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A "BABY DESIGNERS" APPROACH: MAKING TRAINEES AWARE OF MAIN PRINCIPLES OF COLLECTIVE DESIGN WITHIN A FEW HOURS

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ABSTRACT
A course in collective design and project management is faced with two difficulties: firstly, most of the concepts which have to be explained are very abstract; secondly, some ideas about designing seem obvious due to trainees' false preconceptions whereas they are, in fact, complex. In order to make trainees aware of this, the training course puts them in situations in which they must experiment by themselves.
A protocol is presented here, which has been repeated with eight groups, concentrates in few hours some situations encountered during real collective design projects. During one morning, trainees spend three hours dealing with the problem, whereas teachers record their observations. The subject of the exercise is to design professional offices. This problem has the characteristics of a real design activity, without requiring any specific knowledge. In the afternoon, during a two-hour debriefing, both the proposed solution and the design process are analysed and some main principles are identified and illustrated. A first group of principles concerns the difficulties encountered in communication, sharing of information and coordination, etc. A second group deals with generic problem - solving difficulties: re-formulation and validation of the requirements, time and sub-group management, the balance between reflection and action, uncertainty, etc. Finally, specific design principles such as function / structure co-evolution, "satisficing" solution, "fixation" on one solution, the alternation of conjectures and evaluations and design "objects" are introduced. This experiment shows that learning by doing and then reflecting on it, can be achieved even at the very beginning of a design curriculum.

Keywords: Initiation in designing, learning by doing, design activity, reflective practice

1 INTRODUCTION

Teaching design requires the presentation and explanation of some complex and non-intuitive principles, and others that seem to be absolutely obvious … although, in fact, they are not. Take, for example various instructions like "watch the time", "look for alternatives", "share your information", or "check your solution meets *all* the criteria". These recommendations are so often repeated but so rarely put into practice! To teach them, students must not only be given definitions, illustrations, and exercises, but above all convinced of how designers, who are not fully aware of their importance, can fall into common traps. To avoid this, active learning [1] is a necessity, provided it is followed by some reflective work.

This paper is to present an exercise built for students entering an innovative design curriculum, without, in most cases, any previous design knowledge. Referring to water babies (babies discovering water in pools with their parents), they will be called "baby designers". Now, let us … plunge into the description of this exercise!

2 DESCRIPTION OF THE TEACHING SEQUENCE

The sequence is one day long: in the morning, trainees collectively deal with a problem for 3 hours; in the afternoon we (the teachers) run a 2-hour debriefing, examining what happened firstly from the students' point of view, then according to the teachers'.

2.1 Subject

The subject of the exercise, adapted from a real problem encountered, is to design the lay-out of professional offices and one conference room. It requires the analysis and interpretation of client needs, choosing furniture from catalogues and determining their lay-out, in order to meet client requirements. The specifications are as badly formulated as they tend to be in real projects: incomplete and open questions, fuzzy problem boundaries. For example, some facilities like additional meeting rooms or electronic materials are not to be included in the budget despite their detailed description in the specifications. There is missing data and implicit reception criteria. There is a false problem, which is that the cost criterion is in fact very easy to meet, and a true but hidden one, which is that the available area is too small to contain as much furniture as required. This hidden problem cannot be discovered before an initial scaled lay-out is drawn. Moreover, there is no solution matching all the criteria; trainees have to enter into negotiations inside and outside the group and to make decisions, including trade-offs. This makes it impossible to evaluate the quality of the solution according to one single dimension. For all these reasons, it is considered that this exercise deals with design activity, and not only with problem solving: in particular, it meets the main criteria set up by Dorst [2] (challenging, realistic, appropriate for the subjects, not too large, feasible in the available time, within the sphere of knowledge), and requires co-evolution between problem and solution as well as framing of the problem [3].
In order to be close to reality, some means of disrupting the process are specially designed: each trainee gets a different and incomplete set of data … without his knowing, so that a complete initial description of the problem cannot be established without active cooperation. Moreover, some disruptions are introduced during the exercise, for example, a budget cut, or additional criteria revealed, or suggested by the teachers during "client" meetings with some of the students. These meetings require some preparation, parallel work, restitution, and time investment. Except for this, the teachers don't participate in any way while the exercise is in progress.

