MANAGING INNOVATION: HOW COLLABORATIVE DESIGN VISUALISATION CAN FACILITATE TEAMWORK

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ABSTRACT

Problems do not come in disciplines: as they become more complex and multi-disciplinary in nature we must increasingly work in collaboration with others to solve them. This rise in inter-disciplinary working and an increased use of self employed project workers in industry (in particular in the area of design) can lead to social fragmentation and personal isolation, creating problems when adapting to ever changing working environments and when communicating with other disciplines.

It makes sense then to smooth the transition of individuals into new working environments and facilitate the inter-disciplinary working scenarios they may find themselves in. Providing methods to aid these transitions has obvious advantages for employers and employees and if done correctly, may have greater benefits to all involved.

This paper will briefly review the pitfalls associated with these working practices, considering existing strategies and theories most appropriate for coping with them. It then goes on to propose that team prototyping enhances bonding as well as generating innovative objects.

Through recent post-graduate work at the University of Dundee the paper will illustrate how 3D modelling of abstract concepts, rather than designed artefacts, might enhance communication and decision-making in response to emergent conditions in these complex-working environments. The paper then speculates on how this technique aids design team development. It concludes with suggestions for how designers and design managers may use collaborative visualisation as one of a portfolio of techniques for coping with these complex relationships and how these techniques may be applicable to other situations.

Keywords: Design Visualisation, Teams, 3-D modelling, Collaborative Design

1   INTRODUCTION

Throughout history humans have relied on team work and collaboration to facilitate the completion of complex tasks. Some aboriginal American Indian tribes, for example worked almost solely in this manner. It seems, in a time of increasing globalisation and short term contract work, where problems are becoming more and more complicated, the old adage " a problem shared, is a problem halved" is as relevant today as it always has been. As we find ourselves coming full circle in our approach to problem solving, we should be aware that collaboration is a natural way of working. We may only have

to create the correct tools and adapt our ideas to facilitate the organisation of efficient and dynamic project teams.

In his book Designing in the Bubble John Thackara states that, Designers are evolving from being individual authors of objects, to being facilitators of change among large groups of people [1]. With an ever-increasing dependence in design upon inter-disciplinary team-based working, it is therefore logical that we consider the management, or methods for managing the team working process in the context of design.

Most designers are aware of at least some of the many existing design and team process models and their ability for the improvement of inter-disciplinary teamwork.

Team developmental sequence models, although less well known, clearly identify stages of team development to team members. These models tend to be most useful when used as reflective tools. This may well be because they identify subliminal mechanisms of behaviour and emotion that, while vital to the process, are not the main concern of the team in the working scenario, or simply because they are less well known.

 When dealing with the introduction of new team members or short-term contracts however, it is usually a case of "fitting-in and getting-on" on behalf of the new addition. This is not a problem for a highly cohesive or "performance" team but these tend to be few and far between, meaning that the introduction of new members to existing teams can have disastrous results, for this reason it is important to introduce methods to manage these situations earlier in the career of young designers.

2   VISUAL PLANNING

Whatever the journey you're taking, it is always advisable to have a map or guide before setting out and the same is true when embarking on a project.

Designers have a prescriptive rather than a descriptive job. Unlike scientists, who described how the world is, designers suggest how it might be. Designers are therefore all futurologists to some extent. The very essence of their job is to create the future, or at least some features of it [2].

In order to manage innovation, we must make the processes involved explicit. The following hypotheses were formed after the author conducted two experimental pilot studies (hereafter termed 'collaborative visualisation' sessions) on a student teams at the University of Dundee. These studies were inspired by the MPhil work of Sean Kingsley (also at the University of Dundee) in which the 3D prototyping of products was seen to enhance team bonding.

