

Controlled Confusion: Teaching complex multidisciplinary group work

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ABSTRACT

The project described in this paper exemplifies how interaction design students can be prepared for working in groups that are part of a larger, complex, multidisciplinary structure. It shows how a task can be designed to engage a whole class of students, letting each student be a member of at least two groups; one related to that student's assigned discipline, and one related to the sub-project that he or she is working in. This way of intertwining groups necessitates *and* enables communication. The general aim of the project is to increase the understanding of working in these kinds of structures, help students to explore strategies for doing it successfully, inculcate the necessity of communication, clarity and leadership, encourage respect for people from other disciplines, and develop negotiation and communication skills. How the project can be focused towards certain aims is also discussed, as is its strengths, weaknesses and special requirements.

Categories and Subject Descriptors

J.5 [Arts and humanities]: *Fine arts*, J.7 [Computers in other systems]: *Real time*

General Terms

Design

Keywords

Co-operative design, Collaborative Work, Multidisciplinary design, Interaction design, Didactics

1. INTRODUCTION

Large software projects involve several hundreds of people, divided in different groups, each working on their particular part (e.g. the help system) or aspect (e.g. the general graphic design). Also an individual may belong to several groups at once; one may well be part of the group deciding on the general system architecture at the same time as one is responsible for coding part of the system. Overall, these large projects are very complex,

complicated to run, and very unpredictable, and since they involve so many people effective communication and decision-making is important but may be lacking (Brooks, 1995). Naturally, this manner of working necessitates communication skills, negotiation skills (often due to a lack of clear leadership), diplomatic skills and a flexible attitude towards changes to a much higher degree than in a smaller project. Another aspect of real-life work is that it is multidisciplinary; people with many different skills work together on the same project, bringing with it a need to respect and cooperate with representatives for other disciplines.

How can we prepare interaction design students, which are having no previous relevant work experience, for this type of work situation? Possible ways are to let the students work on more or less multidisciplinary design projects in groups, as is done in many design educations (Baumann 2004), or to let them work on a real-life project with a company as customer; another common approach. In the first case however, the amount of involved people, disciplines and need for cooperation with other groups is often lacking. In the second case, the students typically work as a whole *group* of interaction designers, and this may not necessarily be the case in for instance the consulting business; in smaller projects there is often only one interaction designer.

2. RESEARCH GOAL

Below, it is described how a deliberately unstructured and rather informal project featuring groups, subgroups and dual roles for everyone, is tried out as an (other) way to prepare students for *work in groups that are part of a larger, complex, multidisciplinary structure*. To elaborate, the aim was to increase the understanding of working in these kinds of structures, help students to explore strategies for doing it successfully, inculcate the necessity of communication, clarity and leadership, encourage respect for people from other disciplines, and develop negotiation and communication skills.

2.1 Methodology

The project was carried out as an action research project within an education context (cf. Basse 1998, Carr and Kemmis 1986, Elliot 1991, Hopkins 2002, Schön 1983 and many others). Hence it was based on the authors' practical experience from both teaching and consulting in small as well as large software projects, i.e. in the work situations described above. In a sense, the project was already in its second iteration, since it was preceded by a less ambitiously organized project with the more or less the same task the previous year. During this first iteration, the aim was to

explore aesthetics, not to work with complex groups, and thus the students worked in smaller groups only, and only in one group, since much of the overarching job had already been made; code and design guidelines were already written. Thus, the second iteration built on previous experience about the design task per se and the work in small groups, however the second time around in combination with new ideas more targeted towards the (new) research goal. Data was collected in four ways. Three of them were: an evaluating class room discussion, a questionnaire and the students' own reflections in the form of 61 submitted learning incidents. These data were used to see what the students had learned from the experience, the questionnaire data being the most important one, albeit the other two data collecting strategies contributed with specific examples of what was prominent in the questionnaires. In addition, data was collected by the author's observations during the experiment, and these observations, together with the observations made during the earlier year, was the basis for much of what is said in the discussion on what is needed in such a project and how it can be re-focused.

2.2 Setting

The project was run as a collaborative class project in a project course on interaction design. Self-set requirements (due to the course the project was a part of) was that it had to be designed for a class of ca 35 students (not involving students from other classes or programs, to facilitate organization), and last no longer than two weeks. The students that took part were master students in interaction design. All had been studying in higher education for at least three and a half years already, however they came from different educational backgrounds. In all, 38 students took part, and the project was supervised by the author and another teacher. The project was not graded, in order to encourage experimentation.

