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## The Relation between Student Behaviours in Group Presentations and their Teamwork Modalities Using Belbin and MBTI Analysis

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### Abstract

This research paper aims to investigate the relationship between learners' profiles as analysed according to MBTI and Belbin and their behaviour during group presentations while not being the active presenter. This paper is part of a research study in the field of video tagging as a mechanism for analysing individual behaviour in learning activities. As part of this study, the authors analysed videos of student group presentation and associated behavioural patterns to individual student profiles as produced by the Belbin and MBTI analysis models. The aim of the study was to identify how social and teamwork characteristics of individual learners can relate to certain behaviours. Such relations would help to better assess video content of learning activities including meetings and presentations. A primary aim of the study is to identify associations between human behaviour and individual's teamwork characteristics. Such associations could facilitate the judgment of learners' ability to work in a team. The study included quantitative research methods for analysing videos in combination with personality profiling analysis, with emphasis on social and teamwork activities. The Belbin and Myers–Briggs Type Indicator (MBTI) models were used for the purpose of this study. Furthermore, the behavioural patterns monitored during the video analysis included 'eye contact with presenter' and 'eye focus out' as the most prominent observable behaviours. The paper's conclusion is that based on the analysis results, learners classified as Coordinators (Belbin) or Virtuosos (MBTI) are less likely to lose focus while they are not presenting, and students classified as Monitor Evaluators (Belbin) or Logisticians (MBTI) are more likely to look and take care of their team members while presenting.

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*Keywords:* human behavior; student group presentation; video tagging; video content; learning modality; Belbin; MBTI; teamwork modality.

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## 1. Introduction

This field is based on the use of content processing algorithms. There is limited progress with respect to successful trials of algorithms generating fully-automated, high-level descriptions of videos and photos. There is scope for further work in the field focusing on face detection, face recognition, and image similarity algorithms that can generate useful information for consumer content management systems. [1] Improvements in data storage and innovative communication technologies avail video data for the public while interacting with multimedia data. [2] Many industries require video and audio data for different applications. [3] In our research, we focus more on observing human behaviours observable in video content, and how video tagging techniques can increase awareness and support understanding of behavioural patterns in video content that involves several individuals (e.g. group presentations). Previous work has focused on content metadata. [4] Metadata should describe the video content in a generic method to support indexing and searching of information. In our research we use a different way to tag video content and describe human behaviours, by observing specific behaviours and activities that people show in group presentation. We also attempt to find associations which can help in building a future model that can judge video content and generate a points system for specific behaviours such as an individual's behaviour toward their team.

Human gestures originate from different body movements like walking, bending, jumping, and hand waving. The main aim is to detect various gestures in a video by pre-processing the video. [5] In our research we focus on human behaviours during group presentations and in particular expressions towards other participants. These observations help us to make associations with individuals' characteristics as described by teamwork modality surveys. We believe that this investigation will help in building a model that gives an automatic rating for learners and have a good understanding of student activities and common social behaviour. Also, this model would help and support in building algorithms for automatic judgment model or a recommendation system using our findings. Our overarching research also includes an investigation in the way active presenters behave and any associations with personality types and preferences.

While many educators are recommending their students to develop global competencies, most school systems still continue to use traditional instruction forms. [6] Therefore, we selected group presentations as a traditional form of learning activity that may also help learners to acquire skills necessary for globalisation (i.e. presenting to international audiences). For the different models for determining teamwork and social characteristics, we selected Belbin, and MBTI. Belbin states that the team role could be defined as a tendency to behave, contribute and interrelate with each other's at work in a certain distinctive way. [7] Belbin proposed nine team roles classified into three types: (i) People-oriented (P) (Social), (ii) Cerebral (C) (Thinking) and (iii) Action-oriented (A) as shown in table 1.

Table 1. Belbin role.

