
FINAL YEAR PROJECT

CM0343 – 40 Credits

FINAL REPORT

“Label It”

A study analysing the relation between user demographic information and how they label an image.

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Abstract

The objective of this study is to recognise patterns and connections in the way we label and name objects within images, according to the demographic information we possess.

Data was collected through a simple built web form and stored in a relational database for efficient data processing.

The data was normalized and cleansed and the database was mined resulting in annotation frequencies, co-occurrence and collocations given by specific demographic clusters.

Annotation frequencies were graphed and label co-occurrences and collocations were organised into tables of descending order. Results were analysed searching for correlations, uses of concrete and abstract nouns, adjectives and concepts.

This final report focuses on further research into gender differences, the choosing of images for this study, methods of displaying data and analysis on the genders, ages, languages and education level demographics.

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1. Introduction

The purpose of this study is to recognise patterns and connections when individuals of different genders, ages, languages and education levels name objects within and concepts from an image; a topic I believe is overlooked in Computer Science, as images are usually labelled to give semantic content and information for searching facilities.

The interim report covers definitions of perspectives and perceptions, research into how our perspectives are affected, how age, ethnicity and gender affects our vision.

Different possible ways of collecting data for this study were researched – resulting in building a web based image labeller being the most practical solution. Possible technologies to build the web form were explored, with the web languages HTML, CSS and PHP being chosen because of their simplicity.

Ways of storing the data were examined, resulting in a relational database using MySQL – PHPMYAdmin enabling efficient data processing.

The conclusion of the interim report was to choose five images for the web form that was ready to be published to collect data.

Continuing from my interim report and therefore covered in this final piece are the chosen five suitable images to be labelled, collected data from participants and results from mining the database using statistical measures such as co-occurrence, mutual information, co-relations and collocations. From this data, taxonomies - defining and naming groups of objects that share the same characteristics - for each image have been created. A formal definition similar to a dictionary entry has also been given to each concept from the taxonomies. (*taxonomies, taxonomies defenitions.xls*)

Results from this study have been visualised using simple methods.

2. Further research

2.1 How gender affects our vision

Covered in the interim report, (2012, Glynn.S) according to a study published in Biomedicine, the journal Biology of Sex Differences suggests that men and women differ when it comes to vision. While females are better at distinguishing colours, experts suggest that males are more sensitive to fine detail and rapidly moving objects.

“If you look at brains, there is a thing connected to emotion called amygdala, which shows greater functional connectivity in men. And women show greater connectivity when remembering emotional images. There are hundreds and hundreds of studies looking at the brain in various ways using MRI... It is not well understood but there are big differences... If you want good genetic evidence that there's psychological differences between Males and Females, look at the new born children. At birth, girls look longer at the face and boys look longer at a suspended mobile. As young as twelve months, girls make more eye contact and react sympathetically to the distress of others. This cannot be social learning, this is clearly genetically determined.” (2013, Wolpert.L)

(2012, Lee.J) However, another study by researchers of the University of Bristol shows gender differences in terms of where the participants had focused their attention and how much of a picture they had explored. More men had focused on the faces of people in the picture, mainly the eyes as well as other body parts such as hands. However, women explored more of the image, focusing on non-facial areas. Felix Mercer Moss, a vision researcher and doctoral student at the University believes that risk aversion may explain as to why fewer women are focusing on looking people in the eye, as a direct gaze can be interpreted as being threatening in the Western culture.

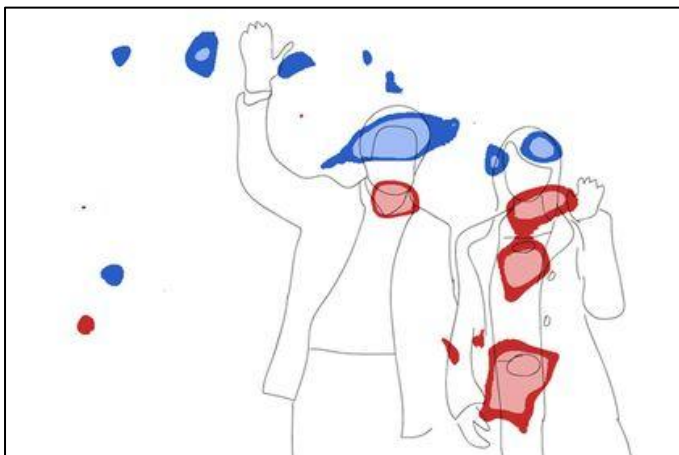


Figure 1

From these studies, it will be interesting to see if similar patterns occur within this study, such as if Females use more colour than Males, or if more Males annotate facial features.

3. Data analysis

The database needs to be queried to find patterns within datasets of participants with different demographic characteristics. Patterns consist of: the frequencies of participants who have annotated a particular object or concept can show where on the image they have focused upon and what intangible concept they relate that image or object with. The amount of words used in an annotation can show how descriptive participants are. The words used in an annotation i.e. concrete nouns, abstract nouns and concepts, adjectives to expand description etc. The co-occurrence of two annotations - specifically analysing their correlation – can show which datasets annotate objects that semantically relate and how dependent those words are on each other.

3.1 Collocation

(2006, Keller.F) Collocations are sequences of words that occur together which correspond to conventionalized, habitual ways of saying things. Collocations contrast with other expressions that are near synonyms, but not conventionalized. For example, the collocation 'strong tea,' is used as opposed to 'powerful tea.' Analysing and searching for annotation collocations will show how descriptive and informative the participants have been. It could also lead to language and translation differences. For example when translating 'strong tea,' into Welsh, the word sequence is switched producing the annotation 'tê cryf.' When this is directly translated back into English it produces 'tea strong.'

There are two ways of finding collocations:

3.2 Co-occurrence

(2006, Keller.F) If two words appear to have more frequently been used together, they form a stronger collocation.

3.3 Point wise Mutual Information (PMI)

(2006, Keller.F) Co-occurrence of words does not necessarily mean they are collocations. Naturally, mutual information tells us how informative the occurrence of one word is about the occurrence of another. Words that are highly informative about each other form a collocation. To calculate PMI, we use the following formula:

$$f(x, y) = \log \frac{\frac{C(x, y)}{N}}{\frac{C(x)}{N} \times \frac{C(y)}{N}}$$

PMI has its disadvantages; it is inconclusive with infrequent data. If two words separately occur only once but appear together, they have a high PMI. (Turney.P et al) Words can also have a high PMI when it comes to word dependence. If we assume that two words are perfectly dependent on each other and they co-occur. High PMI does not mean high word dependence. The rarer the word the higher the PMI.

3.4 Text Normalization and Stemming

(2006, Filip.G et al) Text normalization is an automated process which neutralises differences in order to identify semantically equivalent words or phrases. It consists in

expanding abbreviations, converting names, numbers, acronyms, dates etc. An example is the string £20 would be expanded in English into twenty pounds.

(2008, Manning.C et al) Stemming's goal is to reduce inflectional and derivational forms of a word to a common base form. Stemming is usually referred to as a basic experimental process that chops off the ends of words in the hope of achieving the return of the word root.

(2006, Porter.M) "The Porter's stemming algorithm is a process for removing the common morphological and inflexional endings from words in the English language." It is mainly used as a part of a term normalization process. For example the plural annotation 'cats,' will become 'cat.' Christopher McKenzie built a JavaScript stemmer which demonstrates Porter's algorithm.

The process of normalization is highly needed for this study as participants will have different methods of specifying annotations with similar meanings. This is essentially duplicating data and so could affect results, particularly during collocation analysis.

3.5 Nouns

A noun is a word used to name an object, a thing or an abstract idea. Nouns can be categorised into concrete and abstract nouns. Concrete nouns are nouns that name people, places, things that are tangible or have real existence. Abstract nouns on the other hand name intangible things such as concepts, ideas, emotions etc. The difference between these nouns is what they name. If we take war for example, it is an abstract noun. We cannot see war. We can see soldiers, tanks, weapons and explosions which indicate the concept of war.

