An Initial Study of the effect of personality on group cohesion in software engineering projects

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Abstract

Research into the effects of personality type on software engineering teams was carried out on the Software Hut. This is a module in which students from the University of Sheffield engage in a project, which involves an industrial client. The Myers-Briggs Type Indicator (MBTI) was used to ascertain the personality type of the students. Selected teams were observed in team, client and manager meetings, extensive field notes were taken during these meetings. The main aspects that were recorded included the effect of personality type on behaviour towards teammates; clients and managers and how this related to the amount of disruption, positive ideas and equipoise brought forth from each team-member. Initial findings indicate that certain personality types do have a positive, negative or a combination of both effects on the well being of a software engineering team. At all times during the experimental work other factors unrelated to personality type that had a detrimental effect were also noted.

Keywords
Empirical Software Engineering, Personality Theory, Jungian Psychological Types, Myers-Briggs Type Indicator (MBTI), Discovery, eXtreme Programming (XP), Team Work in Software Engineering

1. Introduction

Software Engineering (SE) is a complex social process in which the kind of communication and cooperative interaction between the participants determines to a large extent the quality of a collaboratively developed product. The importance of social processes to SE was stressed in 1995 when Yourdon, Constantine and Thomsett issued the prophetic warning that any future, substantial SE productivity improvements are heavily contingent on much greater emphasis being paid to the organisational, social and human factors of SE (Yourdon, Constantine et al. 1995).

SE activities are essentially cooperative and are performed by teams. In these cooperative situations, different roles of workers such as clients, users, analysts, designers, and managers and so on participate in the activities and communicate with each other (Saeki 1995).
A growth in Empirical Software Engineering (ESE) research has coincided with the greater focus on human factors of SE. This work is not limited to academic centres as SE companies of varying sizes are also interested in finding out ways of maximising the potential of their team members.

This PhD project aims to identify combinations of personality types that will result in a smooth SE team. An underlying theory is that there is an optimal team in SE with all personalities complementing each other, whilst it would be noble to attempt to find this team one must be realistic and accept that this is a utopian ideal. Ultimately such a team may be found but finding this team will no doubt involve large numbers of researchers working over many years. However this study can highlight certain combinations of personalities that are a long way from any optimum ideal. Providing descriptions for these types will allow predictions to be made and will provide a useful source of information for anyone who wishes to form teams based on MBTI classifications.

The study aims to show pairs and even triads of individuals who clash on a regular basis and have a tendency to disrupt the workings of the team. Another scenario is that certain types will not fit into any team; they could have the effect of swamping everything else. The long term realistic goal of this research is to give deep qualitative descriptions of which types will work well and the area of the project that they will excel in. The impact of types will be accompanied by descriptions by Jung and Myers-Briggs of positive and negative aspects of a particular type. This will give any reader a clear understanding of how and why a particular person behaved the way they did. Another goal is to show that disruptions are consistent with Jung and Myers-Briggs description of the particular type.

Fourth year and MSc students in the Department of Computer Science at the University of Sheffield run a professional software house known as Genesys Solutions. It is Genesys Solutions and other undergraduate group projects including the Software Hut that make up the “Software Engineering Observatory”. The observatory allows empirical researchers to observe, question or interview software developers working on real industrial projects.

The existence of this observatory allows many empirical studies to be carried out. Several PhD students and academics from the Verification and Testing (VT) research group have carried out studies of XP and produced publications relating to their empirical work. These include work carried out by Holcombe and Gheorghe (Holcombe, Gheorge et al. 2001). The Software Hut project uses different methodologies namely XP and Discovery. The reasoning behind this was purely for research purposes as it would allow researchers to draw comparisons between competing methodologies by following teams who were working on the same project. The observatory aims to aid researchers and the members of staff involved are enthusiastic about work that is being carried out on the students.

This study uses the infrastructure by observing teams in the “Software Hut”. This involves working closely with the coordinators of the course, and keeping in close contact with the students who are taking part in the project. The observations took place over an entire semester.
2 Background Literature

2.1 The Work of Dr Carl Gustav Jung

Jung is widely regarded as one of the greatest names in the history of empirical science. It is Jung’s work on psychological types that is of direct relevance to this research. Jung began his career in psychiatry in December 1900 when he was appointed as an assistant physician at the Burghoeltzli Mental Hospital in Zurich under Bleuler an expert on psychological disorders and the first person to use the term “schizophrenia” (Storr 1998).

Jung first became interested in personality differences when he considered his own approach to problems of the day with those adopted by Freud and Adler. How was it he asked himself; that each person could interpret the same material so differently? From this question Jung concluded that people did indeed belong to different psychological types and in 1921 he published his book “Psychological Types” (Jung 1976).

Later in his career Jung would relate this back to his previous work experiences. In one of his papers he wrote “I distinguish four functions: thinking, feeling, sensation and intuition. The essential function of sensing is to establish that something exists, thinking tells us what it means, feeling what its value is and intuition surmises whence it comes and whither it goes” (Jung 1936)

Jung explained why thinking/feeling and intuition/sensing are opposites. Jung pointed out that there are two distinct and sharply contrasting ways of perceiving. One means is through the process of sensing, by which one becomes aware of things directly through their five senses. The other is the process of intuition which is indirect perception by way of the unconscious incorporating ideas or associations that the unconscious tacks on to perceptions coming from outside. When people prefer sensing they are so interested in present actualities that they have little attention to ideas and insights that could come from nowhere. Whereas a person who prefers intuition will be so engrossed in pursuing future possibilities that will neglect and even fail to look at the current actualities. Jung also pointed out that there were two distinct ways of judging. One way is the use of thinking, this is a logical process aimed at an impersonal finding. The other is by feeling; this relies on appreciation and bestows a personal, subjective value on things. The T/F preference is entirely independent of the S/N preference. Either kind of judgement can team up with either kind of perception.

People who differ on both preferences will take a different stand on every debatable position. If they are both members of the same SE team then the constant opposition can be a serious strain.

A clearer explanation of these functions is found in the writings of the Jungian scholar Storr. (Storr 1998) These four functions were also associated with an attitude type, either extraversion or introversion. According to Jung an introvert’s attitude is an abstracting one; at the bottom he is always intent on withdrawing libido from the object, as though he had to prevent the object from gaining power over him. An extravert has a positive relation to the object. The object can never have enough value
for him and its importance is always increased. Jung states that “The two types are so different and present such a striking contrast that their existence becomes obvious to the layman”

Jung could have been addressing SE researchers and practitioners when he stated: “Only by understanding our differences can we get beyond intolerance and conflict and achieve respect and cooperation” These words ring true for almost all human activities, although teams are vital in SE it is also important to keep in mind the individuals who make up the teams; in the words of Jung “Personality is the innate idiosyncrasy of a living being” (Storr 1998)

2.2 The MBTI

The MBTI is now one of if not the best-known personality inventories, with over two and a half million people taking the test each year in the USA alone (Myers and Myers 1997). It is a tool that can be grasped and understood in a relatively short time to give a better understanding of people and their differences. The MBTI is the brainchild of Isabel Myers and her mother Katherine Cook Briggs. Creating this test was a major feat as neither woman had any previous educational background in psychology, psychiatry, statistics or test construction. Myers-Briggs dedicated their lives to understanding, interpreting, expanding and adapting Jung’s theory of psychological type. They searched in vain for a test that would indicate a person’s Jungian type and finally decided to create one of their own.

Myers-Briggs decided that one more preference was relevant to the identification of type. This is the choice, between a perceptive attitude and a judging attitude. Both of these types need each other to some degree.

The description of the introvert-extravert dichotomy is similar to Jung’s. A conduct of an extravert is based on the outer situation whereas an introvert starts with the inner ideas; the mental concepts derived from what Jung termed the “archetypes”.

One process, sensing, intuition, thinking or feeling-must have clear sovereignty, with opportunity to reach its full development, if a person is to be really effective. For people to be balanced they need adequate (not equal) development of a second process, not to rival the dominant process but to act as a welcome auxiliary. The fact that Jung didn’t describe the use of auxiliary processes was the main criticism levelled at him from Myers-Briggs

2.3 Version of the MBTI Used

An online version of the MBTI was the logical choice to use to ascertain the psychological type of software hut students in this research. This involved answering a series of questions, this resulted in a classification for the students or indeed for anyone who takes the test. As there are four dichotomous scales the resulting classification is one of four letters indicating the preference in each dichotomy. There are 16 possible types that can result from the test. An example is INTJ (Introvert iNtuition Thinking Judging). On completion of the test the student will also know their clarity of preference for example the result could be: I 52% N 33% T 22% J 62%. An indicator for clarity of preference is:
• 40 or higher (30 for T/F)- Very clear preference
• 21-39 (21-29 T/F)- Clear preference
• 11-20- Moderate preference
• 1-10- Slight preference

When discussing or thinking about the use of psychological tests one must always keep in mind possible negative effects on the research subjects. Research ethics should always be at the forefront of any researchers mind whilst dealing with human subjects. This is another major advantage in favour of the MBTI. All of the categories are neutral. No type or preference is better than the other. The MBTI typology does not explain whether a person is healthy or unhealthy. It does not explain IQ, maturity, emotions or many other things. This is a major plus point for any researcher who can rest assured that on completion of the test students will not be told that they have a propensity towards a potentially volatile label such as “schizoid”, “sociopath”, “hysteria”, “neurotic” or “psychopath”. Running tests on students that yielded such results could have dire consequences in relation to ethical guidelines. That is why in addition to the being the most widely used instrument for understanding personality differences; the MBTI also represents a safe ethical choice for researchers who are not qualified clinicians, Medical Doctor’s psychologists, psychiatrists or psychoanalysts. The MBTI is a good choice to use with people who don’t have severe psychological problems, or who are unhappy and are seeking professional help. The MBTI was designed to allow ordinary, “normal”, healthy people to understand their type and realise that it is ok to be an individual.

2.4 The Work of Dr. R. Meredith Belbin

Belbin’s work was driven by the ever-increasing importance of team working in all organisations. His major contribution to this area “Management Teams-Why they succeed or fail” was published in 1981 (Belbin 1981). The team roles described in this book came to be regarded as standard canon by many in industry and academia.

Belbin observed 7 categories of behaviour in team meetings: asking, informing, proposing, opposing, delegating, building and commenting. Belbin’s work also disproved another fallacy that a team made up of the most intelligent people would automatically be successful. In his research an “Apollo” team represented a team made up of those people who had scored the highest on mental ability tests taken before the research was commenced. Belbin’s results add more credence to the ideas put forward earlier in this paper about personality of team members and cohesiveness is a much greater recipe for success than individual brilliance.

Belbin also identified psychological types for people then identified suitable career paths for them. Experiments with these “pure” teams showed that none of them were able to get consistently good results for many differing reasons. This suggests that a healthy mixture of personality types is necessary for a successful team. For a full description of these results readers are referred to (Belbin 1981).

Belbin was clearly familiar with Jungian psychological types as he divided his team roles into extravert and introverted roles. The most important point to take out of this
is that Belbin was aware of personality types and his team roles can be linked to such types.