3. THE PROJECT

The project, called Physical Poets, aimed at creating a system of interactive personalities – Poets – manifested both physically, graphically, in words and in code. This meant that this particular project required people of five different disciplines: programmers, graphic designers, writers, craftsmen and actors. (The hardware was already present, as was some code). The task was presented in such a way that the students got a sufficiently detailed (but not too detailed) description of what the system “did”, however without really describing how it looked or seemed, meaning that they had rather free hands. I.e. they were instructed to design poet dolls but there were no instructions on what they should be made of, for instance. To download the entire task description, go to:

http://www.cs.chalmers.se/~lundus/lundgren_physical_poets.pdf

3.1 Organization

The work evolved around two types of groups, poet groups and discipline-based groups:

- **Poet groups** were responsible for creating all the aspects of their Poet, i.e. personality, looks, posture, manner of speech, behavior towards other Poets etc. Each poet group consisted of members from all five disciplines
- **Discipline-based groups** were responsible for creating shared aspects of the entire system, like the system architecture, graphic guidelines, screen layout, choices of materials and forms for the physical part etc. In most cases more than one discipline-based group needed to take joint

decisions on such aspects, e.g. the graphic designers and craftsmen needed to agree on general Poet appearance. Students chose their Discipline themselves.

Hence, each student belonged to two groups, a discipline-based group and the group of one of the six poets. Thus, every student brought unique information to the groups; to the discipline-based group the knowledge about the “own” Poet, and to the poet group the knowledge about the ongoing work and decisions in the discipline-based group. Note that we *deliberately* did not assign any project leaders or any superior leadership, in order for the students to try and evolve strategies to solve this themselves. One of the ulterior motives for this was to show that project leading, time schedules and sticking to deadlines is actually a necessary part of larger projects.

What the students *did* get was a schedule stating different deadlines and twelve scheduled workshops (e.g. “Programmers, Actors and Graphic Artists: Establishing Poet behaviors and interactions between Poets”) with detailed instructions on what to do in each workshop and what to deliver; in all this was a 28-page document. Several of these scheduled workshops involved more than one discipline-based group, which initiated and ensured communication between groups as a whole. The workshop instructions were over-arching; they contained formalities (like deliverables) and suggested ways of work, but did not contain any artistic constraints; partly to make the project fun and interesting, partly to increase fuzziness and communication issues, partly to practice the students' negotiation skills. The students were also instructed to meet in their poet groups every day to share information, as well as put various design decisions in a file marked “Design Requirements” so that any one on any time could get an update as to what was going on in each group.

The entire project description, schedule, and workshop instructions can be found at [reference to own web].

3.2 Ways to work: Cooperation and confusion

When observing the students during the project, it seemed that they mostly worked in discipline-based groups (for scheduled activities) or in smaller pairs; either fractions of the discipline-based group or the poet group. E.g. three of the craftsmen would cooperate in sewing clothes for all six Poets, or two programmers would cooperate in writing a specific code module. Overall, the programmer group was the one working in the most structured way. This may be due to these students' experience from previous programming projects.

Overall there were several clashes between individuals in the same discipline-based group, or between discipline-based groups, but also good strategies to solve problems. A few examples include:

- The graphic designers changed the appearance of one Poet, meaning that the craftsmen had to redesign part of its clothing. This small issue this grew to a large conflict since both parties decided to stand their ground rather than compromise.
- The graphic designers got an idea on how Poets should change appearance depending on mood. When presenting it to the programmers they were told that this was fine per se but that it would require a very large amount of images for each Poet. In this case the graphic designers appointed a spokesperson who, together with the programmers, came up with a solution.

- Since several writers had different strategies for creating their Poet's language, it required several redesigns of the Poet code, but in this case these changes were negotiated with the poet group's programmer.
- The graphic designers were a rather large group, and this group thus had substantial problems in making decisions; in the evaluation they strongly pointed out that having a group leader would have been better.

It seems to have been few conflicts within the poet groups; these were in most cases resolved with the actor as the "judge".

3.3 Learning Outcomes

The class discussion and the comments in the questionnaire were very much targeted towards lessons learnt in terms of organization, working in sub-groups and larger groups. Overall the students expressed that they had missed some kind of superior leadership; several suggested a managing group consisting of group leaders from each and every one of the discipline-based groups. Many of them also discussed not only clashes and issues that had arisen but also the strategies they used to resolve them, indicating that the project had been very instructive in terms of working in larger projects. As for the "learning incidents", 13 were directly related to cooperation issues. Four of these were for instance:

"...[today] gave me the insight that there was a lot that wasn't communicated between the different areas of responsibility [i.e. the discipline-based groups] and that we need more cooperation with above all those who program the view and those who are [designing the physical Poet dolls]."

"Learning: Fast decisions on common things must be made even if all don't agree about everything, one has to mediate between many different groups and listen to above all those who are affected technologically but preferably from as many perspectives as possible."

"Realized the problem with cooperation in between larger groups, to make decisions and agree on what one is discussing gets harder."

"The mental image [of the Poet] became much clearer when meeting both programmers and actors. Interesting with the different perspectives that create discussion and partly different wished regarding the Poet."

In all, the data collected suggest that the student's did learn some, but not all of the intended things. They did get a deeper understanding for working in large structures, and they certainly did see the necessity of leadership and clear communication. They also expressed respect towards the other disciplines. However, some disciplines were much more "in the middle of things" than others (i.e. learnt more); e.g. the writers' tasks were perhaps not so well thought out since they did not do very much together in their discipline-based group. As for the outcome of the system as a whole, the students were proud – and surprised – with the final outcome, and many found the project to be both fun and educating.