3.6 Adjectives

Adjectives are phrases, clauses or a single word that describe nouns by answering one of these questions: what kind is it? How many are there? Which one is it? Adjectives add imagery, expresses and describes nouns in more detail.

It is important to understand exactly the differences between nouns and adjectives for this study, particularly between concrete and abstract nouns as participants correlate tangible objects with meanings and concepts during the co-occurrence analysis.

4. Data visualisation

4.1 Choropleth maps

Figure 1, produced by the University of Bristol, effectively and visually displays the different areas participants of different genders had focused on. This method is similar to choropleth mapping, which is predominantly used in geography (2013, *Barcelona Field Studies Centre*) where areas are shaded according to a prearranged key, with colours representing a range of values. Its popular geographical use is with population data.

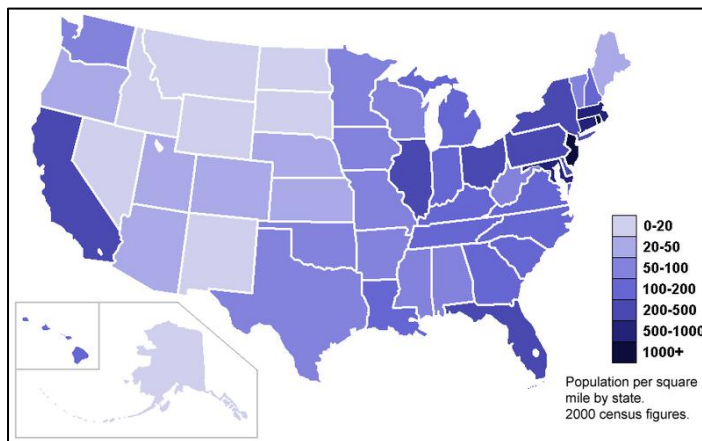


Figure 2 - An example of a choropleth map of state populations of the United States.

A choropleth version of the images in this study could highlight areas that were focused on according to the annotations given, similar to figure 1. A reliable online source (2009, *Clearly and Simply*) describes a step by step tutorial on how to create a choropleth map. To do this, the .jpg formatted images would be converted into a .svg file format with an online converter. This essentially 'breaks' the image into shapes which can be searched, named or edited. The colour from the shapes of the .svg image can be deleted and those shapes can then be layered above the original image corresponding to the original object. Similar to a choropleth map, the shapes layered above that image would then be filled with colour that would represent the difference in frequency.



Figure 3 – An example of an image converted into a .svg format.

4.2 Bubble charts

Bubble charts are unusual for displaying sets of numeric values as circles. It is advantageous to use when datasets have hundreds of values or values that significantly differ. Circles in a bubble chart represent different data values, with the circle area corresponding to the value. The positions of the circles generally do not mean anything. Using Microsoft Excel, a bubble chart can be layered on top of an image. Whereas generic bubble charts do not consider the positions of the circles, for this study, the circles would be located using graphical co-ordinates above where the object in the image is.

The only disadvantage of using choropleth maps or bubble charts to visually display data is that the annotations must be concrete nouns as concepts or abstract nouns are intangible.

4.3 Tag clouds

A tag cloud is a technique for visually representing the occurrence of words. The most popular topics are highlighted in a larger, bolder font, making it easy to distinguish the most frequently used annotation. A tag cloud could be used to effectively visually display the most frequently singular and co-occurring annotations.

5. Design

Continuing from the interim report, the final work to be done on the web form was to choose five images containing objects or a concept that were open to any interpretation.

5.1 Image 1



Figure 4 - An image of New York, one of the busiest and largest cities in the world.

This image is very colourful and takes thorough observation to notice some objects such as the bottom of the American flag at the top of the image. This image was chosen purely because of the American and busy culture that could be interpreted from it. With the question “are there any patterns and connections when individuals of different languages label and name objects within an image,” particularly in mind, it should be interesting to see the results from participants possessing this characteristic. For example, do they also co-relate the yellow taxis with New York or the US, similar as to what I, a Welsh, Welsh speaking, White, Female, had annotated?

5.2 Image 2



Figure 5

Image 2, shown as figure 5, was chosen because of its simplicity. Its lack of objects or concrete nouns prompts participants to think of the concept or abstract nouns relating to the

half glass of water. The half full half empty notion provokes participants to annotate optimistically or pessimistically.

5.3 Image 3



Figure 6

The famous photo of image 3 is of the historic moment on June 5th, 1989 where an unknown man stood in front of a convoy of Chinese Type 59 tanks the morning after the Chinese military removed protesters from Beijing's Tiananmen Square. Image 3 has also a variety of concrete nouns and abstract nouns such as 'war,' or 'brave,' that could be annotated.

5.4 Image 4



Figure 7

Image 4, shown as figure 7 was chosen purely because of the croquet being played in the image. Croquet is a British, predominantly English sport where a ball is hit by a mallet through hoops in the grass. It is not popular and is perceived to be played by members of the upper class.

The last image, figure 8 is of a compass with its point bearing between South and South-West. It sits on a map of Morea, the name that was given to the Peloponnese peninsula in Southern Greece during the middle ages. This image was not chosen because of the location of the map, but the concept of direction and travel perceived by the compass and its point.

6. Implementation

The implementation process consisted of HTML (*Appendix 1,*) CSS (*Appendix 2,*) and PHP (*Appendix 3,*) for structuring, formatting and connecting the web labeller to the MySQL relational database.

No formal testing was performed on the web form; however simple tests were run on all up to date popularly used web browsers testing if it displayed the form neatly and was storing data correctly in the database. The form's URL was also sent to five testing participants who tested its functionality and mainly if it worked on their web browser versions. No errors appeared from this however, when normalizing the data I realised a variety of participants who had annotated 'blank,' or 'no image,' indicating that some participants had issues when viewing image 4.

6.1 Incorrect database structure

When the web form became live, a significant error was found within the database. The PHP was saving each entry as 'image_id, label1, label2, label3, label4, label5, user_id,' in the 'Labels,' table. This meant that querying co-occurrences in the future would be a hard task to complete. With the guidance of my supervisor, the 'Labels,' table was modified so that it is now called 'Annotations,' and is storing 'user_id, image_id, label, stem,' where 'stem,' is the normalized annotation and 'label,' is the original annotation.

6.2 Data cleansing

A personal target was to reach 300 responses, however it exceeded and the final total of participants was 530 (*Users table.xls*) Following this the data needed to be cleansed. Data cleansing is the act of detecting, correcting or removing corrupted data from a database. The participants' information was manually cleansed deleting participants and their corresponding annotations who had given false or illogical information. For example, a participant has stated they were under 10 years of age but had a PhD. Annotations were also cleansed, removing inappropriate text such as swearing or for example a participant had annotated 'penguin,' multiple times. Empty annotations were deleted which resulted in 506 participant appropriate information. This process may have been biased as my opinion of illogical and appropriate data could be different to the opinion of others and so discarding potentially suitable data.

It was specified in the interim report that seven clusters of different demographic information were to be analysed for patterns. Because of the vast amount of responses and data, it was decided to exclude the religion, nationalities and ethnic origin demographics from the analysis.