3 Relation to SE- Importance of Coherent Teams to SE

Essentially this work builds on foundations put into place by other SE researchers who have sought to utilise personality typologies to gain a greater understanding of human processes in SE. Some researchers such as Rutherford (Rutherford 2001) have used Jungian typology and particularly the MBTI to help them carry out work on SE teams and the individuals who make up the teams. Rutherford strongly believes that using personality inventories can strengthen SE teams. She notes “By having a variety of strengths and weaknesses in a group, the group can better manage all problems which it has to handle. When everyone has the same basic strengths and weaknesses, the weaknesses are multiplied since there is no counter balance to cover for them”.

Teague attempted to identify Myers-Briggs Type Indicator (MBTI) personality attributes of computing professionals that are suited to three major subtasks of computing- systems analysis, systems design and programming (Teague 1998). Following on from this Teague gave a description of the main tasks involved in analysis, design and programming and a classification of each person according to MBTI preferences. Findings included; extraverts,judgers and perceivers are preferred characteristics for systems analysts, designers must be thoughtful, motivated people with empathy for the end users. They must also exhibit a high degree of practicality. Programmers were deemed to be precise, structured and detailed.

Hardiman observed software engineers and argues that the MBTI is a valid predictor of who will become a competent software engineer (Hardiman 1997). Elam and Walz were concerned with conflict analysis during the requirements definition phase of an SE project (Elam and Walz 1988). Essentially they wanted to gain an understanding of the processes which occur when groups meet to design large, complex software systems. The authors stated that they hoped that their work would stimulate other additional detailed studies of other software design teams and that they would be happy for researchers to use their coding scheme and descriptive conflict model. They concluded that conflict behaviour was a normal part of group interaction and was neither intrinsically good nor evil. Elam and Walz detected several cases were personality differences led to some kind of conflict.

Elam and Walz were only interested in observing one team at only one phase in the project lifecycle. Another difference is that they didn’t use any personality inventory. The research described in this report is based on observing multiple teams throughout the SE lifecycle. None the less the paper by Elam and Walz is still very important primarily because of the great similarities that exist between their work and the work described later in this report.
4 Software Hut

The Software Hut module was designed to give students experience of working in teams, in dealing with industrial clients and in dealing with the whole plethora of problems that are present in group projects working to a tight time-scale. Throughout the project the students are given advice on generic team working concepts such as team management, conduct of meetings and action minutes.

This project aims to allow students to become responsible team members, to learn and respect the opinions of others. Therefore this project is directly relevant to this research and the people taking part can provide good experimental subjects. The different methodologies allow researchers to compare and contrast different aspects and predict which methodology is most useful for a particular project. The reasoning behind having different methodologies is to aid researchers who are looking into different SE techniques and ideas.

4.1 Methodology Used in Software Hut- XP

XP is perhaps the best known of a new breed of “agile” SE methodologies. The founder of XP Beck states that there are 12 core practices related to this methodology and he describes them fully in his seminal work on the subject (Beck 2000). Beck was always careful to make sure people were realistic when discussing XP, this becomes apparent in the quote: “If you want to try XP, for goodness sake don’t try to swallow it all at once. Pick the worse problem in your current process and try solving it the XP way”.

In 1999 Beck was forced to admit that XP was not suitable for all projects and sensibly distanced himself from people who were shouting from the rooftops that XP was indeed the “Silver Bullet” to slay the mythical lycanthrope that represents SE team/project problems.

XP is aimed at small to medium sized teams. The physical environment is also important, communication and coordination should be maintained at all times. Business culture is another focal issue in XP, if there is any resistance against XP principles on behalf of project members, management or customers then it may be enough to fail the whole process.

4.2 Methodology Used in Software Hut- Discovery

The Discovery method stands in sharp contrast to XP. This is a traditional SE method whose origins can be traced back to the University of Sheffield. Simons a researcher from the university is the main architect behind the Discovery method (Simons 1998). Discovery is a system-development lifecycle methodology that calls for systems analysts to determine and document detailed user requirements before any candidate products are considered.

According to its founder “The method aims to support both expert and trainee software engineers; it seeks to ensure a guaranteed standard of quality in development, for the lowest cost. Discovery is mostly known for the way in which it
directs the developer's attention using sharply-focused techniques which build upon each other in a clear and obvious way.”

Discovery is influenced by Gestalt psychology in the sense that it attempts to delay the formation of fixed object concepts which could introduce bias into the models. Like XP but to a lesser extent Discovery aims to be a participatory method with involvement and feedback from the client.

5 Research Method(s) Used

Both qualitative and quantitative research methods were used in this project. The project started with an e-mail to all of the students taking the Software Hut module asking them to take the time to complete an online version of the MBTI and return their result to the researcher. A response rate of 53% was achieved. From the responses suitable teams had to be picked for observation. These teams had to have some interesting personality characteristics.

The research used a mixture of qualitative and quantitative methods. The results from the initial e-mail for all respondents and the results from a questionnaire given to the selected teams at the start of the project were quantitative. The results from the observations were initially qualitative and were then quantified. A full description of this process will be given later in this report.

5.1 Observation and Ethnography

Ethnographic research methods were originally founded by social anthropologists to aid them in their understanding of different cultures and environments. They are now used in many disciplines in which research involving humans is important including ESE. To the social anthropologists ethnography was synonymous with living in and immersing oneself in the culture of the group to be researched for an extended time period. This was the case with Mead’s work with primitive tribes in New Guinea and Samoa (Mead 1975).

Ethnography is a rigorous research method in which good data collection and analytical skills are vital. This method aims to allow the researcher to arrive at a theoretically comprehensive understanding of a group or culture. One of the key strengths of this method is that it allows one to gain an ‘inside’ account of the lives of people under observation.

Like any other research method ethnography also has a set of potential problems that come with it. The interpretation of the researcher could be disputed by participants, the subjects under study could be affected (The Hawthorne Effect (Mayo 1977)) and in long term studies there is the risk of the researcher going ‘native’ and starting to contribute to the group under study (Gold 1958).

Although the method used in this research was part of the same family of methods as ethnography it would be technically incorrect to term this an “Ethnographic Study of the Effect of Personality on Group Cohesion in SE Projects”. This is because the researcher was not totally immersed in the lives of the research subjects and because the time period of the research was not long enough for it to constitute an
ethnographic study in the eyes of the authorities on this method (6 Months to 2 years). A true ethnographic study would have meant following the students around the university when they had finished their meetings and even going out on social events with the team(s) to see how SE teams bond and relax in their free-time.

When these considerations are taken into account it becomes clear that the method used was short-term observation. There are different depths of observational study and short-term observation represented the deepest method that was practical to use in this project. Short-term observation is very close to ethnography but differs both in depth and time. The subjects are still observed in their natural setting as opposed to a clinical setting so this is clearly a field experimental research method. Using such methods means that the subjects are harder to control but results are more valid as the subjects are in their own natural environment as opposed to being in an artificial clinic.

Short-term observations focus more narrowly on specified categories of group behaviours. This method is an excellent foil for quantitative studies as it “adds meat to the bone of quantitative research” (Creswell 2002). Types of short-term observational research run the spectrum from crossing the boundary into quantitative research to a very nearly ethnographic approach.

5.2 Selection of Teams to Observe

A satisfactory response rate was achieved over 50% of the relevant students completed and returned their MBTI result. For each methodology one team that would be using it was selected for observation on the basis of having a reasonable variety of personality types. Both groups that were selected had a majority of N’s, T’s and J’s. This reflected the overall results, one team had a majority of E’s the other had a majority of I’s. There were big differences in the clarity of preference for each function and attitude and this was reflected in the way the groups went about their respective projects.

The preferences for iNtuition, thinking and judging reflected the overall MBTI scores for all of the students. So this made it impossible to find any team that did not have a clear preference for these functions. The clearest differences were in the prevailing attitude type- extraversion versus introversion and two teams were chosen in which there were apparent differences in attitude. There were also differences in functions but these were not so obvious at first glance. Differences in the ratio of functions and the clarity of preference for each function applied to both teams. In summary the two teams that were chosen represented a good mix of personalities based on the MBTI scores of the 2003 Software Hut students.

6 Classification Schemes Used

One important aspect of classification was that of anonymising results, and this was done in two stages. Initially each person was given a pseudonym, such as “driver” or “loud member”, then when it came to writing up results these pseudonyms were converted to randomly generated numbers within each team, such as A1 and B2 to ensure that anonymity was respected.
There were several phases involved in going from the field notes stage into quantifiable data. Initially field notes were taken during each client, manager and team meeting. All contributions from each member were noted as was any interaction with the client or manager. Each idea and disruption was also noted as was the genesis of the idea or the cause of the disruption.

It was decided to look for certain kinds of information during meetings; all interactions during a meeting would be taken down as they happened. It was decided to record information pertaining to informing the team, coming up with ideas and/or asking questions, responding to proposals and/or answering questions, and recording which person caused or mentioned a problem/disruption. By doing this a profile of each individual could be built up over the project. This is similar to the work of Belbin and Elam and Walz who categorised information arising from team meetings. In Belbin’s case it was the 7 categories, Elam and Walz categorised the root causes of and the resolution of conflicts. There were several phases involved in going from the field notes stage into quantifiable data. Initially field notes were taken during each client, manager and team meeting. All contributions from each member were noted as was any interaction with the client or manager. Each idea and disruption was also noted as was the genesis of the idea or the cause of the disruption.

The next stage was to take the raw data from the field notes and give it some structure. This involved stating whether the meeting was a team, client or manager meeting, writing down who was present at the start of the meeting, late members (with reason for lateness) and those who couldn’t make it (with reason for absence). Then a brief synopsis of the meeting was given. The next part was titled “Informing” this listed any announcements about work done, meetings arranged or feedback from the client or manager. After “Informing” there was “Ideas/Proposals/Questions” a complete list of all ideas raised and questions asked during the current meeting or carried over from previous meetings.

Following on logically from “Ideas/Proposals/Questions” was “Responses to Ideas and Answering Questions”. This listed the team member(s) who responded to an idea or who attempted to answer a question. Then how the team delegated tasks during the meeting was mentioned, whether this was straightforward or whether it represented pandemonium. The last part of this scheme was related to “Problems/Disruptions” all of the team members involved in this aspect were mentioned.

After giving the field notes some kind of structure the next step was to classify aspects of the ordered details. This included mentioning what kind of issue an idea/question or problem was related to. The following scheme was developed to aid in this respect:

- PSI- Project Specific Issue
- MSI- Methodology Specific Issue
- GSEI- General Software Engineering Issue
- THF- Team Human Factors
- C- Client
- M- Manager
Some of the points going under these headings were generic to both teams and probably to all of the teams taking part in the project. Examples of these points are ‘Project Plan’ and ‘Requirements Document’ from the PSI section. The points under the MSI heading differed as the teams had very different experiences with their respective methodologies. General Software Engineering Issues also differed as very different tools and methods were being used by each team. THF, C and M were the same for both teams.

Once all of the points had been listed under each heading the next stage involved listing which members had come up with an idea or asked a question and what heading this came under. As well as listing who raised an idea or asked a question the person(s) who responded to an idea or attempted to answer a question were then listed. Each response/answer was also given a category:

- Acceptance (A)
- Constructive Debate Then Accepted (CDTA)
- Constructive Debate Then Rejected (CDTR)
- Destructive Debate Then Accepted (DDTA)
- Destructive Debate Then Rejected (DDTR)
- Sarcasm (S)
- Anger (ANG)

Questions answered came under the following headings:

- Logically Civil (LC)
- Destructively (D)

What this left us with was the following classification:

NB: Italics denote a quotation from field notes.