Role	Characteristics
Coordinator (P)	Mature, confident, a good chairperson, promotes decision making.
Resource investigator (P)	Extrovert, exploratory. Explores opportunities.
Team Worker (P)	Co-operative, mild, perceptive, Listens, builds.
Plant (C)	Creative, imaginative, Solves difficult problems.
Monitor Evaluator (C)	Sober, strategic, discerning. Sees all options
Specialist (C)	Provide knowledge and skills in rare supply.
Sharper (A)	Dynamic, challenging, overcome obstacles
Implementer (A)	Disciplines, reliable, conservative.
Completer (A)	Painstaking, conscientious, Searches out errors

The Belbin team-role assessment aims at supporting the team's success, as it searches for how people behave as a part of a team. The Belbin team role evaluation tool helps in assessing team skills. [8] MBTI is the second model we used in our research, increasing awareness of different perspectives. While there are lots of similar models, the flexibility and near generic standards of the MBTI system makes it an effective tool. [9] The scale analyses personality into four dimensions: (i) the perspective of whether people tend to focus on the mental energy in the external world or the inner world, (Extroversion, E) and (Introversion, I), (ii) the perspective of how people acquire information, the

personality can be divided into the Sensational type (Sensing, S) and Intuitive type (Intuition, N), (iii) the perspective of how people handle information and make a decision, the personality can be divided into Rationality type (Thinking, T) and Emotion type (Feeling, F) and (iv) the perspective of how people treat the outside world, the personality can be divided into determining personality types (Judging, J) and perception-based (Perceiving, P). [10] Each personality dimension has two different values, that are combined into 16 personality types. Everyone can be classified into one of the 16 types and the corresponding behavioural characteristics as shown in table 2. [10]

Table 2. MBTI personality type.

Result	Type	Role	Result	Type	Role
ENTJ	Commander		ENFJ	Protagonist	
ENTP	Debater	Analysts	ENFP	Campaigner	Diplomats
INTJ	Architect		INFJ	Advocate	
INTP	Logician		INFP	Mediator	
ISTJ	Logistician		ISFP	Adventurer	
ESFJ	Consul	Sentinels	ESTP	Entrepreneur	Explorers
ISFJ	Defender		ISTP	Virtuoso	
ESTJ	Executive		ESFP	Entertainer	

We combine observation results from videos for student's group presentation with all observed behaviours and the result of student surveys (Belbin, MBTI) to identify their characteristics as input before the analysis process. Next, the paper will provide a brief literature review and discussion on the research method followed, as well as discussion on key findings and the main conclusion of the analysis conducted.

## 2. Literature Review and Related Work

Analysis of video content has been investigated in many research areas, including several trials of automatic analysis for video content in different contexts. In the areas of detection, recognition, and clustering of faces or human bodies, one of the first successful attempts in solving the face recognition task was the "Eigen-face" technique which based on principal component analysis (PCA) [1] Some researches tackle the area of video annotation with purpose of utilising device's resources used in video processing by introducing a tool that supports semantic video searching with automatic annotations. [11] A recent research in analysing human gestures in video mentions that detecting human action or gesture automatically is a difficult process, focusing on detecting various gestures in video content. [5] However, most of the researchers working with personal modalities or teamwork preferences focus more on studying different personal modalities and how they help detecting team performance or even lead to career success. Such work is focused on investigating the relation between Belbin roles and continuous improvement programs. [12] Recent research on the use of MBTI for assessing student attitudes in decision-making when selecting higher. Education programmes. [13] There is also work in predicting the performance of enrolled students from their personality, helping educational organisations to make critical decisions such as identifying promising students, and distributing students across department allocation using MBTI indicators. [14] These works provide a good indication of the importance of MBTI in a higher education environment although we want to use them in a different context. We believe that the area of analysing human behaviours in video content (in particular during group presentations) needs more investigation towards associations between human behaviours and social preferences as well as teamwork modalities from established models such as Belbin and MBTI.

## 3. Research Method

### 3.1. Research Question

In our research, we need to answer the following question, "is there an association between human behaviour during group presentation (while not being an active presenter), and Belbin team roles or MBTI types"? To answer this

question, we listed several behaviours that we can observe during the videos for all non-presenting participants. After manual observation of group presentation videos, the study aimed at identifying common behaviours and investigating any associations with specific preferences and personalities. These behaviours included (i) Body Movement, (ii) Body Pose, (iii) Face Expression and (iv) Eye Contact. We recorded student group presentations and asked students to undertake the Belbin and MBTI profiling surveys. In our research, we used Quantitative research method as we observed video's presentation manually to count observed behaviour's occurrence for each team member, as described in Table 3, and we also collected the following information from the video itself to support in the analysis process: (i) order of presentation, (ii) number of appearances per member, (iii) gender of presenter, (iv) individual presentation duration, (v) presentation duration for the team, (vi) count of group members, (vii) start time, (viii) end time and (ix) duration of video.