6.3 Normalization

After the data cleansing process, the data needed to be normalized and stemmed. From the research, Christopher McKenzie's JavaScript built stemmer demonstrating Porter's algorithm seemed acceptable to use to stem annotations. However, some issues occurred such as some letters at the end of the word were being discarded for no reason. Therefore, this also meant that most of the normalization and stemming processes were manually completed, opening a large gate way of potential human errors such as misspelling, spaces after the

annotation or simply missing the annotation. There are 11,657 annotations in total (*Annotations table.xls*,) with 2563 distinct normalized annotations (*Stems table.xls*.) The process of normalization helped:

- expand dates such as '1800,' to 'eighteenth century,'
- converted annotations that consisted of numbers - '2 balls,' was converted to 'two balls,'
- excluded symbols - 'bulb?,' was converted to 'bulb,'
- excluded plurals - 'buildings,' was converted to 'building,'
- rephrased annotations - 'couple of elderly people sitting,' was converted to 'elderly couple sitting in chairs,'
- misspellings - 'concentration,' was converted 'concentration,'
- expanded abbreviations - 'compass pointing SSW,' was converted to 'compass pointing between south and south west.'

6.4 SQL queries

Once the data was normalized, the database was mined. Multiple SQL queries were run to find annotations given by participants from specific clusters of demographic information for each image.

Examples of SQL queries run on the database are:

```
SELECT Users.age, Annotations.label, Annotations.image_id
FROM Users, Annotations
WHERE Users.age = '16 - 24'
AND Users.user_id = Annotations.user_id
AND Annotations.image_id='1';
```

This query produced all annotations given for image 1 by participants who had selected their ages as 16 -24.

```
SELECT stem, Users.gender, LENGTH( stem ) - LENGTH( REPLACE( stem, ' ', '' ) ) +1
FROM Users, Annotations
WHERE Users.user_id = Annotations.user_id
AND Users.gender = 'Male'
AND Annotations.image_id='3';
```

This query produced all annotations of more than one word in length given by Male participants for image 3.

The results were then exported into Microsoft Excel files where they processed further.

6.5 Microsoft Excel

The frequency of the annotations were produced using the =countif function and organised in descending order where the top 20 most frequently annotated labels were graphed.

The bubble charts were created by simply using the bubble chart feature of Microsoft Excel and layering it above the original image. The X and Y coordinate values of the data points are manually adjusted so that they sit exactly where the tag is on the image. The percentages of the annotations were calculated by its frequency out of the total amount of annotations in that cluster. To be able to visually show the data, the annotations needed to relate to concrete nouns. Therefore, the frequency of the annotations per cluster were organised in descending order and the concrete nouns were manually chosen according to their frequency. The bubbles are categorised into three colours, red representing more than 40%, yellow representing between 30 and 40% and green representing less than 20%. The sizes of the bubbles also vary according to the annotation frequency.

It was decided to discard the tag cloud and choropleth method of visually displaying the data. The most frequent annotations were visually displayed best on histogram graphs and in co-occurrence tables. The choropleth method was also discarded because of two reasons; the bubble chart method also produced this result and there was simply too much data, meaning that image shapes became blocks of colour, making objects unrecognisable.



Figure 9 – A choropleth example of highlighting objects within image 1 according to their frequencies.

7. Analysis

Each demographic cluster undertook similar analysis.

For each cluster containing 20 or more annotations, the top 20 most frequent were graphed in Excel. The graphs were manually analysed and observed looking for patterns in the abstract and concrete nouns given, the use of adjectives or generally any peculiar occurrences. Some datasets could not be graphed as they had little participants, therefore for each chapter; a threshold of a minimum of 5 participants per cluster was set.

The database was mined for annotations of two or more collocations from each cluster. The collocations were organised in descending order giving the top 20 most frequently used. The data is displayed in tables and is analysed for adjectives and how many collocations used in an annotation, proving participants have been descriptive.

The co-occurrence of two annotations were mined from each cluster. They were also organised in descending order and the top 20 most frequently co-occurring annotations are also displayed in tables. These co-occurrence tables were manually analysed for semantic correlation.

Following this, the PMI for each co-occurrence in each cluster was calculated to measure mutual information and correlation. The top 10 highest PMIs for each cluster are displayed in tables and are manually analysed for semantic correlation.

The data for the genders dataset are visually displayed by using the bubble chart method. This is just to show as an example of what we can do with the data and highlights particular areas of the image that were frequently focused upon.

8. RESULTS

Dataset: Genders

Are there any patterns that occur when individuals of different genders label image?

320 Females, 186 Males.

8.1 Image 1

8.1.1 Top 20 most frequent annotations – (*Appendix – Genders – Image 1 – Top 20 Most frequent annotations*)

The graphs display that both genders have used similar annotations. Both datasets have annotated concrete nouns with the most frequent being “taxi, people, zebra crossing.” More Females have seemed to use adjectives to describe their concrete nouns, using “yellow cab, yellow taxi” as opposed to the Male’s single collocation “taxi.” Using colour draws our attention directly to that object within the busy image.

On the other hand, Male participants are more descriptive in their annotations, using more collocations to describe the objects. Males have used “traffic sign, watch advertisement,” as opposed to Females who have used “sign, watch.” Although the Females have also specified that the sign is for “no right turn”, their “sign,” annotation could possibly relate to another sign in the image.

8.1.2 Collocation – (*Appendix – Genders – Image 1 – Collocation*)

There are similarities in the frequency rankings, with the first five most frequent collocations being exactly the same stems. More Females have used colours to describe objects, naming a “white scarf, green jumper.”

8.1.3 Co-occurrence – (*Appendix – Genders – Image 1 – Co-occurrence*)

Both datasets have used exact most frequent co-occurring annotations and similar semantically co-occurring annotations throughout. Although, both genders have named objects that are semantically irrelevant to each other such as “bag, taxi,” “shopping bag, traffic light” etc.

8.1.4 Co-occurrence PMI – (*Appendix – Genders – Image 1 – Co-occurrence PMI*)

Analysing the similarity between both stems given by both datasets, there are again similarities. Results show that both genders have co-related co-occurrences of words with high PMIs. The highlighted annotations semantically relate to each other.

There are some inconclusive PMI results that show two stems perfectly dependent on each other with low PMIs. This may be because participants were annotating rarer objects. Therefore a high PMI can also mean how rare a co-occurrence is.

8.1.5 Data visualisation – (visual – image 1 genders.xls)

Females



Males



The bubble charts show that more Males have annotated the bearded man and the blonde haired women. More Females are aware of the American flag in the background, the brown paper bag, the women wearing a brown coat and the women wearing a green jumper. More Males have annotated the watch advertisement in the background, though more Females have annotated the crowd of people and the shops in the background. A high percentage of both genders annotated the taxis, the traffic light, the crowd's shadow and the zebra crossing.

8.2 Image 2

8.2.1 Top 20 most frequent annotations – (*Appendix – Genders – Image 2 – Top 20 Most frequent annotations*)

Compared to Image 1, Image 2 had far less objects to annotate and therefore not many differences were to be expected. Consequently the first eight most frequent annotations are the same. Both datasets frequently used the optimistic annotation “half full.”

More Female participants have used synonyms of the annotation “water,” labelling “liquid, drink, and clear liquid.” Similar to Image 1, Females have annotated and specified the colour “brown.”

8.2.2 Collocation – (*Appendix – Genders – Image 2 – Collocation*)

Unlike Image 1, an equal amount of participants from both datasets annotated the colour of the wall. There are similarities in the collocation frequency rankings, with “half full, half full glass, half empty glass,” appearing to be most frequent. Similarities also appear when using texture or adjectives “wooden table, wooden surface.” A higher frequency of Males have gone into much more detail and annotated “wood grain.”

The annotation “reflection,” was searched as an example.

Both datasets have “reflection,” as their most frequent label. Similar to Image 1, both datasets have high frequencies of annotations that specify the object with a single collocation or describe the reflection with an adjective. Both datasets have an equal amount of stems including the annotation “reflection,” with very similar collocations.

8.2.3 Co-occurrence – (*Appendix – Genders – Image 1 – Co-occurrence*)

Both datasets have exact most frequent co-occurred annotations.