Date of Meeting -20/3/3
A5 3 MSI (3*2) - Indicating that A5 came up with 3 MSI ideas and all three ideas were related to issue 2 under the MSI heading. Likewise the responses would be listed as:

Date of Meeting- 20/3/3
A1 1 CDTR (3.1), 2 A (3.6), (1.0)- This indicates that A1 had a constructive debate and disagreed with an issue related to GSEI 3.1 (HCI Guidelines) for Team A and he agreed with a GSEI 3.6 (SE techniques such as OO or SA) and with a PSI 1 (Project Plan).

Delegation of tasks was listed in the following way:

4/3/3
Very efficient, no arguments

This was a brief description of the teams conduct in the period when tasks were being allocated.
Problems and disruptions all came under the same heading as the issues. What this means is that a problem could be related to a PSI issue or a THF or any of the other categories. Whichever team member caused or mentioned for instance the problem was also recorded. An example is:

Date of Meeting- 18/3/3
A2 mentioned 1 MSI (2.1) - This means A2 mentioned a problem relating to MSI 2.1 (XP pair programming). If A2 had caused the problem “mentioned” would be replaced by “caused”. This classification scheme was clear and was easy to follow.

The next stage involved tracing a specific issue from its inception through to its completion (the last time it was raised in a meeting). Who raised the issue was mentioned along with whether it was informing, an idea/question or a problem. Fig 1 illustrates this.

**Figure 1: Evolution of an Issue**

<table>
<thead>
<tr>
<th>Date</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>28/2/03</td>
<td>Idea/Question- B1 PSI (1.4)</td>
<td>Good things to put on the website would be quizzes, games, animations and flash movies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Idea/Question- B4 PSI (1.4.1) Says there should be an online game based on terrorists attacking a water plant</td>
</tr>
<tr>
<td></td>
<td>Response- B3 PSI (1.4) (A)</td>
<td>Agrees with B1’s proposal, feels site should be entertaining</td>
</tr>
<tr>
<td>21/3/03</td>
<td>Informing- B1 PSI (1.4.1)</td>
<td>Announced he had finished the cockpit game</td>
</tr>
<tr>
<td></td>
<td>Problem/Disruption PSI (1.4.1)</td>
<td>Caused by B1- Forgotten files for cockpit game had to get them off housemate via MSN</td>
</tr>
</tbody>
</table>

This clearly shows how the issue of games/features on the website arose. In the meeting on the 28/2/3 B1 came up with the idea, B3 agreed with the idea. Then on the 21/3/03 B1 informed the team that he had completed a cockpit game and caused a problem in the same meeting because he had forgotten the files for the game.

When this stage was satisfactorily completed an ordinal and a numerical grouping scale were created to classify each individual issue.

The numerical groupings associated with the ordinal ratings(s) are shown overleaf in Fig 2:
**Figure 2: Numerical Ratings**

<table>
<thead>
<tr>
<th>Ordinal ID</th>
<th>Numerical ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Immediate acceptance/No questions asked</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>Harmonious Agreement/Acceptance</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>Decision reached after constructive debate</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td>No decision reached after constructive debate</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>Decision reached after sarcasm, pedantry or conspiracy theory</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>Decision reached after voices were raised some anger evident</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
<td>Decision reached after health problem</td>
</tr>
<tr>
<td>4</td>
<td>9</td>
<td>Decision reached after immoral idea/suggestion</td>
</tr>
<tr>
<td>4</td>
<td>12</td>
<td>No decision reached after sarcasm, pedantry or conspiracy theory</td>
</tr>
<tr>
<td>4</td>
<td>13</td>
<td>No decision after voices were raised and anger is evident</td>
</tr>
<tr>
<td>4</td>
<td>17</td>
<td>No decision reached after immoral idea/suggestion</td>
</tr>
<tr>
<td>4</td>
<td>18</td>
<td>No decision reached after health problem</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>Decision reached after team member has been frozen out of discussion</td>
</tr>
<tr>
<td>5</td>
<td>7</td>
<td>Decision reached after anger and name-calling/expletives</td>
</tr>
<tr>
<td>5</td>
<td>14</td>
<td>No decision reached after team member has been frozen out of discussion</td>
</tr>
<tr>
<td>5</td>
<td>15</td>
<td>No decision reached after anger and name-calling/expletives</td>
</tr>
<tr>
<td>6</td>
<td>8</td>
<td>Decision reached after threat of violence and/or team members shaking with anger</td>
</tr>
<tr>
<td>6</td>
<td>16</td>
<td>No decision reached after threat of violence and/or team members shaking with anger</td>
</tr>
</tbody>
</table>
An ordinal scale relating to these numerical groupings was then produced.

**Figure 3: Ordinal Ratings**

<table>
<thead>
<tr>
<th>Ordinal ID</th>
<th>Ordinal Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Premise uncritically accepted with no interaction between team members</td>
</tr>
<tr>
<td>2</td>
<td>Dealt with smoothly and harmoniously after brief discussion</td>
</tr>
<tr>
<td>3</td>
<td>Lengthy period of constructive debate discussing the virtues of an issue</td>
</tr>
<tr>
<td>4</td>
<td>Caused slight disruption by forcing people off relevant issues</td>
</tr>
<tr>
<td>5</td>
<td>Lengthy period of destructive debate meeting disrupted a lot of time wasted getting back on track</td>
</tr>
<tr>
<td>6</td>
<td>Caused complete disruption to the work of the team</td>
</tr>
</tbody>
</table>

Thus, these six ordinal ratings consist of two groups of three. The first three ratings signify that an agreement was reached or an issue was resolved either immediately, after a brief debate or after an extended constructive debate. In essence the ratings in this first group point to a lack of disruption and to the success of harmonious team-working, although a large number of issues rated 1 could also indicate a problem as it would show a lack of communication and interaction between the team members. In sharp contrast the second group of ratings correspond to varying degrees of disruption, ranging from forcing people off relevant issues via sarcasm, pedantry or anger, to screaming matches that left people trembling with anger and issuing threats of violence.

After these scales were completed the information was recorded in a database. It could then be analysed easily to determine, for instance, how many issues of each type had occurred, or of each ordinal rating, or how many had involved particular individuals or combinations of individuals. The results of these analyses could be presented in bar charts, showing for instance which kinds of issues were dealt with smoothly, which caused disruption and which involved some kind of personality conflict.

**7 Results**

**7.1 Overall MBTI Results**

In total 44 people responded and completed the online version of the MBTI test. This was out of a total of 83 people. Therefore a response rate of 53% was achieved.

**Figure 4: Total MBTI Results**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Extravert</td>
<td>22</td>
<td>Introvert</td>
</tr>
<tr>
<td>Sensing</td>
<td>18</td>
<td>Intuition</td>
</tr>
<tr>
<td>Thinking</td>
<td>29</td>
<td>Feeling</td>
</tr>
<tr>
<td>Judging</td>
<td>33</td>
<td>Perceiving</td>
</tr>
</tbody>
</table>
Figure 5: Average Clarity of Preference for all Respondents

<table>
<thead>
<tr>
<th>Extravert</th>
<th>Introvert</th>
<th>Sensing</th>
<th>Intuition</th>
<th>Thinking</th>
<th>Feeling</th>
<th>Judging</th>
<th>Perceiving</th>
</tr>
</thead>
<tbody>
<tr>
<td>32%</td>
<td>38%</td>
<td>20%</td>
<td>42%</td>
<td>22%</td>
<td>27%</td>
<td>28%</td>
<td>21%</td>
</tr>
</tbody>
</table>

7.2 Results for Group A

Figure 6: Average Clarity of Preference for Group A

<table>
<thead>
<tr>
<th>Extravert</th>
<th>Introvert</th>
<th>Sensing</th>
<th>Intuition</th>
<th>Thinking</th>
<th>Feeling</th>
<th>Judging</th>
<th>Perceiving</th>
</tr>
</thead>
<tbody>
<tr>
<td>12%</td>
<td>55%</td>
<td>22%</td>
<td>50%</td>
<td>31%</td>
<td>11%</td>
<td>42%</td>
<td>11%</td>
</tr>
</tbody>
</table>

Figure 7: Results for Group A

<table>
<thead>
<tr>
<th>Team Member</th>
<th>E-I</th>
<th>N-S</th>
<th>F-T</th>
<th>J-P</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>144%</td>
<td>N11%</td>
<td>F11%</td>
<td>J33%</td>
</tr>
<tr>
<td>A2</td>
<td>E22%</td>
<td>N67%</td>
<td>T1%</td>
<td>J33%</td>
</tr>
<tr>
<td>A3</td>
<td>E1%</td>
<td>N67%</td>
<td>T1%</td>
<td>J33%</td>
</tr>
<tr>
<td>A4</td>
<td>178%</td>
<td>S22%</td>
<td>T66%</td>
<td>J67%</td>
</tr>
<tr>
<td>A5</td>
<td>144%</td>
<td>N56%</td>
<td>T56%</td>
<td>J33%</td>
</tr>
</tbody>
</table>

7.2.1 Results from Questionnaire at the Start of the Project

A questionnaire was handed out to the selected teams at the start of the project to get information on things such as opinions on project, client and methodology choices. Then to find out what the team members thought about the client, project and methodology they had been allocated. This questionnaire would help to identify the state of mind of the team members at the start of the project.

Figure 8: Group A Satisfied with Project Choices

Figure 9: Group A Satisfied With Choice Of Client

One of the members of group A was absent when this questionnaire was circulated. Hence all of their answers were from 4 people. As Figure 8 shows 3 out of 4 people seemed satisfied with the projects on offer. This question related to the three clients at the start of the project. None of the team members in group A showed any negative feeling towards the clients on offer and one member selected very satisfied.
No one had any negative feelings towards XP at this point. Group A responded with a mixed bag of results to the question of how satisfied they were with the project they had been allocated. One member was very unsatisfied, but he was the minority as the rest of the team were either satisfied or very satisfied. The team member who was unsatisfied was vocal in his opposition to the project in early meetings particularly with the client and manager.

Group A had no problem with the client they were allocated, with every one expressing some satisfaction with him/her.

7.2.2 Results from Observing Group A
This shows that 4 (Caused Slight Disruption by Forcing People off Relevant Issues) was the single most common ordinal rating for group A. After this 3 (Lengthy Period of Constructive Debate Discussing the Virtues of an Issue) was the second most common. This shows that issues with a slight disruption were the most frequently occurring. In the case of group A, they have many more issues under 1 and 2 suggesting that many issues were solved amicably and quickly as opposed to after a heated debate.

For group A 4 was the most common ordinal rating in team meetings. A look at group A shows that 3 and 1 were also frequently occurring. This shows that although 4 was the most common rating- many issues were resolved in a smooth harmonious manner, including ones involving constructive debate.

7.2.3 Discussion of Results for Group A Team Meetings

These results can be related back to the personality types of the team members. Group A has a clear preference for Introversion if one looks at the MBTI scores for this team. All of the members of group A have a preference for judging over perceiving. This helps to explain why many of the issues for team meetings were given an ordinal rating of 1. Judging types like to decide things quickly and to come to a conclusion. This goes a long way to explaining why the team members accepted so many initial ideas without questioning them.

