initially not fully embraced by the students, it has become more eagerly accepted by their design coaches. While some coaches did not adopt the use of progress cards immediately, over time it has become a coaching habit to print out and annotate a progress card before meeting a student group for a coaching session. Halfway and at the end of the course, all progress cards were printed out, assembled chronologically in timelines, compared and annotated by design coaches, as shown in figure 2. In this way, for example, moments when each team's final concept was chosen, when fixation occurred or when the group reverted to an earlier idea were identified, or even influences between groups were spotted, giving design coaches insights and overview that regular coaching sessions failed to provide.

6 CONCLUSIONS

Progress cards have been introduced and evaluated in a range of prototype-oriented design studio courses dealing with interaction design topics. The use of the format caused initial resistance from the student designers due to perceived additional work. However, the format's acceptance has been substantially improved by a) introducing fast to fill in digital forms, b) using clear form structure with main areas clearly designated for documentation of intermediate process outputs, c) drop-down categorisation of these outputs, and d) providing a separate field dedicated entirely for teamwork. The progress cards have also proven to be of high value in providing insights into the student design processes for design coaches and design process researchers, both in respect to assessing and guiding work of individual students and teams, as well as for comparison of design processes across multiple teams. The digital version of the progress card format has also reduced the workload for design coaches by improving consistency of documentation across time and between design teams, and allowing automated extraction of data for comparison. Based on the success of the format in education, we envision applying the progress cards as a tool for supporting design processes in professional design situations.

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