In our research, we focused more on specific characteristics, that are related to teamwork social traits, so in Belbin we focused more on student classified as people oriented (Social) category, whole in MBTI we focused more on Extroversion, Introversion, Consul (Social and extraordinary caring) as these are relevant to our research to correlate the behaviours of students with those characteristics.

Table 3. Behaviour's description.

Behaviour	Values	Description	Note
Body Movement	Stable	This is the default behaviour for the member that he is stable and in a standing position while he/she is not presenting.	Assumed as default, calculated automatic by subtracting movement duration and member presentation duration from total video duration.
	Moving	This behavior happened when the member starts to move his body by changing his legs location on the ground.	Calculated manually by counting the number of occurrences, assuming that each occurrence takes 1 second.
Body Pose	Front	This is the default behavior for the member, as he is facing the camera or audience with his body.	Assumed as default, calculated automatic by subtracting moving duration and member presentation duration from total video duration.
	Side	This behavior happened when presenter move his body away from the camera so one of his shoulders is not shown.	Calculated manually when the body in a side position.
Face Expression	Normal	This is the default behavior for the member to show neutral facial expression.	Assumed as default calculated automatic by subtracting smile duration and member presentation duration from total video duration.
	Happy (Smile)	This behavior happened when a member shows some positive expression such as happiness, smiling and relaxing.	Calculated manually by counting the number of occurrences, assuming that each occurrence takes half a second.
Eye Contact	Neutral	This is the default behavior for the member that he/she has generic eye contact with the audience or camera.	Assumed as default, calculated automatic by subtracting looking to presenter duration and looking out of focus duration and member presentation duration from total video duration.
	To presenter	This behavior happened when the member is looking at the presenter. this behavior has a good impact and shows more caring from a member toward his team.	Calculated manually by counting the number of occurrences, assuming that each occurrence takes 1 second.
	Out of Focus	This behavior happened when the member is looking to the ceiling or to the floor or reading a note or looking to his cell phone or even to his watch. this behavior has a bad impact and shows less caring from a member of his team.	Calculated manually by counting the number of occurrences, assuming that each occurrence takes 1 second.

### 3.2. Tagging Technique and data set

We used each behaviour as a tag (node) to collect and record the occurrence of the behaviour, the following table describes each behaviour and how to be observed. We recorded videos for a group of final year students at Middlesex University while they were presenting their projects in a group presentation, a snapshot from a video presentation shown in Figure 1. Table 4. shows video information.

Table 4. Video information.

Academic Year	Number of Clips	Total Duration	Average Duration
2016-17	15	2.7 hours	11 minutes
2017-18	14	2.9 hours	12 minutes
2018-19	12	2.6 hours	13 minutes
Total	40	8.2 hours	12.3 minutes

We observed the occurrence of the behaviour manually. After we finished observing 41 distinct video files containing more than 8 hours of presentations for 40 groups of students, we came up with the result of 137 different presentations for 132 students. We then calculated the percentage of behaviour occurrence against duration to normalise all the presenter's behaviours and ensure that the results were comparable and capable to generate valid results. The student Belbin and MBTI profile samples are shown in table 5.

Table 5. Survey sample.

Member	MBTI	Belbin	Extroversion / Introversion
#1	Sentinel	Monitor Evaluator	Extroversion (E)
#2	Sentinel	Team Worker	Introversion (I)
#3	Analyst	Implementer	Extroversion (E)
#4	Analyst	Resource Investigator	Extroversion (E)
#5	Sentinel	Resource Investigator	Extroversion (E)
#6	Sentinel	Implementer	Extroversion (E)
#7	Sentinel	Resource Investigator	Extroversion (E)
#8	Analyst	Plant	Extroversion (E)
#9	Sentinel	Implementer	Extroversion (E)
#10	Sentinel	Implementer	Introversion (I)
#11	Sentinel	Resource Investigator	Extroversion (E)
#12	Sentinel	Shaper	Extroversion (E)
#13	Explorer	Completer Finisher	Extroversion (E)
#14	Sentinel	Coordinator	Extroversion (E)



Fig. 1. Presentation snapshot.