The kind of issues that came under ordinal heading 1 included ideas about doing functional requirements analysis each week, having a search engine on the site, not a good idea to use e-mail addresses as an identifier and functional testing. In these cases an idea was mentioned and it was uncritically accepted. The team also have a clear preference for intuition as opposed to sensing. This means that the team are mainly interested in possibilities, not in actualities which would be the case if sensing predominated. As intuitives are interested in ideas that can give inspiration some play it could be the case that even if they unsure about the original premise they could still see that it has potential to become an inspirational idea, this is telling in the way that many issues were resolved in an amicable manner. As the group also have a preference for thinking this means that they are looking for objective truths about issues they can agree on. Myers-Briggs listed thinking as being useful for issues such as “building a bridge” or “interpreting a statute” so in this sense proposed solutions/ideas can be seen and judged from the viewpoint of true or false. It is worth
looking at the issues that were amicably resolved and relating this back to MBTI typology.

As Figure 15 shows most of the issues were either PSI or GSEI. This includes many issues that would be ideal for a strong thinking, judging, and intuitive team. Some of the PSI that were resolved in this manner included risk factors, not a good idea to use e-mail addresses as an identifier, functional requirements analysis, and having a search engine as part of the site. All of these issues can be judged from an impersonal true or false standpoint. The only issues that required lengthy debate were agenda/project plan and requirements document. The debate in these issues typically involved a team member writing an idea down on the board and explaining the reasoning behind it and then inviting comments. Changes were made after lengthy debate across several meetings relating to the agenda/project plan. In the case of the requirements document there was a long debate across three meetings about problems the team are having with this document and a genuine fear that they may not get it done on time. A similar story occurs with the GSEI. Here the subjects ranged from class diagrams/roadmaps to software found that could help the team. The main cause of debate was the issue of parsing data, A1 wanted the team to search for a MIME parser, and A3 advocated writing his own. Eventually A3 agreed with A1, after a lengthy debate discussing the virtues of each option.

Only one of the THF was given a 1 or 2 ordinal rating. The others were all rated three. This shows that the team had to discuss these issues at length before coming to a decision. Typical examples of these issues include sending an ambassador to meetings, or contacting the client after the project has finished. Because these kinds of issues are not simple “true/false” issues the team had to spend a lot more time working on them and debating them.

The MSI were both rated as a 3 on the ordinal scale. These involved discussing XP pair-programming practices and writing a report based on their experience with XP. A2 termed this a report about “additional XP practices”. As the members were new to XP they were not in a position to make a quick judgement.
Now we come to look at the issues that were causing disruptions. They are shown in Figure 16.

![Figure 16: Disruptions in Team Meetings Group](image)

This shows that THF were the most likely to cause a disruption during a team meeting. On 3 occasions, the team were given ratings of 5 in relation to THF. These issues were Problems with A4, A4 Problems-during 5/4/3, and Plans for Easter. An ordinal rating 4 was also associated with A4. So what was the nature of the problems involving this person?

### 7.2.4 A4 and Group A

The first time A4 was mentioned was when A1 asked the team for suggestions about what to do about him. A1 felt that the team may have to issue an ultimatum to A4. This caused anger in the sense that the team were indecisive about what to do with him, A4 was called names by angry team members, yet they offered no solution. Personality came into play at this stage as well, the only member to offer a solution was A1 who came up with the idea of issuing an ultimatum, and this is interesting because A1 is the only team member with a preference for feeling over thinking. This situation wasn’t a simple “yes/no” type scenario; it involved human motives which are notably personal. This goes a long way towards explaining why the rest of the team had problems coming to a conclusion with regards to this issue.

Other issues with A4 actually involved the man himself. Typical problems involving this member included him either acting passive or commenting with harsh sarcasm, rarely offering any constructive criticism to suggestions. On occasions he would act as a nuisance tapping his feet and looking at the ceiling showing no interest in ideas or showing open contempt by shaking his head. A4 also had a tendency to stifle debate by making sarcastic comments; people were unwilling to make ideas if they felt they were going to get shot down in flames. Some comments such as asking A5 if he had printed out a version of the requirements document in Greek didn’t serve any purpose. A4 is a very strong introverted thinker according to Jung and Myers-Briggs this means he will make judgements and answer questions in a no-nonsense manner and not have any concern for anyone else’s feelings. This was the case when he responded to ideas and questions. Because he also had such a clear choice of judging as opposed to perceiving he was also very critical during issues when numerous options were being discussed. A4 was the only member who had a preference for sensing as opposed to intuition. This means he was more in touch with concrete
realities and the present than with future possibilities and developments, this could explain some of his sarcasm in the face of ideas put forward by his team-mates. At this point it is appropriate to look at all issues which involved A4 as shown below in Figure 17:

Figure 17: Ordinal (A4 Involved)

Figure 17 shows that even when A4 got involved in an issue that was not directly related to him, he was still a pernicious influence. This was consistent across all issue types. So what does Jung have to say about the personality type of this person?

Jung states “Introverted sensation is an irrational type, because it is oriented amid the flux of events not by rational judgement but simply by what happens.” Jung goes on “Such a type can easily make one question why one should exist at all, or why objects in general should have any justification for their existence since everything essential still goes on without them”. Jung then describes what happens when and how this type can become a nuisance “When the influence of the object doesn’t break through completely, it is met with well-intentioned neutrality, disclosing little sympathy yet constantly trying to soothe and adjust. In this way this type becomes a menace to his environment because his total innocuousness is not altogether above suspicion. In that case he easily becomes a victim of the aggressiveness and domineeringness of others. Such men allow themselves to be abused and then take their revenge on the most unsuitable occasions with redoubled obtuseness and stubbornness”

Jung also states the dangers that face this type: “So long as the individual does not hold too aloof from the object, his unconscious intuition has a salutary compensating effect on the rather fantastic and over credulous attitude of consciousness. But as soon as the unconscious becomes antagonistic, the archaic intuitions come to the surface and exert their pernicious influence, forcing themselves on the individual and producing compulsive ideas of the most perverse kind. The result is usually a compulsion neurosis, in which the hysterical features are masked by exhaustion”.

Myers-Briggs state that ISTJs (A4’s Type) emphasise logic, analysis and decisiveness. Apparently they make exhaustingly thorough lawyers who take nothing for granted and thus catch many slips and oversights that others make. This helps to explain the reasoning behind A4’s sarcasm and hair splitting pedantry that caused so many disruptions. Tellingly an ISTJ will give any amount of help if they can see that
it is needed but their logic rebels against requirements or expectations to do anything that doesn’t make sense to them. This is another telling insight into the A4’s sarcasm, it could have been that he didn’t fully understand or appreciate the ideas being put forth by others.

7.2.5 Time Keeping Problems

Of the other THF problems that caused a problem two were related. These were time keeping and time of meetings. The time keeping issue refers to the argument put forward by A5 that people turning up late for meetings was causing a lot of disruption and wasting too much time. Certain members of the team were persistently late and didn’t seem too concerned about this. A5 tried to make people understand that lateness was causing a problem and that it wasn’t fair on the team members who had made the effort to turn up on time. A4 had a problem with turning up on time as did A3. A3 was a good contributor to meetings when he arrived but he regularly missed the start of meetings. A5 was also concerned about the starting times of the meetings. He felt that if they had the meetings earlier than 11am they could get more work done throughout the day. This brought a heated response from A3 and A5 who both complained about the early starts, saying 11am was too early for them and they were making an effort by turning up at this time.

7.2.6 The Role of A5

A5 was always conscientious and always made an effort to be in time, on most occasions he was the first into the meeting room. He expected the same commitment and organisation from his team mates. A5 is an INTJ. Myers-Briggs describe this type as having a keenly critical organising faculty, and adds they are likely to organise themselves out of a job. They cannot continually reorganise the same thing, and a finished product has no more interest. This type has a tendency to ignore the views of others, this relates back to the A5’s lack of understanding with regards to the complaints of A4 and A3 about having to get up so early. Throughout the project A5 was organised and never missed meetings.

7.2.7 Other THF/PSI Problems for Group A

Other THF problems to emerge in team meetings were plans for Easter and problems over Easter. The first problem was caused by A4’s sarcasm in response to claims that the team could get the project finished over Easter. In response to this claim he coughed and uttered an expletive and then laughed and shook his head in response to ideas. This forced A1 to freeze him out of the discussion therefore creating a very frosty atmosphere. The second Easter related problem was down to the lack of organisation the team had over the holidays and the belief that the team had not completed enough work in this period. A3 had not contributed anything over Easter and most of the work was done by A1 or the A5.

The PSI problems were caused by a combination of attempted caustic sarcasm, severe doubts about the project and documentation related issues. In terms of time spent on the project A1 stated that the team may have to skip lectures in order to complete the project. The team agreed with this; however no one suggested doctoring timesheets. The problems relating to the documentation were health related. A1’s health was
affected by the amount of time and effort he was putting in reading and understanding the project documentation. A1 announced that he was suffering from stress and nervous exhaustion due to the amount of time he had spent reading the documentation. He said that he sometimes stayed up until 5am reading project related documentation. He added that he was “Exhausted and this is not doing his health any good”.

7.2.8 The Working Practices of Group A

Another telling problem that can be related back to MBTI typology was the problem relating to the working practices of the team. A1, A4 and A5 (all with a very clear preference for introversion) admitted that they didn’t like to work in the lab with all the noise and other students. A1 said this situation was “Far from ideal”, A5 said “I prefer to work at home rather than here” and the Fifth Member announced that he liked to “Stay at home, shut off from the world”. This shows how personality type can have a clear affect on working practices. This problem is also related to the problem about other coursework outside the project being team-based; A1 announced that he was not happy with this situation.

7.2.9 The Role of A1

The most important point made by A1 was that all of the team must start to understand the documentation otherwise most of the ideas and informing will come from one man. So was this statement vindicated by observations, the charts below show the sources of both ideas/questions and which team members informed the others in team meetings:

Figure 17: Informing (Team Meetings):

![Figure 17: Informing (Team Meetings): Group A](image)

Figure 17 shows that in team meetings A1 was in a league of his own when it came to informing his team mates about issues. So what kind of things was A1 informing the team about? A lot of it was related to research carried out by A1 in his own time. Such things were MIME Parsers, MIMERIP, and collaborative editors. Other things A1 informed the team about included his own ideas such as DREAD and EEL. The remainder of the issues were specific to areas of the project such as the agenda and project plan, the database and problems over Easter. So it shows that at least half of the informing done by A1 was related to his own innovations or as a result of his own research. So did A1 come out on top in when it came to generating new ideas and questioning aspects of an idea?
A1 was clearly the most creative member of the team when it came to generating ideas and posing questions to the rest of the team. So then how does all of this relate back to A1’s MBTI type? According to Myers-Briggs INFJ’s concern themselves with people, sometimes so much as to appear extraverted. This could be why A1 was reluctant to take action against either the late-comers or A4 because of his concern about not hurting anyone’s feelings. To this type harmony is very important, they try to win (rather than demand) acceptance of their purposes. By the time they have induced others to understand, approve and cooperate toward a goal, they have fitted both the goal and themselves quite naturally into the community pattern. A1 was always happy to discuss at length with his team mates the reasoning behind an idea or why he felt an original idea should be adjusted, he never tried to force ideas on anyone. Perhaps he was too good natured at times as he failed to implement decisions that had been reached about team problems. Jung described people of this type as being almost exclusively women! He stated that the phrase “Still waters run deep” is very true for this type. Jung goes on to state that “Although there is a constant readiness for peaceful and harmonious co-existence, strangers are shown no touch of amiability, no gleam of responsive warmth, but are met with apparent indifference or a repelling coldness.”