It was expected that irrelevant annotations were given. “glass, wall,” are objects that are completely disconnected. However, high frequencies of participants have annotated “glass, water,” “reflection, water,” etc. which semantically co-relate.

8.2.4 Co-occurrence – PMI – (*Appendix – Genders – Image 1 – Co-occurrence PMI*)

Analysing the similarity between stems, there are some semantic similarities with high PMIs. Both datasets have annotated “half full, half empty,” which semantically are similar and have high PMIs. This is also true with the water synonyms “clear, transparent.”

Yet again PMI has proven to produce inconclusive annotation similarities as the majority of the highest PMIs do not semantically correspond. The annotations “liquid, water,” have the lowest PMI of -0.08 which is inconclusive.

8.2.5 Data visualisation - (*visual – image 2 genders.xls*)

Females



Males



The bubble charts show very little differences in annotations and their frequencies. Fewer Females have annotated the glass “rim,” yet fewer Males have annotated the “light,” reflection at the glass base.

8.3 Image 3

8.3.1 Top 20 most frequent annotations – (*Appendix – Genders – Image 3 – Top 20 Most frequent annotations*)

Image 3 also contained very little concrete nouns. Similar to Image 2, the top seven most frequent annotations by both datasets are equal, with more Males annotating “tiananmen square.”

Higher frequencies of Male participants annotated labels that co-relate with the happenings of Tiananmen Square. The concrete nouns “protest, protester, communist,” and “china,” are annotations of the larger semantic field “tiananmen square,” and “war.”

The abstract noun “war,” was used frequently by both genders. The frequently annotated concrete noun “tank,” is a label of the larger semantic field “war.”

Many Males perceive the man in the image as courageous and brave. It was expected following the patterns from Image 1 and 2 that, along with the most frequent annotation “tank,” the annotation “four tanks,” would have been frequent.

8.3.2 Collocation – (*Appendix – Genders – Image 3 – Collocation*)

Similar to Image 1 and 2, the collocation frequencies for Image 3 are similar, with the top six most frequent annotations being the same but ranked slightly differently.

Females used more than two collocations to specify that the man is standing in front of the tanks. An equal amount of Females and Males have used the annotation “red star.” Yet, Male participants have annotated a variety of annotations that semantically co-relate to “tiananmen square,” specifying that the tanks and that the single protester is Chinese. More Males have specified the man’s bravery.

More Females have used four or five collocations to describe the light. Overusing collocations may sometimes be useless as prominent concrete nouns do not need to be specified and a simple annotation “street light,” or “light,” has the same affect.

Females have used adjectives with the annotations “white light bulb,” “five large light bulbs,” and “five rounded white light bulbs,” providing information of the appearance of the street light.

8.3.3 Co-occurrence – (*Appendix – Genders – Image 1 – Co-occurrence*)

The first nine most frequent co-occurring annotations having similar.

Annotations such as “street lamp, tank,” “arrow, person,” “light, person” etc. do not have any co-relation. However, the annotations “gun, tank,” “road, street light,” “army, tank” and “tank, war,” which have semantic co-relations were frequently used by Females.

8.3.4 Co-occurrence PMI – (*Appendix – Genders – Image 1 – Co-occurrence PMI*)

The Female dataset, “death, terror,” are the only co-occurring annotations that correlate. With a PMI of 0.51, “war, tank,” was one of the lowest co-occurred related annotations.

Males have more co-occurring co-related annotations with high PMIs. Similar to Image 2, lower PMIs could have been calculated for correlating labels because of participants naming rarer annotations.

8.3.5 Data visualisation - (*visual – image 3 genders.xls*)

Females



Males



There are little differences in annotations and their frequencies. More Males have annotated the bag in the protesters hand. Yet, more Females have annotated the person itself and the arrow road marking.

8.4 Image 4

8.4.1 Top 20 most frequent annotations – (*Appendix – Genders – Image 4 – Top 20 Most frequent annotations*)

The top six most frequent annotations given by both datasets are yet again following the same frequency ranking. This is the first occurrence where Females have two equal most frequent concrete nouns, these being “shed,” and “tree.”

Fewer Males have annotated the yellow and red balls that are prominent in the image. More Males have annotated that the senior croquet player and spectators are retired.

8.4.2 Collocation – (*Appendix – Genders – Image 4 – Collocation*)

Both genders have used similar collocations describing croquet accessories. Compared to two Male participants, a significant amount of Females used the annotation “red ball.” This can be referred back to Image 1, where more Females annotated labels including colours.

8.4.3 Co-occurrence – (*Appendix – Genders – Image 1 – Co-occurrence*)

Comparing the co-occurrence results from Image 4 with the previous images, it seems that the annotations given for this image are the most non-related co-occurring annotations. Only one set of co-occurred annotations “grass, tree,” semantically co-relate.

8.4.4 Co-occurrence PMI – (*Appendix – Genders – Image 1 – Co-occurrence PMI*)

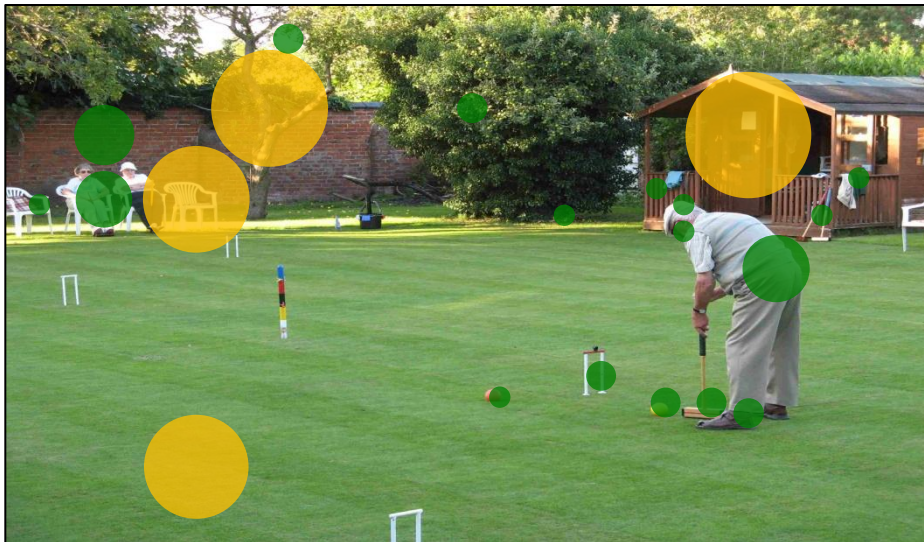
The PMI results show that Females have more co-related co-occurred annotations with high PMIs. However, the top 10 highest PMIs for the co-occurred annotations given by Male participants show no relation other than “red ball, yellow ball.”

8.4.5 Data visualisation - (*visual – image 4 genders.xls*)

Females



Males



Females have annotated the blue towel hung over the side of the shed's fence, whereas Male participants have annotated the shed's fence. Male participants have also annotated the old man's glasses whereas Females have not. Many more Females have labelled the yellow ball and the croquet mallet used by the croquet player or leaning against the shed. Male participants have annotated the shoes and the chair.

8.5 Image 5

8.5.1 Top 20 most frequent annotations – (*Appendix – Genders – Image 5 – Top 20 Most frequent annotations*)

A significant amount from both datasets have frequently annotated “compass,” and “map.” A variety of abstract nouns were given proving that participants correlate objects within this image with “adventure, travel, explore,” which are labels of the larger semantic fields “compass,” and “map.”

8.5.2 Collocation – (*Appendix – Genders – Image 5 – Collocation*)

Both datasets have frequently used similar collocations to describe the direction of the compass pin. A higher frequency of Males have identified that the compass is pointing south south-west, using fewer collocations. Both datasets have specified the letter ‘a’ on the map, describing it is a capital letter. Also, both genders have high frequencies in specifying that the map is old as opposed to the singular collocation “map.”