2.2 The observation

The two teachers are in the same room as the students and move freely from place to place, trying to be as discrete as possible. During the exercise, their only role is to observe and record all the facts esteemed "significant". These recordings concern: external events such as disruptions and client meetings, organization (such as parallel work, meeting coordination, individual trainee attitudes, roles and missions attributed, space organisation), time management, transmission of information, construction and use of design objects (such as drawings, both individual and collective), emergence and resolution of sub-problems. When possible, they try to follow sub-processes leading from individual concerns to collective ones. The main recordings take the form of

handwritten notes, sketches, photos, and few short video sequences. They attempt to note as many observations as possible in order to give students a true reflection of their activity, demonstrated by "objective" facts.

2.3 Debriefing students

The teachers prepare the debriefing during the students' lunch break. They first compile their individual notes, prepare an evaluation of the work done and choose the facts to point out in order to illustrate specific project and/or design principles.
To begin the debriefing, students are asked to evaluate their own work, to identify what they consider positive or what could be improved, according to the two directions "what" (the deliverable) and "how" (the process). Then, the teachers complete this evaluation with their own. Finally, the teachers take time to name, illustrate and comment on some principles and to give possible recommendations for improvements.

2.4 Limitations

First, the supports used for making notes were not fully formal; they did not contain a strict definition of the information to be recorded and they developed slightly from one session to one other. Secondly, the same points were not systematically focussed on for all the groups, partly due to the development of the teacher's role, and partly due to the necessity to adapt the exercise to the objectives of the various different courses it is included in. In addition to the absence of reproducibility, this makes formal comparisons between the groups irrelevant.

3 RESULTS

This experiment was conducted on eight groups. Five of these groups were studying for a Master's degree in product innovation (see [4] for a description), one group came from a Master's degree in international project management, and two groups from a vocational training course in project management. The number of trainees in each group is respectively 13, 8, 10, 13, 6, 16, 8, and 13.

3.1 About the deliverable (technical proposal + its presentation)

All the groups were able to propose a solution, but its "quality" varied largely. Only two groups proposed alternatives. The problem boundary was not always kept to: three groups included additional materials (such as computers) and one included additional meeting rooms. Two groups appeared to fail to discover the existence of a problem with the available area. Arguments to justify the proposed solution were included (budget + area) even if not really consolidated from our point of view. The final presentation varied from "100% improvised in a panic" only based on the re-use of the documents built during the collective work, to a "not-too-badly" prepared meeting with an agenda, including tables or sketches specifically prepared.

3.2 The design process

The design process can be flagged by remarkable events; some of them are individual, some concern the whole group reaching some consensus. Some of those events are mentioned here, with the time elapsed from the beginning of the exercise (the total duration of the exercise varies from 150 to 180 minutes).
The first verbal exchanges come soon, from 2 to 10 minutes. They often concern sharing information or organising the space by moving tables. The discovery of the first trap (no one has a complete set of information and problem definition) ranges from 2 to

23 minutes and the time before a first set of requirements is shared can be long (from 18 to 47 minutes). Information is collected and interpreted, often leading to a list of criteria (15 to 72 minutes). This list is not always correct; the two groups who established it soonest failed to see the problem of insufficient space. In this first phase, the nature of the deliverable is also discussed (but rarely displayed on a board), and the same is true for the project plan.
Questions to the client are also collected and the first client meeting comes between 14 and 73 minutes (!). Only four groups asked for a second client meeting; three of them after 2 hours work. As a result, these groups were able to obtain reactions of the client on a hypothesis for a solution before the final presentation.
A key event of the process is the first hypothesis of a solution. It is a very crucial milestone, since only a scale drawing makes it possible to detect and then demonstrate the problem due to little available space. Furthermore, it was observed once that this problem can be explicitly evoked but not taken into account, by a group that did not make scale drawings. A difference was suspected between "innovation" and "project management" group behaviours. The first groups seemed to start a structural description of a possible solution sooner, despite the fact that a list of criteria was not yet completed, whereas the latter only started after a "long" time (≈ 90 minutes). The delay between scale drawing and an effective collective grasping of this problem can be short (11, 16 minutes) or … infinite. Finally, an explicit convergence of the whole group was only rarely observed for and that happened in the case where a very sound solution description had been achieved.
Some other observations can be pointed out. Parallel work is the norm, probably also due to the number of students, sometimes with individuals acting as interface actors to transmit information and coordinate sub groups. These roles can be implicit, occasionally explicit, or else correspond to leadership. The work packages more often correspond to a splitting of the deliverables, where one group chooses materials and the other draws, than to the product structure, where one group designs the meeting room, the other the offices. In one such case, quite a convincing solution was observed. Finally, the scheduling of time is often poor, even though regular reminders of time are made, although sometimes late in the procedings: one full hour (i.e. nearby 40% of the exercise duration) can be elapsed before the word "time" is first mentioned! As a consequence, a high level of stress is the norm at the end of the session.