7.2.10 A3

In a sense A3 was an excellent foil for A1. A3 fine-tuned many of A1’s original ideas during debate. Hence what started out as a good idea could be turned into an excellent idea after it had been fine-tuned. This is validated by looking at how many times A1 and A3 were the sole participants in issues and how many times they were both involved in other issues.

Figure 19 shows how many times A1 and A3 were the sole participants (Team Meetings Only):
As this shows there was only one disruption when A1 and A3 debated issues. This disruption was concerned with EEL, when A1 complained about the lack of contact with A3 over the Easter holiday.

Figure 20 shows the ordinal rating when A1 and A3 have been central in issues concerning other team members:

The issues that caused the disruptions were as follows: Problems with A4, Time Keeping, Opinions of Discovery and XP, XP-Story Cards, DREAD, Project not suited to XP, Plans for Easter, EEL, and Problems over Easter. These issues by nature would have caused disruptions regardless of who was involved. Many were down to the general problems of teamwork, the methodology and A4. So what was the personality of A3 and how did this help him to become an excellent foil for A1?

A3 is an ENTJ. Jung states that this type is “a man whose constant endeavour – in so far of course, as he is a pure type is to make all of his activities dependant on intellectual conclusions which in the last resort are always oriented by objective data, whether these be external facts or generally accepted ideas” Myers-Briggs state that “Intuition heightens their intellectual interest, curiosity about new ideas (whether immediately useful or not), tolerance for theory, taste for complex problems, insight, vision and concern for long-range possibilities and consequences” This types interest is in the broad picture rather than minor details. So the natural interest in new ideas coupled with the range of possibilities and interest in a broad overview made A3 a very good foil for A1 who came out with new ideas specific to certain areas of the project and had them fine-tuned in debate. A3 looked at the relevance of the idea or suggestion by relating it to the project as a whole.
7.2.11 The XP Problem

One area in particular proved to be a major source of discontent for all of the team. This was the methodology-XP. This proved to be problematic whenever it was discussed regardless of the meeting type. Figure 21 shows the ordinal ratings for MSI:

The 6 is the only occurrence of this value across all of the group’s meetings. This occurred when the team were discussing XP story-cards. The primary factor for this problem was A4’s sarcasm and hair-splitting pedantry which kept forcing A3 to backtrack and explain the same thing 2 or 3 times. This was annoying for someone who likes to take a broad overview of the system. A3 eventually shouted “People who cannot use the system should be gunned down” in response to constant digs from A4 about usability. The relentless picking of holes and nit-picking eventually got A3 down and he snapped and shouted at A4 and started walking menacingly up and down the room. The problem didn’t end at that point, when A3 said that the story-card concerning the E2B was the backbone of the system A4 nonchalantly said “No-S*** Sherlock”. At this point A3 started to ignore A4 for the sake of morale. A4 then said in a loud voice “The project isn’t rocket science”. Story-cards were discussed over 5 meetings; the first meeting was the one that had the most problems. The remainder of the meetings went smoothly apart from some disgruntled comments from the Third Member about having to change the story-cards.

The other problems relating to XP were general team complaints about the methodology. One problem that condemned XP from the start in the eyes of this team was the admission that they all enjoyed Discovery and found the module very interesting and would have liked to have used it in this project. As the weeks went on the team’s attitude toward XP became more and more cynical. A5 said the team should admit they are not XP people and start using UML and Discovery. Things came to a head when A1 advocated changing to Discovery and abandoning XP. To this A2 responded that the team were already using an “unholy-amalgamation” of methodologies and they are not using XP. A5 stated that the team were not doing XP correctly but neither they nor the client “gave a toss”. A1 said that the team should make it look as if they are doing XP and concluded that he felt the team had been dealt a bad hand with XP.

There was a similar problem with pair-programming, the team never got used to this method and worked by running from one machine to the next. A3 advocated doing what needed to be done rather than being so rigid with XP. A1 came out with a very interesting argument against XP. He said that “Discovery gave people more of a chance; it allows people who enjoy doing documentation work to come into their
own”. He added that some people liked to do certain roles in a team and that XP forced people to be programmers against their will. A5 admitted that trying to keep to XP guidelines had prevented him from doing much work.

The methodology problems are very interesting for anyone interested in SE teamwork and indeed for anyone interested in XP. Whilst giving a fascinating insight into potential problems facing SE teams it was difficult to trace this problem back to MBTI typologies as the entire team expressed a negative opinion on this issue and there was no real debate between them with no one trying to argue the case for XP.

7.2.12 Group A Manager Meetings

Software hut teams generally had one meeting per week with their manager. Figure 22 shows the ordinal ratings for all issues in manager meetings:

![Figure 22: Ordinal (Manager)](image)

Interestingly 4 was once again the most frequently occurring rating. When one looks closer at this it becomes clear that in many cases problems occurring during team meetings were causing the same kind of disruptions in manager meetings; such as the A4, DREAD, XP, planning for Easter amongst others. The frustration that the team were unable to resolve these issues meant that they remained a thorn in their collective sides. The problem that rated 5 was due to bickering between A1 and A3 that threatened to boil over whilst the manager was talking to A1. The issues that were resolved without any disruption mainly involved A1 mentioning research he had done and when the team had specific technical questions for the manager. Examples of this are testing, requirements document, pharmaco, collaborative editors and parsing. Such issues were generally straightforward and the team were anxious to hear the manager’s opinion on such matters. On several occasions they had a good debate with him as is shown by the number of issues that rated 3.

7.2.13 Group A Client Meetings

The team met the client on a weekly basis for the first four weeks of the project and then met him/her again for the demonstration at the end of WK 10. The ordinal ratings for the client meetings are shown in Figure 23:
Figure 23 shows an equal split between disruptive and non-disruptive issues. The problems and disruptions again stemmed from issues raised in team meetings such as strong opposition towards the project from A2 and the constant worry from A1 in regard to project documentation. The problem that rated 5 was an angry dispute between A1 and A3 during the demonstration due to the latter criticising the formers work.

The non-disruptive issues consisted of A2 announcing things to the client about DREAD and the status of the requirements document. The other issue involved the client answering a question about the volume of reports the system can be expected to receive.

7.2.14 The Role of A2

A2 acted as an effective bridge between the team and the client/manager and indeed with any researchers involved with the team including the authors of this paper. The importance of A2 to the team becomes apparent when one looks at the figures for informing and ideas/questions during manager and client meetings; Figure(s) 24 and 25 illustrate these figures:

A2 was dominant in these meetings when it came to informing and he also came up with more ideas or asked more questions than anyone else. A2 had the strongest preference for extraversion in the team and was very much at ease when informing the manager and client about developments. A2 was clearly missed when he was not in a manager or client meeting. The reason A1 was not so far behind A2 when it came to Ideas/Questions was because after the initial informing A2 usually brought A1 in to speak about specific technical aspects of the project to verify ideas brought forth during team meetings.
A2 was the same MBTI type as A3 (ENTJ), but he had a stronger preference for extraversion 22% as opposed to 1%. Like A3 he liked to take a broad overview of the situation and look for future possibilities to come out of current ideas. In this way he was happy to mention the individual parts of the project to managers/clients but was happy to let A1 explain the finer details.

7.2.15 Summary of Group A

All in all group A showed many examples of how MBTI types can have both a positive and a negative affect on SE teams. This was apparent from looking at the disruptions caused by A4, the professional public image provided by A2, the astute leadership from A1, the debating skills of A3 and the organisational efforts of A5. A3 proved to be an excellent foil for A1 and together they fine-tuned many ideas during debate. In the main they managed to debate in a mature intellectual manner without resorting to insults or childish smears. A1 led by example and generated the most ideas in team meetings as well as posing the most questions to his team-mates. Group A were a very interesting group to observe and the individual members of the group exhibited a lot of characteristics that could be traced back to their MBTI type. In summary this group worked well together on some aspects yet on others they had serious problems as evidenced earlier in the report.

7.3 Results for Group B

Figure 26: Average Clarity of Preference for Group B

| Extravert: | 55% | Introvert: | 28% |
| Sensing:   | 12% | Intuition: | 45% |
| Thinking:  | 23% | Feeling:   | 33% |
| Judging:   | 33% | Perceiving: | 22% |

Figure 27: Results for Group B

<table>
<thead>
<tr>
<th>Team Member</th>
<th>E-I</th>
<th>N-S</th>
<th>F-T</th>
<th>J-P</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>E 56 %</td>
<td>N 56 %</td>
<td>T 66 %</td>
<td>J 44 %</td>
</tr>
<tr>
<td>B2</td>
<td>I 33 %</td>
<td>S 22 %</td>
<td>T 1 %</td>
<td>J 44 %</td>
</tr>
<tr>
<td>B3</td>
<td>E 67 %</td>
<td>N 33 %</td>
<td>F 44 %</td>
<td>J 22 %</td>
</tr>
<tr>
<td>B4</td>
<td>E 44 %</td>
<td>S 1 %</td>
<td>F 22 %</td>
<td>J 22 %</td>
</tr>
<tr>
<td>B5</td>
<td>I 22 %</td>
<td>N 33 %</td>
<td>T 1 %</td>
<td>P 22 %</td>
</tr>
</tbody>
</table>

N.B Project Hours are from the timesheets; they may not be accurate due to students doctoring them or not filling them in. This is the case with Team B who did not fill in the timesheets after week 7-8. Therefore according to the timesheets this team have not put many hours in throughout the project.
7.3.1 Results from Questionnaire at the Start of Project

The results for group B were similar to group A except no one was unsatisfied, one member was merely indifferent. All 5 members from group B filled in the questionnaire. In group B the feeling towards the clients on offer was either indifferent or satisfied.

This question asked the students to rate the methodologies on offer. No one from this team had any negative opinions of Discovery. However they expressed deep dissatisfaction with the project they had been allocated. All members were unsatisfied with 4 out 5 people stating that they were very unsatisfied. This was a very negative attitude to be going into a project with.

The results for group B showed that each member expressed dissatisfaction with the client; with 3 out of the 5 stating that they were very unsatisfied. This negative attitude was prevalent before any client meetings. The results for group B showed 4
out of 5 people expressed satisfaction with Discovery and no one stated that they were unsatisfied.

![Figure 34: Group B Overall Attitude to Project](image)

The results for group B were a mixed bag with the majority being indifferent or positive and with one person having a negative attitude to the project.

7.3.2 Results from Observing Group B

![Figure 35: Group B All Issues (Ordinal ID)](image)

The fact that 4 was the most common ordinal rating for both teams is misleading, as the descriptions highlight that the underlying reasons for the disruptions were very different between the teams.

![Figure 36: Group B Ordinal (Team Meetings)](image)

In group B team meetings 4 was by far the most common rating and the next most popular was 5 (Lengthy Period of Destructive Debate Meeting Disrupted a Lot of Time Wasted). This shows that this team had a difficult time resolving an issue
harmoniously. The two extreme score 5 and 6 (Caused Complete Disruption to the Work of the Team) were prevalent to a greater degree than in the case of group A.

Group B had a clear preference for extraversion. However this group shared a strong preference for judging with group A with only one member of the team showing a preference for perceiving. There was a 3:2 ratio in the E-I, N-S and F-T dichotomies. All in favour of the former rather than the latter. As with group A ordinal rating 4 proved to be the most popular rating.