The act of creating a model seems to encourage commitment and familiarise team members with each other. Individuals can represent skills, and in doing so give greater understanding of their value and the roles they perform. In these ways a visual plan can accelerate a team's progress and act as a social 'ice-breaking' tool. Through the construction of a visual plan we can demonstrate links and relationships and the framework they create. By doing so as a team, interacting around a model, and involved in its construction it may be possible to create a psychological change within the group, encouraging people to think out of the institutional mindset and power structures, and therefore developing creative relationships with one-another. Visual planning [3] has been used extensively in the past, but not necessarily for the creation of shared intellectual space and not, as far as the author has been able to ascertain, in three dimensions.

3 COLLABORATIVE VISUALISATION: BUILDING MODELS OF TEAM PROCESSES

A small pilot study conducted by the author focused upon the need for the rapid development of the common understanding of roles, responsibilities and processes amongst members of small project teams in order to accelerate team development, as described by Bruce Tuckman in the Psychological Bulletin 1965. Tuckman proposed four developmental sequences in small team development: Forming, Storming, Norming, and Performing [4].

Two model-building sessions were held using rough prototype kits as the modelling medium. Ten students were asked to construct three-dimensional plans of their forthcoming team project with one another. The experiments were recorded using video and stills cameras. The prototype output and video recordings were studied to extract information from the project. Observations, concerning the level of involvement, focus, and interaction amongst team members, were made. Participants also provided feedback through a questionnaire.

In the first session students, working on a brief to create a publication of their work as a whole, were asked to model their roles and responsibilities and create a timeline for the project. They were given a basic prototype kit consisting of card strips and a wooden frame from which the model could be constructed (simpler materials were chosen to aid the speed with which things could be done as well as being more 'portable' – i.e. not requiring workshop facilities). The group was asked to represent the progression of time vertically and level of involvement horizontally. Information could be written on the card strips to explicitly state what was being represented. A facilitator was present during the session to offer guidance and advice.

Reflecting upon the first session, modifications were made to both the kit and how the session was run. A second session was then held. Key modifications were: (1) the modelling kit was developed to be more flexible in its construction and deconstruction (parts being connected with Velcro), allowing individuals to make changes more easily; (2) to facilitate eye contact between participants, transparent acrylic pieces took the place of the original card - it was hoped that this would aid interaction and communication; (3) in addition to a session facilitator, a set of instructions was provided; (4) coloured 'arrow' stickers was given to each participant.- these allowed someone to show involvement and direction in the core aspects of the project and/or team [5].

Both experiments yielded findings which are pertinent to team development. The key findings are presented in the next section, with contextualisation from the 'team' literature.

3.1 Power structure

Power structures, whilst needed for the general running of an organization, can have critical bearing upon the creativity of a small project team. "The only practical way to deal with power structure issues is to address them immediately upon the outset of a project" with "the correct conditions set to encourage creativity: Openness, equality, a common identity, and shared ideology" [6]. In the ideation phase of any project it is important to abandon the usual organisational power relationships, promoting openness in order to freely express opinion and ideas without fear of negative criticism. A team (as opposed to a group) is committed to open communication. Team members feel they can state their opinions, thoughts, and feelings without fear. Differences of opinion are

valued and methods of managing conflict are understood. Through honest caring feedback, members are aware of their strengths and weaknesses as team members [7].

Relinquishing control may be difficult for some team leaders, and more traditional thinkers, to accept, but by focusing on skills, rather than status, a productive working environment will be nurtured. Leaderless laboratory groups begin by placing major emphasis on problems of orientation, this orientation serves to define the boundaries of the task (what is to be done) and the approach that is to be used in dealing with the task (how it is to be accomplished) [4].

Using the collaborative visualisation technique at the outset of a project may counter the negative aspects of hierarchical power relationships often associated with traditional management in organisations. The experiments indicate that, as a team becomes more deeply involved in the construction of the three-dimensional visual plan, they become less reliant on the instructions from a team leader and less dependent upon guidance from the facilitator.