The next step was to use Tableau in order to provide visual analytics of our results. Initially we showed the variation of behaviour occurrences and the different ranges for. Each behaviour as shown in figure 2. After measuring the standard deviation for the five behaviours' duration percentages which are (i) 'Eye focus out', (ii) 'Eye Focus on the presenter', (iii) 'Smile', (iv) 'body side position', and (v) 'movement' we found that 'eye focus out' and 'eye focus to presenter' had the highest standard deviation values as shown in table 6. Therefore, we produced the visualisation of the relation between these behaviours and the results from the profiling surveys. As 'eye focus out' and 'eye focus to the presenter' are the most important measures for student behaviours, while they are not a presenter, we combined both values in one measure we called 'eye contact factor' using the following equation:

$$\text{Eye Contact factor} = \frac{T_p \%}{T_o \%} \quad (1)$$

Where:

$T_p$  %: Percentage of Time focusing on the presenter to the time of an inactive presentation.

$T_o$  %: Percentage of Time focusing out to the time of an inactive presentation.

This new factor gives us a better indicator for eye focus as the higher the value of this factor means more focus on the presenter and less focus out, and the lowest value means the opposite. The next step was to produce a graph for eye focus out, eye focus to presenter percentage and eye focus factor with different roles in both model (Belbin and MBTI).

### 3.3. Calculations

After observation of behaviours in the videos, we created some calculated fields from our observation as follows:

$$T_a = T_e - T_s \quad (2)$$

$$T_i = T_t - T_a \quad (3)$$

$$T_n = T_i - (T + T_p) \quad (4)$$

$$T_o(\%) = \left(\frac{T_o}{T_t}\right) * 100 \quad (5)$$

$$T_p(\%) = \left(\frac{T_p}{T_t}\right) * 100 \quad (6)$$

$$T_n(\%) = \left(\frac{T_n}{T_t}\right) * 100 \quad (7)$$

Where:

$T_a$ : duration for each member while he is an active presenter.

$T_e$ : end time of the presentation.

$T_s$ : start time of the presentation.

$T_i$ : duration for each member while he is in an inactive state (not presenting)

$T_t$ : duration for all member's presentation

$T_n$ : duration of time while his eye contact is neutral.

$T_o$ : duration of time while his eye is out of focus.

$T_p$ : duration of time while looking to the presenter.

Table 6. Behaviour measurement values.

Behaviour	Minimum	Maximum	Average	Standard Deviation
Body Pose %	0	1.045	0.013	0.106
Eye Focus Out %	0	24.52	3.67	4.23

Eye Focus to Presenter	0	1.027	0.044	0.151
Movement %	0	11.94	0.33	1.31

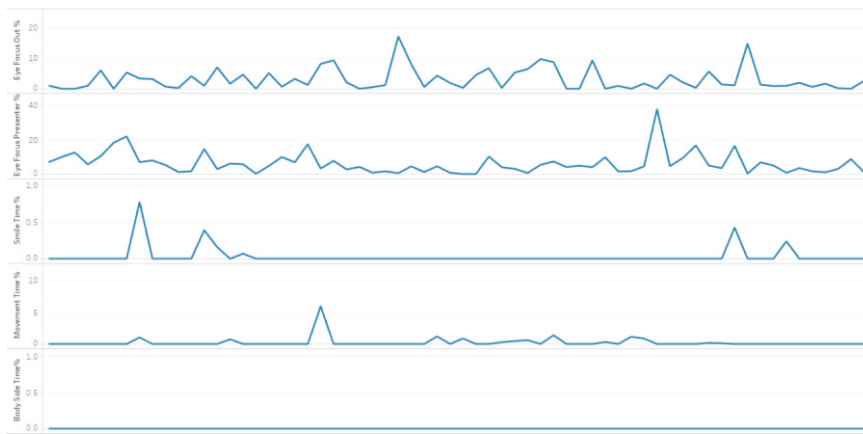


Fig. 2. Behaviour variations.

#### 4. Findings

Combing our observations for student's behaviours with the Belbin survey's results, we concluded to the following:

- Students who present first in their teams have the highest average eye focus to presenter and lowest eye focus out value, and of course they have the highest eye focus factor among the average for people presenting in second or third order this interesting fact shown also in details in figures 3 and 4.
- The Belbin role who got the lowest eye focus out was the Coordinator (Social), with average value 1.9%, while the role with highest the eye focuses out was the Plant (Thinking) role with average value 6.6%.
- In eye focus to the presenter, the highest value was for people with Monitor Evaluator role with average value 9.5%, while the role with the lowest eye focus to presenter was Plant role with average value 2.1%.
- Eye contact factor also shows a similar result as the highest value was the Monitor Evaluator role and the lowest value was for the Plant role.