The non-disruptive issues are shown in Figure 37:

So first let’s examine the issues that didn’t cause any disruption. Many of the 1 and 2 issues were simple “yes/no” type scenarios or times when a team member was explaining something to the rest of the team. Examples are CVS, Project Plan, and Photographs for website, Career Information, and Estimating Resources. In the case of things such as project plan, career information and estimating resources these issues were either part of the protocol of software but or requirements of the client so the team had no option but to agree quickly on them. This suited group B as these were all the sort of issues that required a quick judgement. Non-disruptive issues that required a period of constructive debate included checking each others work, information gathered, and data-protection issues. Information gathered involved B4 explaining to the rest of the team about all of the research he had done in the past week and then inviting questions. Checking each others work involved the team members reporting back to each other about the faults they had found in each others work and how to commence from there. These kinds of issues were on the whole dealt with in a smooth manner.

This result is interesting because it shows that the two main types of issue that were resolved without any kind of disruption were GSEI and PSI. This was the same for
group A. As was the case with group A many of these issues were simply not open to
debate such as deadlines for documentation in software but or using CVS. The
students were expected to do these things so it was pointless arguing amongst
themselves about things they had to do to pass the module. Other PSI issues that were
resolved peacefully included the business goals and information that the client wanted
the team to put on the website. Again it seemed pretty pointless arguing about things
that simply had to be done and were beyond the teams’ control. Any requests from
the client had to be agreed upon, Discovery and software but protocol also had to be
adhered to throughout the project, in the mind of group B these were closed issues
almost standard canon.

The team had a majority of intuitives who were willing to accept ideas if they
sounded reasonable and would help develop possibilities. However the team did have
2 people who expressed a preference for sensing. These types depend on their five
senses for perception. Whatever comes directly from the senses is part of the sensing
types own experience and is therefore trustworthy. This means that if these people
had heard or experienced some of the ideas being mentioned and they had a positive
opinion about them then they would be happy to go along with it. On the other hand
to a person with a strong preference for sensing what comes from other people
directly through the written or spoken word is less trustworthy. Myers-Briggs states
that this type “Is in danger of becoming frivolous, unless balance is attained through
development of a judging process”.

So what kind of disruptions did this team encounter? As we shall see there were many
angry exchanges between people who had a clear preference for extraversion and
heated debates over problems relating to individual team members. One point worth
mentioning is that this team never had set roles for the project in the same way that
group A had. The plan for group B was to change roles weekly, as will be seen this
causen a lot of chaos in its own right as there were many cases of confusion over who
should be doing what. There was also a problem with people overriding the authority
of whoever was deemed to be in charge for a particular week. Sometimes this was
manifested in a minor disruption other times it exploded and caused major chaos. So
what kinds of issue were the roots of the problems for this team?
Figure 40 shows the origin of problems:

![Figure 40: Disruptive Issues for Group B](image)

This differs from group A’s result as PSI is the most common disruptive issue as opposed to THF. Group A did not have any disruptions relating to client issues as opposed to 4 for group B. The PSI that caused problems were in many causes innocuous sounding issues that should not have caused any major problem. The fact that they did cause problems can be put down to the personalities of those involved. Here are some of the PSI that caused disruptions: features on the website, functional requirements document, FPA, buying space on a web-server and day trips arranged by team. So what was it about this team that allowed so many harmless seemingly straightforward issues to cause so much chaos?

7.3.3 Angry Clashes in Group B Meetings

At this point it is worth looking in detail at some of these problem issues. Take for example FPA. This issue started off innocently enough with B3 admitting he didn’t know what FPA was. In a later meeting B4 announced he had done some research on FPA and decided it wasn’t suited to website design. B1 then started an angry debate with B3 accusing him of wasting the team’s time with FPA. This became a very loud screaming match which dominated the meeting and made the atmosphere very unfriendly. It wasn’t a friendly atmosphere for the team to discuss issues. B2 mentioned that he was unwilling to chip in when B3, B1 and B4 were engaged in a debate because he didn’t want to get shouted down.

A very angry exchange between B1 and B3 took place over something as harmless as web accessibility guidelines. This issue warranted a 6 on the ordinal rating scale. This argument all started because B3 told B1 to keep quiet in a very angry tone when he said it was important that the team adhered to accessibility guidelines. The argument got very heated with both men standing up and B3 telling B1 to “Get Out”, both were shaking with anger after the argument.

Loud angry exchanges particularly between B1 and B3 were a feature of Group B’s meetings across a range of issues. Some of the other disruptions associated with PSI did not have such dramatic undertones. They were caused in the main by neglect, and bad time keeping/organisation. For example problems such as features on the website were caused by B1 forgetting files for a game a similar problem occurred with the functional requirements document with B3 leaving it until the last minute and not
even having time to run a spell-checker on it, with less than an hour to go to the client meeting.

The day trip arranged by the team problem was mainly a result of B4’s intransigent attitude towards any trip. His first response was to state he would simply not turn up and then he said that the entire team should get very drunk before going. He remained unconvinced of the virtues of a trip even though this was the will of both the client and the manager. A similar story occurs when one looks at THF disruptions. Research for Team, Recording Information, Pedantry, Importance of Situation, Allocating Tasks, Meeting Times, B5, and Easter Plans all caused problems of varying degrees.

Three of these issues rated as a six on the ordinal scale, and with others rating five it becomes clear that THF were a major bane for group B. Allocating tasks was one issue that rated as a six. This issue started off on a bad note as B1 dismissed the initial suggestion by B3 as “Sheer Madness”. This was in response to a suggestion that tasks be allocated by drawing names out of a hat. B1 also howled in derision at a suggestion by B4 who stated that the team should change roles daily. The team had a very ad hoc way of allocating tasks this stemmed back to the lack of clear team roles. B3 angrily dismissed any opposition from B4, B1 screamed back when B3 tried to shout him down. Then a screaming match broke out between B4 and B1 about task allocation as both felt that the other was overriding their authority. B3 tried to resolve this by screaming at B1 to act as Chairman. B1 responded robustly to this attack. None of the team had any tolerance for the ideas of others. B1 accused B3 of trying to force his will on the team and called him “George Bush”. Once again this exchange ended with both men trembling with anger.

7.3.4 MBTI Types of the Main Protagonists

So why were there so many angry debates between these two men? Also with B4? B3 is an ENFJ with a very strong preference for extraversion. Both B1 and B4 also had a strong preference for extraversion. So what do Jung and Myers-Briggs have to say about their types and about people who have such a strong preference for extraversion?

Jung says this about strong extraverts “The more complete the conscious attitude of extraversion is the more infantile and archaic the unconscious attitude will be. The egoism which characterises the extraverts’ unconscious attitude goes far beyond mere childish selfishness; it verges on the ruthless and the brutal”. This is an interesting observation from Jung as the aforementioned members certainly were ruthless at times during the project with none of them asking for any quarter or expecting any to be given.

Jung had this to say about extraverted feeling “Feeling in the extraverted attitude is oriented by objective data, the object being the indispensable determinant of the quality of feeling. A person may be moved to say something is good not because they find it “good” from their own subjective feeling about it but because it is fitting and politically correct to call it so, such a contrary judgement would upset the general feeling situation”. Jung went on to say “Over extraverted feeling may satisfy
aesthetic expectations, but it does not speak to the heart; it appeals mainly to the senses or worst still-only to reason”

Myers-Briggs state that on the whole ENFJ are affable people who fit in well with group-work and have a lot of creativity that can be channelled into new ideas. But they do add that “In the absence of adequate perception, the extraverted feeling types are prone to jump to conclusions and to act on assumptions that turn out to be wrong.” Jung’s description of extraverted feeling and strong bias towards extraversion seems very accurate when one looks at the conduct of the extraverts during certain meetings.

B3 also started several conspiracy theories about other team members and particularly about the client. He accused the client of “waging psychological warfare against the team” and of “Trying to play with our heads”. He also felt that the B5 had some ulterior motive. He claimed that B5 “Knows he is on his way down and wants to drag me down into the abyss with him”. No one refuted these conspiracies, but with such rampant paranoia evident it was not surprising that mistrust and anger were recurring problems.

The task allocation issue was typical of many issues that boiled over into screaming matches. It is unnecessary to list the minor details of each issue; the purpose of this report is to make the reader aware that the problem was indeed a major obstacle to harmony in team meetings.

The principle antagonist of B3 was B1. B1’s MBTI type is ENTJ. Like B3 and B4 he also shows a strong preference for extraversion. As was previously described Jung stated “a man whose constant endeavour – in so far of course, as he is a pure type is to make his entire activities dependant on intellectual conclusions which in the last resort are always oriented by objective data, whether these are external facts or generally accepted ideas”. Myers-Briggs state that this type is interested in the broad picture as opposed to minor details of each important issue. In group A A3 acted as an excellent foil for A1, in group B B1 and B3 did generate a lot of ideas and had a lot of debates but disruptions and anger were much more prevalent. As both of these men are strong extraverts the ruthless streak described by Jung may have come to the fore on many occasions-particularly due to differing opinions or angry responses. In many cases it wasn’t a case of disagreeing with an idea that was the problem it was the surly almost angry tone used when responding that usually caused the problem.

B4 had angry debates with both B1 and B3 but he was not as consistent as the other two when it came to disruptions. Some interesting patterns are noticed when looking at issues that involved only B1 and B3 and then looking at issues in which B4 got involved. Figure(s) 41 and 42 show that on several occasions B3 and B1 could agree on something after a rational, insult free debate. However it seems that when B4 joined in all hope of reason was abandoned. As Fig 42 shows only one issue was debated and resolved without any disruption when B4, B1 and B3 were all involved. An interesting fact is that all three men had a clear preference for judging as opposed to perceiving. This is a major factor to consider when one looks at the issues involving these people. They all seemed determined to come to a conclusion in the shortest possible time and displayed anger when their ideas were stalled. This strong judging preference meant that it was hard for them to take in other points of view and even harder for them to accept that their original premise was faulty.
So then what of all the team issues in which these three men were involved? Figure(s) 43, 44 and 45 below list the ordinal rating of all issues involving these three.

Figure(s) 43, 44 and 45 show that for B1 67% of issues he was involved in had some form of disruption. The figures for B3 and B4 are 82% and 71% respectively. All three team members had a very high percentage of disruptions yet it was B3 who proved to be the most destructive element. This is not to say that he was the cause of the disruption in all cases but the figures show that his mere involvement in an issue was almost certain to cause disruption, this could be said for all three men.

So what about B4 what type was he and why was he prone to disruption? B4 is an ESFJ like B1 he has a preference for feeling and judging but differs in his preference for sensing over intuition. Jung says “The more sensation predominates, so that the subject disappears behind the sensation, the less agreeable does these types become. He develops into a crude pleasure-seeker, or else denigrates into an unscrupulous, effete aesthete”. Myers-Briggs states that “ESFJs tend to be matter of fact and practical, conventional and factually conversational. They are primarily concerned
with the details of direct experience- their own, that of their friends and acquaintances, even the experience of strangers whose lives happen to touch theirs” This shows that B4 may have had grave doubts about ideas that he was unfamiliar with or were not part of his direct experiences. This was true in many aspects of this project as B3 was the only member who had experience with HTML, FLASH and Internet technologies in general. B4 was therefore faced with information that was not part of his direct experience. If one couples this with his clear extraversion and judging preferences some insight is gained into the root cause of the disruptions involving this man.