More Females describe the map by using two or three collocations. Both datasets have a significant amount of users who frequently used the singular non descriptive label “map.” Some participants proceed to describe the map with synonyms of the word “old,” by describing it as “ancient,” and “vintage.” Similar to Image 1 and 4, Females also proceed to describe the sepia colour of the paper.

8.5.3 Co-occurrence – (*Appendix – Genders – Image 1 – Co-occurrence*)

The co-occurring annotations given by both datasets for Image 5 again show correlations. Both genders have a high frequency in using the annotation “compass, map.” Ssimilar to all 4 images, there are some non-related annotations such as “map, ring,” “compass, morea,” “compass, paper,” etc.

8.5.4 Co-occurrence PMI – (*Appendix – Genders – Image 1 – Co-occurrence PMI*)

Both top 10 PMI results have very little correspondence, with only three co-occurred annotations given by Females and two by Males having the highest PMIs. “north west, west,” “direction, place,” “east, south,” This is similar to the Male’s annotations.

8.5.5 Data visualising - (*visual – image 5 genders.xls*)

Females



Males



The bubble charts above show that more Females have annotated the compass pointer. Males have focused more on the text “Morea.” There are very little differences, with both datasets focusing on the compass’ cardinal directions, the sea, the compass’ shadow, the capital letter A and the text “Golfo di Coron.”

9.RESULTS

Dataset: Ages

Are there any patterns that occur when individuals of different ages label image?

**10 (11 – 15), 329 (16 – 24), 49 (25 – 30), 15 (31 – 34), 25 (35 – 40),
15 (41 – 44), 29 (45 – 50), 16 (51 – 55), 7 (56 – 60), 6 (61 – 64), 5 (Over 65).**

9.1 Image 1

9.1.1 Top 20 most frequent annotations – (Appendix – Ages – Image 1 – Top 20 most frequent annotations)

11-15

A low frequency of participants gave the most prominent label “taxi.” It was specified that the taxi is an “american taxi.” This is interesting as this participant acknowledges the taxis as American, possibly due to its common American yellow colour or that they are aware of the location of the image. The shirt has been specifically described with two adjectives. Not only is the shirt yellow, but it is neon and bright. Looking back at the image, without this information the object is easily missed however the use of these adjectives makes it noticeable. Lastly, the annotation “life,” is quite interesting. It has a low frequency yet the participant possibly could have annotated this as they associate their life or life in general with busy crowds of people.

16-24

Unlike the 11-15 dataset, a significant amount of participants annotated “taxi.” The annotation “new york,” was given frequently showing that participants are aware of the image location. Similar to the 11-15 dataset, “yellow cab,” was frequently given. Along with specifying the colour yellow, a cab is an Americanism for taxi, therefore this could mean that a larger amount of English American speakers of this age participated.

Both datasets have high frequencies in annotating “shop,” before the “shopping bag.” The 16-24 dataset has also a high frequency in the annotation “watch,” whereas the 11-15 dataset has only one participant who annotated the watch advertisement.

25-30

Similar to the 16-24 dataset, 25-30 frequently annotated “taxi, traffic light and “people.” Yet unlike both previous datasets, participants from this dataset have annotated “flag.” The area where this object is in the image is quite dark and is hard to identify.

31-34

Similar to the previous datasets, the 31-34 participants have also frequently annotated “taxi,” and “people.” Unlike all previous datasets; a participant has noticed the shop’s “awning, bearded man and busy.”

35-40

No differences can be found in the annotations given by this dataset. A higher frequency of participants have specified the people wearing the concrete nouns. The use of adjectives specifies that the blonde haired woman is wearing a red top. With this information, we can instantly see her in the image. The word “bloke,” in the annotation “bloke with sunglasses,” is English slang for man, potentially meaning that a British participant gave this annotation.

41-44

No differences occur from this dataset. Similar to the 31-34 dataset, the mature annotation “bustle,” describes the state of the image as opposed to “busy.”

45-50

Unlike any other dataset, two participants from this dataset have specified “men,” and “women.”

51-55

One interesting result appeared from this dataset where a participant expressed their opinion believing that the people within the image belong to a community of wealth or are well off.

56-60

A very low frequency of participants from this dataset annotated “taxi.” An equal amount of participants annotated “shadow,” and “silhouette.” The use of the annotation “silhouette,” which from the folksonomy is defined as “the dark shade and outline of someone visible against lighter background,” specifies that the participant is annotating particularly the shadow of the crowd as opposed to any other shadow.

61-64

Unlike any other dataset, no participant from the 61-64 dataset annotated “taxi.” There are three annotations which refer to English American words, these being “girl wearing red sweater, green sweater, intersection.” British English speakers would call a sweater a jumper and an intersection a junction. This could again mean that there were higher frequencies in English American participants of this age. The annotation “shadow,” is most frequent. This could be down to the fact that the shadow produced is dark and takes up the majority of the space in the image.

9.1.2 Collocation – (*Appendix – Ages – Image 1 – Collocation*)

Almost all datasets have similar frequently annotated collocations. All clusters excluding the 61-64 and Over 65's have frequently annotated 'traffic light, zebra crossing, shopping bag.'

All datasets used adjectives, mostly colours. More 61-64 participants have used colours to describe concrete nouns, with the first five most frequently used collocations involving a colour. Participants of the 31-34, 35-40, 45-50, 51-55 and 61-64 datasets have specified who is wearing the coloured object.

There are also a number of collocations that semantically relate to New York or America, with participants of the 16-24, 25-30, 35-40 and 45-50 clusters semantically correlating the taxi as being American or specifying the location of the image as Times Square, New York. Older generations have simply stuck to annotating generic concrete nouns that could be found in any location of the world.

9.1.3 Co-occurrence – (*Appendix – Ages – Image 1 – Co-occurrence PMI*)

The 11-15 dataset have annotated five co-occurring annotations which correlate.

The 16-24 dataset has similar co-occurrence patterns to the 11-15 dataset, with both having high frequencies in the use of "people, zebra crossing," and "traffic light, zebra crossing."

However, the 25-30 dataset has less correlating co-occurring annotations. The annotations "bag, sunglasses," semantically correlate as they are accessories which frequently occur together in this dataset.

The remaining datasets contain generic co-occurred concrete nouns. The 51-55 and 56-60 datasets contain fewer co-occurrences that relate compared to any other dataset. The 56-60 dataset has only one co-occurred annotations "scarf, sunglasses," with any relation.

The over 65 dataset similar to almost all other datasets contain a similar amount of relevant co-occurrences revolving around road traffic terms.

9.1.4 Co-occurrence PMI – (*Appendix – Ages – Image 1 – Co-occurrence PMI*)

Analysing the top 10 highest co-occurrence PMI for each cluster, there are high correlations between a variety of annotations relating to road traffic terms, men and women, scarf and sunglasses and shop and shopper.

Unlike Image 5, participants have seemed to focus on annotating concrete nouns as opposed to correlating nouns with meanings, concepts and abstract nouns.

Again, similar to the results from analysis on the Genders, PMI has produced inconclusive results, with the 16-24 cluster and the 'crowd and people,' annotations producing a low PMI of -0.09.

9.2 Image 2

9.2.1 Top 20 most frequent annotations – (Appendix – Ages – Image 2 – Top 20 most frequent annotations)

11-15

The most frequent and prominent objects in the image are “glass,” and “water.” A participant from this dataset has used the pessimistic annotation “half empty glass of water.”