3.4 Possible improvements

There are some possible improvements to make in this particular version for the project (as for re-targeting the project, see below). If the actors really are to be kept as a discipline-based group they need more support, and in addition they as group need to get a

responsibility to contribute to the final result. However, they will still only become a valuable part of the project if the students that are assigned the actor role *are* good actors. Thus, omitting them as a discipline may be a better choice. Another, more feasible change is to give the writers more shared tasks; instead of allowing each writer to create their own strategy to be able to generate the Poet's language, they could be forced to come up with a joint model. This in turn would reduce some of the programmers' work which would be beneficial, since they worked hardest of all.

4. GENERAL DISCUSSION

To clarify, the main idea behind this type of project is to create intertwined groups, in this case poet groups – hereafter referred to as sub-project groups – and discipline-based groups. The main idea behind this duality is to both necessitate and facilitate communication; necessitating it because the groups are working independently and facilitating it since members bring information from the sub-project group to the discipline-based group and vice versa. Again, the duality brings with it more insight into the entire work process and communication structures, than just belonging to one group.

This of course brings with it the task to create a project task which contains both a significant amount of disciplines and a suitable number of sub-projects. On the other hand it does not matter *which* disciplines or *which* sub-projects. In the project described, the students were already trained in different skills (except for acting), so it was easy to create a task relying on their different skills. If, on the other hand, the class is not heterogeneous, one can use the rather common approach to recruit the different disciplines from students studying different subjects, turning it into some kind of joint project course. Or, the project can be steered towards communication and negotiation skills in which case the different disciplines can become more common. Regardless of which disciplines that are chosen, having several of them brings with it issues of influence and work load; every discipline should have the same influence on the final result (i.e. avoiding boring, unrelated "maintenance work", e.g. lots of low level programming), and in addition every discipline should have equally much to do (or else sub-project groups need to be redesigned, e.g. consisting of two programmers, one craftsman etc.). Introducing an unbalanced work load will of course increase complexity since it brings with it aspects of agony, irritation and jealousy, probably aggravating communication, but these feelings will most likely reduce the wanted outcomes of exploring communication strategies and respecting other disciplines, as well as cloud the entire experience, and can thus not be recommended.

Then there is the issue on exactly how much confusion and misunderstandings one wants to expose the students to; obviously this increases with the number of disciplines, groups and students. This is also related to the size of the sub-project groups; the ideal team size is 5-6 people (Jaques 2000). Keeping teams at this size turns focus towards inter-group relations rather than intra-group relations (Jaques 2000) – which are practiced in any group project anyway. Then again larger teams or larger amounts of people can be moderated or steered by some kind of formal leading structure, e.g. by letting project leading become a discipline. Or if not, one could still encourage or enforce each discipline-based group having its own leader, leading to the next issue – by whom (and how?) should this leadership be assigned?

If one wants to refocus the project a little bit towards actually practicing skills and an exploring overarching theme, one can decrease the amount of joint structure, i.e. decrease the work carried out by the discipline-based groups. In the Physical Poet case this would mean omitting for instance the directives on creating a joint "world" for the Poets (they look the same way, they use a substantial amount of shared code etc). Another possible way would be to decrease the amount of collaboration by decreasing the number of disciplines, or by excluding parts of the project, shrinking it.

In short, it seems that the hardest, and most important part of running a successful project of this kind is to design a suitable project task that gives members of each discipline a sufficient amount of meaningful work. The other aspects – balancing the complexity – do not affect the learning outcomes as much; the project will inherently be more or less complex.

5. CONCLUSION

One may well use a tailor-made version of this project in order to let students practice working in groups that are part of a larger, complex, multidisciplinary structure. There are however a few fixed requirements:

- Every participant must be a member of at least two different groups, one sub-project group and one discipline-based group.
- Sub-project group sizes should be 6 - 3 people.
- The workload must be balanced so that each discipline delivers approximately the same amount of work (regardless of in which group).
- Each discipline's work – except project leading if present – must contribute significantly to the final result.

It is also recommended that the project is not graded in order to encourage experimenting, cooperation and exploration.

The project can be designed towards promoting complexity as follows:

- Not including project leading as a discipline
- Involving more than five different disciplines
- Including a complex and elaborate joint structure that all disciplines must design – and use – aspects of
- Not explicitly planning or requiring group meetings.

- Providing unclear and/or ambiguous requirements
- Not planning the order of the work in advance – or do.

Obviously the project can also be more targeted towards practicing skills and/or focusing on project theme if the above suggestions are inverted. Note that an alternative to decreasing a joint structure can be to provide parts of it from the start.

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A full project description can be downloaded at:
http://www.cs.chalmers.se/~lundus/lundgren_physical_poets.pdf