Despite all of the disruptions this team still managed to produce quality documentation and code. This is remarkable given the disorganised nature of the team. When the pressure was really on the team had no option but to cast aside their differences and work things out the best way they could. Of course this kind of team-working would never applauded by the management and team experts such as Belbin, and De Marco and Lister (De Marco and Lister 1987)- but what this shows is that in reality achieving a cohesive team is not as easy as one imagines.

7.3.5 The Issue of B5

The remaining two members of group B were both introverts. B5 was the source of much controversy throughout the project and on many occasions he was the primary subject of debate. The problems with B5 stemmed from him not turning up to team, manager and client meetings and giving what the other team members termed as unoriginal excuses such as “dentist appointment”, “waiting to see landlord” and “careers meeting”. Whether these excuses were valid or not is outside the scope of this paper. What is relevant here is that the rest of the team did not believe him. The issue “B5” rated as a six on the ordinal scale and was discussed over a total of five team meetings. The first time it was mentioned B3 called for the expulsion of B5 from the team due to him not turning up to a team meeting. In a later meeting B3 said the team must give B5 work and expect him to do it before a deadline. At this point the Driver simply said that B5’s excuses were “unoriginal”. B3 stated that he didn’t trust B5 and continued to whip up a feeling of anger against him.

In later meetings B1 called B5 names and B3 screamed that he was pushing him too far. Both members were directing a lot of venom in the direction of a man who was not even present in the meetings. They seemed to be using a lot of energy to resolve the issue of B5. B1 called for a crisis meeting to be held that dealt solely with B5. The team agreed to go along with this.

In the crisis meeting B1 said it was a “Final Solution to the problem of B5”. B3 said it would be a good idea to “gun the fifth member down”. This brought nervous laughter from the others. B3 then called B5 and spoke to him in a loud surly voice.

Throughout all of the discussion B2 tried to find a peaceful, fair solution to the problem. He first mentioned that B5 could have “Personal or psychological problems”, then in later meetings he declared that he was “prepared to give B5 another chance”. All of these pleas fell on deaf ears. B3 screamed back “If he has problems he should let me know”. B1 was also very angry but kept it in check better than B3. He said that “Today is history” and argued his case why he felt B5 had hindered the
team. He then remarked on work that B5 had still not done, which should have been completed weeks ago.

B5 was eventually reported to project management. They decided that the team would be justified in giving him a lower percentage of the marks. So did B5 have any personality traits that caused problems for this team? Or was the problem with him due solely to him not turning up to meetings?

Figure 46 shows that this member also caused problems when he was present. Each issue he was involved in was rated as a disruption. When one looks at the disruptions one can see that some of them were general team problems and others were caused or aggravated by B5. An example of this is recording information. In this issue the team all agreed to gather round the laptop whilst B4 recorded information. B5 continued to complain 10-15 minutes after this decision had been reached. This prompted B1 to say he was sulking which got a robust response from B5. The other charge that could be levelled at B5 was that of pedantry. B3 felt that the team and B5 in particular were being too fussy about terminology used and taking too long to reach decisions due to B5. B5 responded by saying “I am a pedant, being pedantic is important”. The MBTI type for this person is INTP. He was the only member of the team to show a preference for perceiving as opposed to judging. Jung had this to say about introverted thinkers “He will hardly go out of his way to wins anyone’s appreciation of his ideas. He merely expresses them and is often extremely annoyed when they fail to thrive on their own account”.

Myers-Briggs goes on to state “Introverted thinkers use their thinking to analyze the world, not to run it. Relying on thinking makes them logical, impersonal, objectively critical, not likely to be convinced by anything except reasoning”. The INTP is said to be “The most intellectually profound of all the types. Intuition brings a deeper insight than is granted to thinking alone”. As B5 was not present for the majority of team meetings it is difficult to state how much of a problem personality clashes particularly with B4, B1 and most of all B3 would have affected the team. Most of the anger directed towards B5 was due to him not turning up, not towards his attitude in meetings. One interesting issue that was brought to the fore was that of pedantry. B5 was a perceiving type in a group full of judging types. This meant he liked to look at things in a more analytical fashion; he would shut-off judgement until all possible evidence was in. Perhaps to the judging types who wanted a quick decision the pondering of the perceiving B5 was seen as childish pedantry, but to B5 it was simply his way of coming to a decision.
7.3.6 B2

B2 was often shouted down by the extraverts in the team and they rarely listened to his ideas. He had a calm demeanour and would keep quiet even if he disagreed with an idea. B2 contributed some good work and ideas and tried to resolve problems between the team members in a mature, peaceful manner. He never got involved in any screaming matches and kept a dignified silence on many occasions.

B2 is an ISTJ. This is the same type as A4, the difference between the two is that the man from group A did not keep quiet he used sarcasm and ridicule on many occasions. Although these two are the same type there are major differences between them. A4 from group A had clarity of preference of 78% for introversion, compared to 33% for B2; he also had clarity of preference of 66% for thinking as opposed to 1% for B2 and clarity of preference of 67% for judging as opposed to 44% for B2. So it becomes clear that there is a sharp contrast between the two. Another point that should be kept in mind is that there were no strong extraverts in group A, no angry screaming matches that went on over several meetings. This meant that in group A A4 was much less likely to get a robust response; he was also much less likely to be shouted down.

7.3.7 Source of Ideas/Questions and Informing in Team Meetings

Figure 47 shows the figures for informing, Figure 48 shows the results for ideas/questions. As this team had not allocated anyone to act as Chairman for the project it is interesting to see whether one person dominated on these aspects as A1 did in group A.

A very different pattern emerges here as opposed to group A. There was not as much informing and the two loudest members of the team came up with most of the ideas. B1 did most of the informing in team, client and manager meetings. As the charts show, he was also the most prolific member of the team when it came to generating ideas and asking questions in client and manager meetings.
7.3.8 Group B Client/Manager Meetings

So were there any underlying personality traits that can explain B1’s position in client/manager meetings. He had the clearest preference for intuition, thinking and judging in the team. As a strong intuitive it was natural for him to be very imaginative, inventive and original, according to Myers-Briggs such intuitives can contribute to public welfare with powers of inspired leadership in every direction of human interest. So it was no surprise to see B1 coming out with original ideas to both the manager and client. He didn’t lack in persistence or balance due to his clear preference for judging. This judging allowed him to depend on reasoned judgements either his own or those borrowed from someone else, this helped him to decide which matters were important and which should be settled as quickly as possible. The clear thinking preference ensured that B1 would be logical and very likely to question the conclusions of other people on principle. This meant that B1 would respond to any claims from managers or clients if he felt that they were flawed and that he would present his ideas and opposition to suggestions in a clear rational manner. At times B1 could be a little brusque when responding or putting ideas forward however he was often the only member of the team who was willing to debate the manager. He also managed to debate the client successfully on several occasions. In this way B1 was contributing to the exchange of wisdom by intellectual criticism of suggestions and ideas.

Issues that were resolved without disruptions in client meetings included Games on site, Trip to water plant, and HCI Guidelines. These kinds of issues were not open to debate as the team had often asked the managers opinion on a subject such as games and the manager always responded with an answer that was in line with project protocol. Similarly the team didn’t try to debate with the manager when the visit to the water-plant was mentioned, if the manager expected them to go it would be very risky to try and argue with him.

Problematic issues in the manager meetings included discussing B5, once more the B3 displayed anger when raising the issue of this person; once more he drowned out the reserved member with a surly tone when discussing B5. Another problem was the requirements document which was caused by no one taking charge of the team and ensuring they kept up to date with this important document; this made the team look unprofessional as they were leaving work until the last minute.

Similar problems to the ones evident in team meetings came to the fore in manager meetings, albeit on a lesser scale.
One issue that didn’t rank as a disruption but was still interesting was that the team expressed doubts about the client to the manager. B1 initially complained about the vagueness of the requirements and he then argued that the client was deliberately trying to stall the team. The manager didn’t agree with this and said that the team must be honest with themselves and stop trying to pin everything on the client. The idea that the client was deliberately stalling the team or waging psychological warfare was dismissed by the manager. He also said the problems with the client may not necessarily be a bad thing as the team members may have many similar clients if they decide to embark on a career in SE.

In the client meetings there were many interesting debates and ideas. Issues resolved quickly and without problem included “The Main Aim of the Project”, and “Image the site will give off”. These issues couldn’t cause a problem as the main aim of the project was what the client deemed it to be, the team would have to comply with his wishes. All of the team also agreed that they must make the web-site give off a positive image that will make people interested in control instrumentation.

Problems arose when the team allowed the client to go on rambling discourses about his career background and not stepping in to bring him back onto the topic in question. This was a serious recurring problem as the client meetings only lasted for 10-15 minutes. Some of these problems could only be blamed indirectly on the team. The client sometimes got teams mixed up and this worried group B, they worried that he would give their information to another team.

The presentation was a problem because B3 forced B2 to do the presentation and he also expressed some veiled anger towards the client. This came to the fore when he was talking about how much research the team had to do, due to the lack of information given out by the client.

7.3.9 Problems with the Client

Group A had a recurring problem with XP, for group B their recurring problem was not the methodology (Discovery) it was the client. B1 voiced an opinion very early in the project that he was unsure about carrying out a project with real industrial clients;
B3 agreed that the team would have a difficult job finding the requirements for the project.

In a later meeting B1 raised the idea of contacting other teams doing the same project and asking them if they had problems with the client. This idea was rejected as being too drastic; but it seemed tame compared to some of the later ideas raised by the team. B4 said the team should ask the Client if he is wasting their time. This was rejected by B3 because it would have caused too great a rift between the team and the client. This would have put the team in a very precarious position as the client would not be willing to give them any benefit of the doubt if they asked him such a question.

B3 also accused the client of waging psychological warfare on the team. No one dismissed this idea no matter how far fetched it seemed. It is worth noting the negative opinions of the client that the team had at the beginning of the project as shown in the questionnaire. It seems this negative attitude toward the project and client never really went away, if anything it got worse as the conspiracies showed.

7.3.10 Summary of Group B

This group also proved to be very interesting to observe and provided many colourful and sometimes memorable moments to look back on. The fierce no holds barred screaming matches between B1, B3 and B4 showed how easily personality clashes can erupt when there is more than one very clear extravert in the team. Detailed descriptions of the personality types of these members as given by Jung and Myers-Briggs can be found earlier in the report.

Despite the angry debates these people were able to put aside their differences and produce quality work when it mattered. B2 with his calm demeanour and friendly attitude served as a good peacemaker and he always liked to view things in a positive light and look for solutions that were not too drastic. This was in sharp contrast to B1 and B3 who seemed keen to resort to draconian measures particularly with B5 and the Client. B5 was a fascinating member due to the fact that so much time was devoted to him even when he was not present. In some meetings he was judged as being a childish pedant and not someone who can work well in a team, this is telling as he was the only member of the team who expressed preference for perceiving over judging. As with group A, observing group B proved to be a highly enjoyable and more importantly a highly educational exercise.

8 Comparisons of the Teams

Although 4 proved to be the most popular ordinal rating for both teams it is wrong to assume that these teams had similar experiences during the SE project. One thing lacking in group A was the angry loud exchanges that dominated the meetings of group B on a regular basis. Similarly group B did not have any one who tended to stifle debate with sarcasm and pedantry; in group B debate was stifled by screaming and the refusal to listen to other viewpoints.