The findings in association to the MBTI survey are shown in figure 5:

- The MBTI personality type who got the lowest eye focus out was the Virtuoso type. with average value 1.0 %, while the type with the highest eye focus out was the Architect type with average value 18.7%.
- In eye focus to the presenter behaviour, the highest value was for people with Logistician type with average value 7.1%, while the type with the lowest eye focus to presenter was Logician type with average value 0.5%.
- Eye contact factor also shows a similar result as the highest value was a Virtuoso type and the lowest value was for Logician type.

All these findings are shown in details in figure 5.

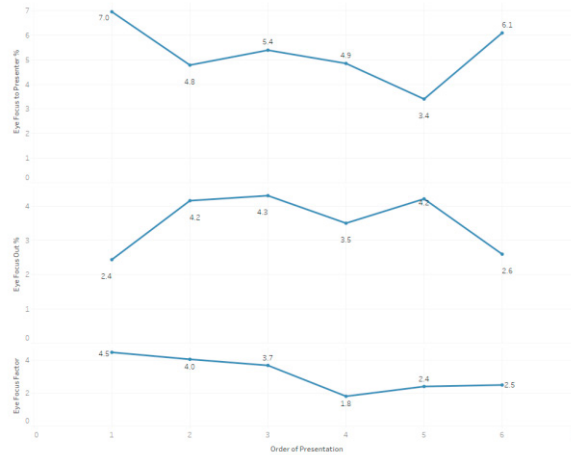


Fig. 3. Order presentation results.

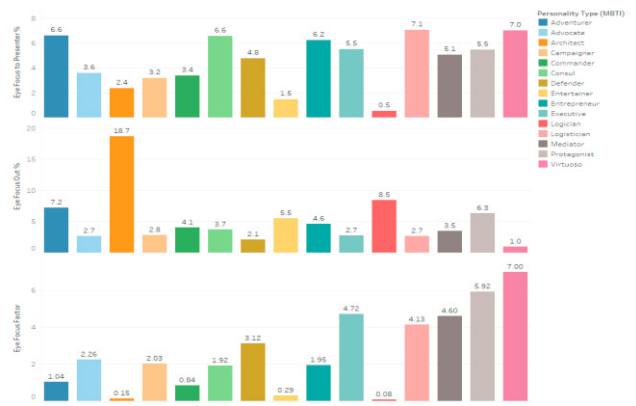
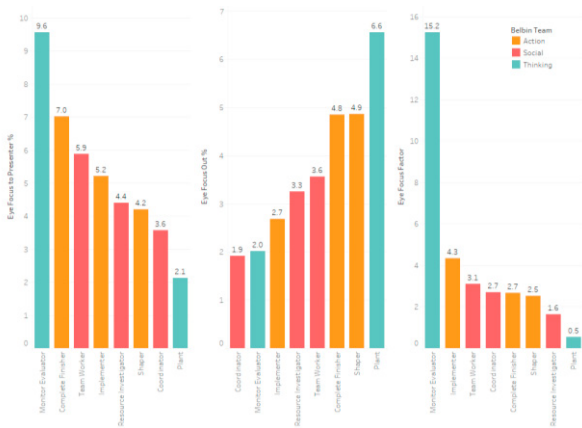


Fig. 4. Belbin role results. Fig 5. MBTI type results.

### 5. Conclusions

Following our findings, we can conclude that with regards to the Belbin roles classification, students with the Coordinator role have less probability to lose focus while they are not presenting, while students with the Monitor Evaluator role have much probability to look and take care of their team members while they are presenting. With respect to the MBTI profiles, we can conclude that students of the Virtuoso type have less probability to lose focus while they are not presenting, and students with Logistician type have much probability to look and take care of their team members while they are presenting. Finally, students who present first in group presentation are most likely to have good eye contact with the presenter and doesn't lose the focus easily. This paper is part of an overall study that focuses on the analysis of learner profiles and identifies associations between certain behavioural patterns that are more prominent to certain types and roles. The work is currently extended to include further models and analysis of more video files.



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