16-24

The 16-24 dataset have also frequently annotated “glass, water and table.” Unlike the 11-15 dataset, many more participants have annotated the optimistic term that the glass is half full. This dataset also uses synonyms of water and glass giving the annotations “liquid,” and “cup.” They have extended their vocabulary and have used the annotation “meniscus,” which is the curved surface of a liquid in a cylinder container. This is a much more advanced and scientific term to have used as opposed to the 11-15 dataset who refers this as being “round.”

25-30

This dataset has also used the synonym “liquid,” and the optimistic term “half full.” However, participants of this dataset used the annotation “circle,” as opposed to “meniscus.” This annotation is similar to the label “round,” given by the 11-15 dataset.

31-34

This dataset has also used the annotation “meniscus,” and similar to the 11-15 and 25-30 dataset have used the annotation “circle on top of glass” and “oval,” to describe its shape.

35-40

Participants from this dataset have also used the optimistic term “half full.” This dataset has used more water synonyms, annotating “drink,” and “fluid.”

41-44

Participants from this dataset have used colour to describe the wall in the background. This dataset also contains water synonyms, annotating “clear liquid, drink,” and “fluid.” An equal amount of participants have used the annotations “half full,” and “half empty.” This could be the same participant, as it is common to relate these terms together. Interestingly, the annotation “fragile item,” was given.

45-50

The annotation “transparent,” a synonym of the word water, it is essentially used similar as the word clear which was given by other datasets. These annotations define the state of the water. The annotation “meniscus,” appears again. High frequencies of participants have used the optimistic annotation “half full.”

51-55

The annotation “glare,” is used to describe the glistening produced by the light reflecting from the water.

61-64

The annotations “gin,” and “vodka,” were only given by participants of this dataset. The annotation “meniscus,” and the optimistic term “half full,” were also given.

9.2.2 Collocation – (*Appendix – Ages – Image 2 – Collocation*)

All datasets, excluding the over 65s have frequently used the annotation 'half full, half empty.' Participants from these clusters have positively and frequently used the collocation 'half full. ' Variations of the glass state were given by almost all clusters, annotating 'half glass of water, half full half empty, half empty glass, etc.' The 16-24, 25-30, 35-40, 41-44, 45-50, 51-55 and 61-64 clusters have frequent uses in using more collocations, increasing the information they give.

Another observation is that the 25-30, 16-24, 41-44, 51-55 and 56-60 clusters have used the annotations 'transparent, clear liquid or clear fluid.' These words semantically correlate to the concrete noun 'water.'

No cluster has used abstract nouns of more than one collocation long. Almost all clusters excluding the 31-34 and 56-60 have used colours to describe the background and the table. Similar to image 1, the older generations have frequently used colours.

9.2.3 Co-occurrence – (*Appendix – Ages – Image 2 – Co-occurrence*)

All datasets have correlating co-occurring annotations. Each dataset have higher frequencies when using the annotations "glass, water." There are a variety of annotations that do not co-relate given by each cluster. This could be because participants seemed to have fixated on annotating concrete nouns.

9.2.4 Co-occurrence PMI – (*Appendix – Ages – Image 2 – Co-occurrence PMI*)

Similar to Image 1, PMI measures for each cluster have resulted in a variety of correlated and unrelated annotations. The 41-44 and 51-55 clusters having no correlations. Most clusters have similar correlating annotations, these being 'glass, water, reflection, half empty and full.'

An interesting result is the highest PMI for the 'clear and transparent,' annotations given by the 45-50 cluster as these annotations were not frequently given.

9.3 Image 3

9.3.1 Top 20 most frequent annotations – (Appendix – Ages – Image 3 – Top 20 most frequent annotations)

11-15

One annotation draws our attention here, this being “death.” Although the image does not specifically display death or the act of killing, the position of the man, the generic concrete nouns such as tank which semantically related to the abstract noun war has been perceived by the participant.

16-24

Similar to the 11-15 dataset, this dataset has also annotated “tank,” most frequently. Participants from this dataset seem to acknowledge that it is Tiananmen Square. The annotation “protest,” is frequently used signifying that the participants are aware that the man was protesting. The annotation “war,” was frequently given, perceived by the tanks which are commonly correlated with war. The annotation “courage,” was also frequently given, signifying that participants have also perceived his acts as being courageous.

23-30

The annotations “brave person, bravery, courage, fear,” have been given again signifying the correlation between the man’s actions.

31-34

The annotation “camouflage,” tank appears to only have been annotated by this dataset. Again, the annotations “death,” and “fear,” are used proving correlation from the tank imagery with war. Yet, differently to any other dataset thus far, the annotation “demonstration,” was given, proving that participants from this dataset understand why the man stood in front of the tanks.

35-40

Participants have annotated “person standing in front of tanks,” whereas six participants have used the annotation “person.” In this instance, as the person standing in front of the tanks is prominent within the image, there is no need to describe using a large amount of collocations. They realise too the “aggression,” portrayed in the image.

41-44

Along with generic objects, participants have correlated this image with “oppression, aggression, bravery, control, fear, history.” These annotations relate to the acts of Tiananmen Square, relating control and oppression with the Chinese military.

51-55

The annotation “chinese intolerance to change,” signifies that they are aware of the history of the image.

61-64

Very little total participants belonged to this dataset. However, they are the first participants to have annotated “four red stars,” on the tanks. Similar to the 11-15 dataset, one participant has used the annotation “killing.” This abstract noun is intangible and it perceived and correlated from the war portrayed from the image.

9.3.2 Collocation – (*Appendix – Ages – Image 3 – Collocation*)

Almost all clusters have used colours, mainly to describe the 'red star,' on the tanks, the white road lines and the white shirt. Unlike image and 2, participants over 65 have not used colour within their annotations.

All clusters, excluding the over 65s, have annotated concrete nouns that semantically correlate to war and the history of Tiananmen Square. A variety of collocations are used to inform the location of the star, the amount of tanks and their colour, war and army accessories, connections with China etc.

Some clusters, specifically the 16-24, 25-30, 36-40, 41-44 and 51-55 have used abstract nouns and adjectives such as 'bravery, brave man, depth of feeling, act of desperation, etc.' Unlike any other image thus far, this shows that participants of younger and middle age seem to correlate protesting with these annotations.

9.3.3 Co-occurrence – (*Appendix – Ages – Image 3 – Co-occurrence*)

Some dataset do not have co-related co-occurrences.

With very little relating co-occurrences, this again could be down to participants naming less concrete nouns and more rarer abstract nouns.

9.3.4 Co-occurrence PMI – (*Appendix – Ages – Image 3 – Co-occurrence PMI*)

Image 3 has resulted with each cluster using generic semantically correlated concrete nouns with high PMIs. Similar to Image 5, annotations for this image specifically from the 16-24 and 25-30 clusters, relate to concepts and abstract nouns. 'gun, violence,' 'bravery, fear,' and 'brave person, war,' semantically correlate and have high PMIs.

On the other hand, participants from the 41-44, 61-64 and Over 65 clusters have no correlated annotations. This could be because of the total amount of participants from these clusters being quite low, meaning it is less open to a variety of abstract nouns or that participants have fixated on purely annotating objects within the image itself.

9.4 Image 4

9.4.1 Top 20 most frequent annotations – (Appendix – Ages – Image 4 – Top 20 most frequent annotations)

11-15

Very little participants have annotated the most prominent action in the image which is “croquet.” This could be because participants from this dataset are not aware of the English sport. The people in the image have been specified as being “pensioners,” due to their elderly persona. Due to this persona, a participant has related the playing of croquet to the pensioner’s “lifestyle.” This dataset has also annotated “ball,” yet have not specified its colour.

16-24

Unexpectedly the annotation “croquet,” was not the most frequently given. More participants from this dataset used the adjective “old,” to describe the people within the image as opposed “man,” and “people.” The annotation “retirement,” also relates to the elderly croquet players and spectators. An interesting observation is that the “red,” and “yellow ball,” have an equal amount of frequencies. A number of participants have annotated the season as being “summer,” possibly because of the weather and the croquet players and spectators are wearing summer clothing. They have also specified the relaxing atmosphere.