The teams had different attitudes going into the project with group B having a much more negative opinion of their allotted project and client. This distrust of the client
never went away throughout the entire project; it reached its zenith when the conspiracy theories started to circulate.

Both teams had problems with certain members. For group A the problem was one of having meaningful dialogues with A4 without any harsh sarcasm, initial problems were also raised about him not turning up to meetings. Group B highlighted the poor attendance of B5 as a problem and also his refusal to complete work that had been allocated to him. This criticism was levelled at both people, but to a much greater extent in the case of group B. In some cases group B wasted a lot of time and energy discussing B5; this wasn’t a serious problem for group A as they spent as little time as possible discussing A4. None the less both teams did devote time to trying to resolve their respective issues.

Group A had a problem with the methodology; group B had a problem with the client. Both of these problems were constant throughout the project. In the case of group A they were new to XP and they didn’t feel that it was fair that they had been allocated this methodology. Several members of group A expressed deep dissatisfaction with XP regularly throughout the project. The negative feelings expressed towards the client from group B never wavered throughout the project. This team felt that they had been dealt a bad hand with the project and client; group A on the other hand felt they had been dealt a bad hand with the methodology.

There were many instances when the idiosyncrasies of the individual personality types of the team members caused problems. Examples of this include the admission from group A that they preferred to work at home alone not with other people in the lab. An example for group B is B2 complaining about being drowned out by the louder members of his team. Such problems were unique to each team and were a direct result of the personality type of the team members.

In some aspects the teams had similar problems such as problem team members; lateness for meetings; and failure to complete work on time. But they also had very different problems such as the angry debates, the vicious diatribes of B3, and the conspiracy theories of group B. For group A problems such as A4’s sarcasm, lack of a confident speaker if the regular spokesman was absent, refusal to debate certain issues and personal working preferences all highlighted the gulf that existed between the two teams.

9 Evaluations

9.1 Evaluation of the Process

The entire project did not go entirely to plan; the process of converting the initial field notes into the charts that are seen in this report was a particularly long and arduous affair with many instances of backtracking until the classification scheme became tenable. In some senses this was to be expected when one realises how much data was generated in the field notes and it was the first attempt at carrying out this kind of experimental work in a disciplined research environment.

Making observations of the team was also a learning process. As the project went on it became easier to note specific instances of behaviour and to observe and write at the
same time. In some of the early meetings important points may have been missed as it was difficult to keep up with the debate going on and trying to write at the same time. As time went by experience taught that it was not necessary to write down every last detail during the meeting. As long as the official write-up of the field notes was going to take place straight after the meeting it was sufficient to make indicatory notes and then record the event from memory after the meeting.

It must be remembered that research in this area is carried out on human beings. It is important to quote Jules at this point who says “While dogs are bound by biology, humans can soar on the wings of conventional misrepresentation” (Jules 1967) and Hudson “To require that results must be universally generalizable is to assume that people are as impermeable as billiard balls” (Hudson 1975)

The argument being put forth here is that in research involving people it can often be futile to keep trying to try to generalise results across entire populations as if this represented the Holy Grail. Often it is the case that a deeper understanding of the underlying reasons behind a specific form of behaviour is of more value to the academic community then striving for a generalisation that does not exist. That being said it is also important to make any experiment valid and reliable. Reliability is the ability of a measurement process to produce consistent results when the same variable is measured several times. A reliable experiment would mean that a researcher could use exactly the same classification and observational techniques utilised in this project on similar teams and come out with very similar results. Validity refers to the ability of a measurement process to measure correctly that which it is intended to measure. This would mean that researchers can use the results from this work in the knowledge that they are meaningful and apply them to other SE teams. It is important regardless of the size of the data set to try to ensure that experimental work is both valid and reliable.

The overall results from this initial study are valid in the sense that behavioural patterns were observed that were in accordance with the MBTI type (s) of the group members. This was verified by analysing relevant MBTI/Jungian literature and relating this back to the observed patterns. In many cases the behaviour exhibited was what one would expect from a particular type.

In terms of reliability another researcher could expect to see similar patterns of behaviour whilst using the same classification and observational techniques on groups with similar MBTI types to those used in this study. Given the breadth of SE projects it would be unlikely that an exact or even a very close replication could take place. Other factors regardless of personality can have a serious effect on SE teams, as shown in this report clients and methodologies are two such factors. If teams have an awkward client or if they express deep dislike of the methodology they have been forced to use then more problems will logically follow on as a result of this regardless of the mix of personalities. Another factor unrelated to personality is that of team members being absent, a high percentage of absent members missing from meetings would also cause severe friction.
9.2 Evaluation of the Results

The initial results from this experimental research suggest that personality type can have both a positive and negative affect on both the amount of work done by a team and the cohesiveness of a team. This research was conducted over a period of four months and involved spending over 50 hours in team meetings. In total there were 54 meetings involving both teams. A meeting generally lasted between 40 minutes and 1 hour but sometimes they only lasted for 20 minutes and then on other occasions they lasted for 1 ½ to 2 hours.

An important part of this experimental work was to relate MBTI types to the way in which a team member got on with his team mates and how he contributed ideas and work. The results show that certain types were more predisposed to certain roles and certain kinds of work. When discussing the affect of MBTI types it is important to list both positive and negative aspects. It is clear that some team members contributed more than others in terms of ideas, others contributed more in terms of speaking in public for the team, others contributed more by being a foil for ideas or for working hard behind the scenes, by being a leader or even a peacemaker. The MBTI descriptions for these individuals explain why they acted the way they did and why they played a certain role within the team. This initial study has therefore validated the use of the MBTI as a measure of personality differences that are significant to the ways in which software developers interact within teams.

Three people were responsible for the majority of the disruptions that took place. In one group there was a disruptive individual, while in the other group there was an individual plus another who formed a pair which in turn was part of a disruptive triangle. The behaviour observed was not an attempt by individuals, pairs or the trio to hijack the team and cause chaos; it was behaviour that was typical of that particular MBTI type. In a sense it was to be expected, especially when cross referenced with the work of Jung and Myers-Briggs. For instance the member of group A who stifled debate with what was perceived as sarcasm was not trying to disrupt but rather was behaving completely in accordance with his type.

Certain flashpoints have been identified on the MBTI map. One is the combination of an ISTJ with very clear preferences in a group otherwise containing N’s with moderate judging preferences. Several instances of personality clashes were observed involving the ISTJ.

Another disruptive point can be listed as the combination of an ENF, ESF and ENT all with moderate to high clarity for each function or attitude. Many disagreements broke out between these people and often became very emotional. In the same group a disruptive influence was also noted with one perceiving member in a group with a preference for judging. The perceiver was accused of being pedantic because he could not come to a decision as quickly as his team mates. This highlighted two more flashpoints on the hypothetical MBTI map.

The ordinal and numerical ratings give another dimension to the research. In addition to being able to point out disruptive points on an MBTI map the ratings allow one to numerically quantify all issues that had arisen within a particular team thereby creating a detailed profile of overall team and individual behaviour throughout the
The ordinal rating has six levels going from a passive incident without any debate to a violent screaming match. These ratings correspond to sixteen numerical ratings; the numerical ratings offer a description of the events that took place during the resolution of an issue. The existence of these ratings adds to the reliability of the research carried out. Essentially they allow any researcher to carry out an analysis of the field notes and then to classify each issue under an ordinal and numerical rating.

Detailed descriptions of a person’s personality type were given by referring to the works of Jung (Jung 1936; Jung 1976) and Myers-Briggs (Myers and Myers 1997). Both of these works proved useful throughout the project, Jung’s work was used for describing problematic instances of personality; Myers-Briggs was used for describing general personality traits. These works are vital for anyone who wishes to carry out research relating to personality typology.

10 Conclusions and Future Work

This study yielded a fascinating insight into team meetings in SE projects and how MBTI types can help to support a cohesive team. A whole plethora of issues were raised, a whole plethora of problems arose. Many different personality types were evident and the discussion encompassed such diverse topics as SE techniques to psychological warfare. The work was also a very challenging but enjoyable experience for the researchers involved.

Based on the analysis of the results in this research it is clear that the MBTI is a useful classification tool for verifying if a team will be cohesive. The MBTI is a reliable tool to use and has a lot of empirical support.

The initial results show that personality can seriously affect the cohesion of teams in meetings. Personality can also have a very positive affect on team-work; this was also demonstrated throughout the project. It was important to mention both positive and negative affects of personality differences. This would give an accurate picture of events as opposed to either looking at things through rose-tinted spectacles or constantly emphasising negative aspects. Many people have stated that differences between people can either help a team to grow and be strong or they can help to destroy it from within. What is lacking in such statements is an explanation of how and why the people are different and what it is about them that makes them either a cooperative or intransigent person. It may seem like a common sense statement to say that people are different, but without understanding the reasons behind the differences the original premise is almost meaningless. One can apply the deductive syllogism to this argument:

1st Proposition A) People are different (Major Premise)
2nd Proposition B) Personality typology attempts to classify differences (Minor Premise)
Therefore Personality Typology shows people are different (Conclusion)

Only by carrying out more research in this area can we gain more of an understanding of how and why individual differences should be appreciated in SE teams.

A logical extension of this work is to carry out more experiments on more teams. This will help to give validity and reliability to this initial study. The results of this
research will then have more academic standing. Using the MBTI seems to be a secure and wise thing to do as it leaves researchers less vulnerable to attack on the grounds that they are using an unreliable tool to measure personality differences.

One goal is to establish deep qualitative descriptions of the different personality types and their role in SE teams. A large scale research project carried out over a number of years would enable researchers to create a multi-dimensional map of the MBTI with clear indications of when and where disruptions will occur. This is not a realistic proposition for a PhD project with only one researcher but it is a possibility for future research directions. If pairs and triads that have a propensity to clash can be found during the research period then this will be useful information for SE managers. The impact of the types will be based on empirical evidence backed up by the writings of Jung and Myers-Briggs. In particular there is a need to establish a qualitative understanding of how team behaviour, whether constructive or disruptive, actually affects the activity of developing the software, and this needs to be the subject of further studies.

The long term goal is to encourage more collaborative research between ESE researchers and psychologists. ESE as a discipline can learn a lot from these people as they have many years of experience in dealing with people. By working in tandem with researchers from this discipline the ESE community can create a set of guidelines and roadmaps for carrying out human based research. This can only be beneficial in the long run as it will help ESE to evolve and hopefully generate interest in this area.

It may not be possible to find a team of maximum efficiency throughout this research period but an attainable goal is to highlight certain combinations of types that can cause problems. If one looks at the MBTI one is faced with a 16 dimensional space, if mixes that are destructive can be highlighted and explained then this would represent useful knowledge for the ESE community and for SE managers at large. Throughout the PhD efforts will be made to look at the MBTI indicators as they roughly follow the bell curve. Whilst extreme scores will not be discarded it will be kept in mind that they are uncommon in practice.

The ultimate vindication of this research would be to convince SE managers that it is a good idea to use the MBTI on prospective job candidates to ascertain whether they would fit smoothly in their existing team. It is hoped that this research will be useful for both the academic and industrial sectors; to raise awareness of human differences and pass this onto SE industrial managers would be a very useful contribution to existing SE knowledge.

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