4 PRINCIPLES HIGHLIGHTED

In compiling the eight sessions, students were shown and given illustrations of concepts on "working together", solving problems", and "designing". They must be read as possible principles that can be observed and identified in order to make students aware of them.

4.1 Working together

In this section, principles are presented that could be seen as obvious. It is necessary to show that communicating, working in groups and sharing information is neither easy nor natural. This exercise is to convince students firstly that these difficulties actually exist and that one must pay constant attention to steer clear of their pitfalls. We also introduce the notion of roles, from discussions on leadership and coordination of sub groups; for instance, we show that working together requires these roles to be maintained even when their "owner" changes (for example when the "leader" meets the client, or when no information comes from the other sub group for long a time). Terms

like "mission", "listening and reformulating", "enrolment" and "process" are voluntarily used and illustrated when possible.

4.2 Solving problems

Before looking in particular at the act of design, generic principles to any problem solving situation are presented.

The first one concerns the understanding, (re) formulating, and validation of the requirements. The necessity to collectively interpret the initial problem including possible shifts and to have the client's feedback is focussed on.

The second is the balance between reflection and action. The very short time allowed requires, on the one hand, taking the time to clarify the problem, on the other hand, starting very soon to search for solutions. Semantic differences are made between reflection before action, reflection in action, and reflection on action [5].

The third concerns the prioritising of tasks and the attribution of resources. In particular, the discovery of a new problem disturbs an existing organisation and can reveal a better or worse controlled management of these collective situations from "no reaction" to "stop everything, everyone work on the new emergency".

Finally, the management of uncertainty and its "tolerance" can be examined: the tendency to reduce uncertainty is common in this exercise. It was observed that amazingly nearly all the trainees confronted with missing information prefer to try to guess it (to make hypotheses about it) instead of searching to get it elsewhere: the client is never perceived as a potential partner.

4.3 Designing

Specific to the act of designing, is the necessity to see an artefact from multiple points of view, among which function and structure are probably the main ones. The requirements are mainly set in functional terms but not exclusively, as some elements of solution are given, whereas the "result" appears as a structural description. But in fact these two descriptions are more intricate. The best indicator is certainly the notion of a "satisficing solution" [6]. This term must be understood, not as a sub optimal solution but as a solution which satisfies the designers themselves. It is for instance easy to show that some criteria have been interpreted, sometimes added or neglected.

These two descriptions co-evolve [7], and iterations due to the wicked nature of the problem are necessary. The emergence of a problem via the materialization of a solution is an unexpected discovery [8]. As a consequence, the final proposition should include both descriptions: what the object is, what it does and the arguments linking the proposed structure to the interpreted functions. Nevertheless, trainees rarely carry out a briefing before presentation in order to consolidate their proposition. Regarding this aspect, a contradiction can be identified between the reality of co-evolution, and the standard rules of project management: firstly identify/clarify the problem, and then search for its solution without modifying it.

Giving attention to some short interactions, it is also possible to show students the constant "back and forth" between conjectures and evaluations: "what if design"[9].

Concerning the vision of the solution trainees have, we observe some elements of "fixation" and more often "attachment to the first principle": the first hypothesis of solution, if traced forward is regularly a strong foreshadow of the final proposition.

Finally, the different functions of design objects can be illustrated: they are media for individual and collective reflection, parts of problems and of solutions; they are traces for the activity and have also some socio-technical functions.

5 CONCLUSIONS

The complexity of designing and the existence of preconceptions [10] make it difficult to teach it. Learning by doing is probably the natural response. In this article, we show that the method of observing designers and engaging with them on a review of their past activity can be extended to novices. Asking "baby designers" to design is a good way to name and illustrate principles suitable for the description and comprehension of the activity and to make them aware of them. These principles (and future associated skills) relate to "working together" (socio communicative skills), "solving problems" (piloting the process with a permanent reflection on it) and more specifically "designing": understanding function / structure co-evolution, being able to go beyond the "only satisficing solution" and the attachment to the first principle, to move rapidly between conjectures and evaluations and to use design objects in an optimal way. This exercise can also introduce the necessity for a reflexive activity [11].

In order to conduct such a teaching strategy, a design problem was chosen which could be accomplished without specific knowledge. The observation and restitution process of the trainees' work was also constructed. Nevertheless, the protocol can still be improved in order to adapt it to specific purposes when required, and to collect more objective and systematic data.

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