3.2 Understanding

Common understanding of the roles and responsibilities of the individuals involved is essential to the smooth running of any team project. Through participant feedback, our experiment suggests collaborative visualisation of roles, responsibilities, and skills gives team-members greater understanding of the individuals involved and the reason behind their inclusion in the team. Team-members state that because the model visibly shows roles, responsibilities and ideas, they become more easily understood. They also report that because everyone has a different visual style and level of input in the process of model building, a clearer picture of the individual and their willingness to be involved as a team player becomes apparent. For example, when asked if the model building helped them understand their fellow students better, all students replied positively. One participant expanded on this commenting; "some people were a lot more detailed than others, they put a lot more effort in." Another stated, "the model shows ideas as well as members' mind models. Each person has their own ways to present their ideas, it helps keep a clear mind and learn from each other. The model is a base for dialogue."

3.3 Shared space

The term, 'shared space' refers to the creation of a common intellectual space, an object or sketch in which a group of people become communally engrossed [8]. The creation of shared space promotes collective thinking, where individuals ignore hierarchical relationships and attend to the job at hand.

At the beginning of the model building process the team appeared rather fragmented as you might expect. However, once the team had been building the model (which on both occasions took around sixty minutes) for fifteen to thirty minutes, they seem to become focused upon what they are doing. They are "speaking less, saying only what needs to be said, and not talking over one-another" as one participant commented. It seems that by working on a three-dimensional model in a very tangible, 'hands on' way, individuals, though focussed on what they are doing, are aware of their colleagues and became coerced into interaction and communication in order to complete their collective task.

The development of shared intellectual space made tangible, through the collaborative visualisation technique, is invaluable for creating a team ethos. It seems to give individuals a feeling of ownership of the project and membership of the team. To assess the effect of the model building process on accelerating team development and helping

create shared space, further investigation is needed. Researching with teams made up of members who are not known to one another would be advisable. This is because team members known to one another may not go through all the stages of struggle and adaptation associated with team development.

Further investigation is being carried out to demonstrate whether the model can maintain the feeling of shared space at later points of a project and how this may be achieved.

3.4 Interaction

If, as Tuckman purports, it is advantageous for teams to progress through the first three, non-productive stages as quickly and with as little upset as possible, then it is logical to suppose that rapid interaction between individuals is vital in the acceleration and formation of team relationships. Collaborative visualisation, especially at the beginning of a project, would appear to encourage interaction: as the process becomes a platform for dialogue. Team members have to communicate in order to create the model and, due to working 'in-the-round', eye contact and conversation are encouraged. The model takes the focus away from the individual, thereby removing barriers often associated with new social interaction.

4 SUMMARY AND CONCLUSIONS

The aim, to use collaborative visualisation as an acceleration tool for small project team development through the creation of understanding amongst the individuals involved, has been accomplished through this pilot study.

The feedback from participants in the experiments has shown they feel the process allows an exchange of ideas within the team whilst creating a clearer picture of the project ahead of them: as one participant commented, "it is a really good way of visualising ideas, encouraging communication and facilitating team work." They also state that the technique allows them to relax and have fun with their colleagues, acts as a platform for dialogue and, because of the three dimensional physical nature of the model, it nurtures a feeling of intimacy amongst the team.

The conclusions drawn from feedback are reinforced by the actions and interactions recorded on video. Due to the size and scope of the study, these are somewhat subjective and would benefit from deeper analysis. A longer study and input from psychologists, anthropologists or other behavioural specialists to accurately assess video and feedback information is necessary.

The development of the technique has drawn upon the Tuckman model of team development. While this has been the reference model for our study, it is felt that Collaborative Visualisation is adaptable to any team developmental model. For example, the use of progression criteria [7], where team members decide the existent conditions to allow them to progress onto the next stage, could be modelled using the collaborative visualisation technique.

The experiments and conclusions have clearly related to small team project activity, though the participants were from a design background, they were from different design domains. The conclusions on the technique of collaborative visualisation may also relate to general views of interdisciplinary team development, whether those teams are related to design or not.

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