25-30

No participants from the 25-30 cluster has annotated “croquet.” In fact, three participants have mistaken this sport for “cricket.” The adjectives “old people,” and “old man,” is used again used to describe the elderly in the image. The annotation “calm,” is given to describe the image atmosphere. This dataset have frequently used the annotation “ball,” yet have very few participants who have specified its colour.

31-34

Participants of this dataset are the first to annotate “blue coat on kiosk fence.” The use of the adjective “blue,” makes the coat stand out instantly from the kiosk fence when looking back at the image. Again, it is interesting that only two participants have annotated “croquet.” This is the first dataset to name croquet accessories.

35-50

It is interesting to see that participants from this dataset have only annotated “yellow ball.” Compared to the 31-34 dataset, more participants from this dataset have acknowledged that this is a game of “croquet.” Similar to the 31-34 dataset, this dataset has specified some croquet accessories.

41-44

Similar to the 16-24 dataset, this dataset has also annotated the season “summer.” Very low frequencies of participants have again annotated “croquet.” Two participants have annotated “concentrate,” which has not appeared before in any other dataset.

45-50

This dataset has a minimal amount of participants who annotated “croquet.” Two participants have annotated the abstract noun “companionship.” These participants therefore acknowledge that the people in the image are friends.

61-64

This dataset has one participant who gave an annotation containing multiple collocations to specify that they are annotating the “cloth item hanging on the kiosk rail.” The annotation “small brown building,” also uses multiple collocations, however due to the small building being quite a prominent object within the image, the annotation “shed,” has also the same effect.

9.4.2 Collocation – (*Appendix – Ages – Image 4 – Collocation*)

The annotations 'old man, old people, elderly people, etc.' gradually decrease in frequency as the participants become older. The 16-24 cluster in particular has a very high frequency in describing the people as being old. This could be because older generations have a different outlook on how they see themselves as to what younger generations do.

Again, similar to the previous images, most clusters have used colour to describe the concrete nouns. With only the 16-24 dataset annotating the 'yellow ball,' and 'red ball.'

It is also interesting that more of the middle aged and older participants have annotated the concrete nouns croquet and its accessories. This could be because croquet is stereotypically played by the elderly and as it is an old and unpopular sport, it may not be recognised by younger generations.

We see the annotations 'blue outline, blue box, question mark, etc.' frequently used by some clusters. This proves that some participants struggled to view the image.

9.4.3 Co-occurrence – (*Appendix – Ages – Image 4 – Co-occurrence*)

The 11-15, 31-34, 41-44, 56-60, 61-64 and Over 65 clusters did not have co-related co-occurring annotations. However, the remaining datasets only contain one co-related set of co-occurred annotations.

9.4.4 Co-occurrence PMI – (*Appendix – Ages – Image 5 – Co-occurrence PMI*)

The PMI measurements for each cluster have on average not produced successful results, with many datasets producing uncorrelated annotations with high PMIs.

9.5 Image 5

9.5.1 Top 20 most frequent annotations – (Appendix – Ages – Image 5 – Top 20 most frequent annotations)

11-15

The most obvious and prominent object in the image “compass,” has expectedly been annotated most frequently. Participants have used adjectives to describe the map as “old,” and “ancient.” It is interesting to see the abstract nouns “direction,” “discovery,” and “navigation.” This shows participants correlate a compass and a map with these abstract nouns. The name has also been specified as being Latin, as opposed to actually annotating the name itself. They also specify the area as “morea.”

16-24

A large frequency, similar to the 11-15 dataset, annotated “direction.” The annotation “adventure,” and “explore,” was used quite frequently, assuming that the participants correlate a compass and a map as a sign of going on an adventure. A number of participants also named the cardinal directions “north,” and “south.”

25-30

This dataset has also frequently annotated “direction, adventure, morea,” and “travel.” Participants have given three collocations to annotate the direction of the compass point. This dataset also has noticed the “golfo di coron,” written on the map. This dataset is also the first to have participants who acknowledge that the “land,” on the map is a part of “Greece.”

31-34

A participant from this dataset has also noticed the “crease,” in the paper on the right hand side of the image which is not visible at first glance and takes detailed observation to notice.

35-40

Similar to the 31-34 dataset and unlike any other dataset so far, this dataset has noticed the letter “a,” prominently located on the right side of the image. A participant proceeds to use three collocations to specify that the letter “a,” is a capital letter. Participants have also used the adjective red to describe the colour of the compass arrow tip whereas most participants from this and other datasets have only specified the “arrow.”

41-44

Similar to the 25-30 dataset, a participant from this dataset has also acknowledged that this map is of “Greece.” An interesting annotation is “choice,” and “artwork.” These annotations have not occurred in any other dataset. The “artwork,” refers to the drawings on the left side of the map and is quite noticeable.

51-55

The participants of this dataset have annotated the “star,” on the compass face.

61-64

Similar to the 55-60 dataset, the participants of this data have also annotated the star on the compass face. However, whereas the 55-60 dataset annotated the single collocation “star,” the participants of this dataset have used three collocations to specify the “eight pointed star.” They have also given the annotation “love,” which correlates to the text language. A participant of this dataset has also annotated “sepia,” and “shade of brown,” to describes the colour of the map. Similar to the 31-34 dataset, a participant from this dataset has also noticed the crease in the map.

9.5.2 Collocation – (*Appendix – Ages – Image 5 – Collocation*)

There are interesting results found in each cluster for this image. Most participants have annotated the generic concrete nouns. Some clusters contain annotations such as 'outdated form of navigation, treasure hunt, lord of the rings, faraway place, coast line, image of god, plan trip, captain hook, unfamiliar place, land mass, etc.' These abstract annotations semantically correlate to the map and the compass in the image.

Another observation is that almost every cluster has frequently specified that the map is old or as the 45-50 participants have annotated 'antique.'

A variety of cardinal directions have been given, with multiple collocation lengths. Participants have either specified the direction of the compass arrow or have used shorter collocations to specify the direction only, which has the same affect.

Again, the use of colour is prominent by most clusters, with the red compass pointer and the gold of the compass case being annotated. The 61-64 cluster has used colour to define the brown shade of the map and the compass pointer. Most clusters have also annotated the 'compass key ring,' and 'place name.'

Participants of the 16-24 and 35-40 only have frequently annotated the 'capital letter a,' with a variety of clusters observing and annotating that the map's text is in a 'foreign language.'

9.5.3 Co-occurrence – (*Appendix – Ages – Image 5 – Co-occurrence*)

All datasets have frequently annotated the co-occurring labels “compass and map.”

All datasets excluding the 51-55, 56-60, 61-64 and Over 65 have used either "compass, direction," or "compass, travel." To a certain degree, this shows that higher frequencies of younger participants correlate a compass with going on a course along where someone moves.

The 31-34 dataset is the only dataset that has frequently used the annotations "reflection, shadow," and "arrow, circle," together.

The 45-50 dataset contains the most participants who annotated cardinal directions most frequently. This could be because they struggled to name objects or annotate relations to the image.

9.5.4 Co-occurrence PMI – (*Appendix – Ages – Image 5 – Co-occurrence PMI*)

Unlike any other PMI measurement results, Image 5 has produced conclusively high PMIs for correlated c-occurring annotations for each cluster. The most interesting annotations are the abstract nouns 'ambition, direction,' 'explore, knowledge,' 'adventure travel,' 'compass, direction,' and 'explore, map.'

Cardinal directions given by participants have also appeared with high PMIs.

10. RESULTS

Dataset: Education level

Are there any patterns that occur when individuals of different education level label image?

47 (High/ Secondary school), 1 (Middle school), 72 (Higher education (Year 12&13), 299 (University/ College (Undergraduate), 60 (University/ College (Postgraduate), 17 (PhD), 17 (Other), 3 (Without education).

10.1 Image 1

10.1.1 Top 20 most frequent annotations – (Appendix – Education – Image 1 – Top 20 most frequent annotations)

Higher education (Year 12 & 13)

Similar to the High/ Secondary School dataset, a high frequency of participants have annotated “taxi,” with only a five participants specifying the colour. This dataset has annotated the flag within the image which is less visible.

University/ College (Undergraduate)

Fewer participants from this dataset have specified the “watch advertisement,” as opposed to the participants who annotated the single collocation “watch.” Participants from this dataset specified the location of the image which is “new york.”

University/ College (Postgraduate)

The results displayed in the graph above are very similar to the University/ College (Undergraduate) participants, with both datasets having the same five top most frequent annotations. Similar to the Higher education dataset, participants from this dataset also acknowledged the “flag,” in the image.

PhD

The PhD dataset has the annotation “shopping bag,” as it is most frequent. In fact, no participant from this dataset has annotated “taxi,” and one participant has annotated “people. Similar to some previous datasets, two participants used the annotation “watch,” however as opposed to “watch advertisement,” the participants with a PhD have annotated the advertisement incorrectly as being a “ring advertisement.”

Other education level

The annotations that draw attention here are “colour, affluent community, bright sunshine, disinterested,” and “green sweater.” The annotation “disinterested,” was given to describe the emotion on the people’s faces

10.1.2 Collocation – (Appendix – Education – Image 1 - Collocation)

Almost all datasets have frequently used the collocations 'zebra crossing, traffic light, no right turn and shopping bag,' which are generic visible concrete nouns.

All datasets, excluding the participants without education have used adjectives such as colour within their annotations. Whereas participants from the High/ Secondary school, Postgraduate, PhD, and Other education level clusters tend to have focused on annotating colours of the concrete nouns, participants of the Higher education cluster have annotated more clothing items and have specified exactly who is wearing these items. They have used a variety of collocations to specify the person wearing the item, increasing how informative their annotations are.

When it comes to defining the location of the image, almost all clusters excluding the Middle school, other education level and Without education clusters, have annotated 'new york,' or 'new york city.' It is interesting to see that a participant from the PhD cluster has annotated 'new york taxi.' It is commonly known that New York taxis are yellow and therefore the participant could have correlated this.

10.1.3 Co-occurrence – (*Appendix – Education – Image 1 – Co-occurrence*)

A high frequency of High School participants annotated 'taxi, zebra crossing,' and 'traffic light, zebra crossing.' Following this, 'crossing, taxi,' and 'pedestrian crossing, taxi,' were also frequently annotated together. Participants from the Higher education and the Undergraduate cluster have also frequently annotated concrete nouns that co-relate with road traffic and its characteristics. An interesting result given by the Postgraduate participants is that the annotations 'men and women,' were annotated together. There are no significant important results found from this analysis.

10.1.4 Co-occurrence PMI – (*Appendix – Education – Image 1 – Co-occurrence PMI*)

The PMI measurement for the analysis of this image did not produce an extensive amount of conclusive results. Overall, it produced eight conclusive correlated annotations with high PMIs over a set of eight clusters.

10.2 Image 2

10.2.1 Top 20 most frequent annotations – (Appendix – Education – Image 2 – Top 20 most frequent annotations)

High/ Secondary School

The frequent annotations “half empty glass,” and “half empty,” show that more participants have used the pessimistic term. Four participants have annotated “liquid,” a synonym of water.

Higher education (Year 12 & 13)

Double the amount of participants in this dataset have annotated the optimist term “half full glass,” as opposed to the “half empty glass.”

University/ College (Undergraduate)

A higher frequency of participants of this dataset, similar to the Higher education (Year 12&13) dataset, has annotated “half full,” or “half full glass.” Seven participants annotated the “meniscus,” produced by the water. Compared to the previous dataset who have annotated this as a “circle,” this more scientific term was not frequently used by another other dataset.

University/ College (Postgraduate)

Two participants have annotated “curve,” and “rim,” which has not occurred in any current dataset. The “curve,” annotation possibly refers to the meniscus produced by the water.

PhD

Unlike any other current dataset, a participant from the PhD dataset has annotated the “two marks on glass rim,” produced by the reflection of the light on the glass.

Other education level

Unlike any other dataset, two participants who have a different education level have annotated the synonym of water, “fluid.” A participant has also interestingly annotated “fragile item,” possibly referring to the glass or relating to that water gives life and that it too is fragile. An equal amount of participants have annotated “half empty, half full.”

10.2.2 Collocation – (Appendix – Education – Image 2 - Collocation)

The main result from the collocation analysis is that a variety of different ways of annotating the state of the water in the glass have been used by participants of each cluster. The participants from the High school, Higher education, Postgraduate and Other clusters in particular, have used on average six different ways of annotating 'half full,' or 'half empty.' A high frequency of the participants from the Higher education and Postgraduate clusters have annotated 'half full glass and half empty glass,' as opposed to the significant amount of participants who used the annotation 'half full.' Again, similar to Image 1, the over use of collocations can be effective when creating imagery or describing an object. Another observation is that, on average, a higher frequency of participants from each dataset have

used the optimistic approach and have annotated that the glass is half full as opposed to empty.

The use of colours is also popular with the High school, PhD and Other education clusters. These adjectives have been used to describe the meniscus of the water or the colour of the background.

The annotation 'clear liquid,' appears within four datasets. This annotation belongs to the larger semantic field water, has only been annotated once by every cluster.

10.2.3 Co-occurrence – (*Appendix – Education – Image 2 – Co-occurrence*)

Analysing the co-occurrence of annotations given by each cluster, there are some correlations.

An interesting result is that two participants from the without education cluster have annotated 'thirsty and water.' This is interesting purely because no other cluster has annotated a concrete noun along with an abstract noun or a human state.

10.2.4 Co-occurrence PMI – (*Appendix – Education – Image 2 – Co-occurrence PMI*)

Again, similar to Image 1, the PMI measurement for the correlating and co-occurring annotations given for Image 2 has produced nine conclusive results. This image lacked concrete nouns probing participants to name five objects or abstract nouns.

Most conclusive results seem to appear within the High school cluster, where the co-relating annotations 'cup, cup reflection,' 'door reflection, light reflection' and 'half full, half empty,' have high PMIs. Interestingly, the Undergraduate and Other education level clusters who co-occurred 'half air, half water,' also has a high PMI along with 'clear, transparent.' Another interesting result from the PMI measurements is the co-occurring and semantically correlating concrete and abstract nouns 'thirsty and water.'

10.3 Image 3

10.3.1 Top 20 most frequent annotations – (*Appendix – Education – Image 3 – Top 20 most frequent annotations*)

High/ Secondary school

Three participants from this dataset have co-related this imagery with the annotation “war.” They are also aware of the relation between “communists,” and the image.

Higher education (Year 12 & 13)

Similar to the previous dataset, the participants with Higher education have also frequently annotated the object “tank,” and “road.” Other than the annotation “war,” this dataset has focused on annotating the objects within the image.

University/ College (Undergraduate)

Participants have annotated “courage,” proving they correlate the man’s actions with being courageous.

University/ College (Postgraduate)

Both Undergraduate and Postgraduate participants have the annotations “tank, road, light, man,” as their most frequent labels. Similar to the Undergraduate dataset, the Postgraduates have annotated “bravery.” Participants have also acknowledged the “oppression,” and “aggression,” perceived from the image, which no other dataset has.

PhD

Unlike any other dataset, a PhD participant have been very specific in using the annotation “four chinese type 59 tank,” proving they are fully aware of the history of Tiananmen Square. Again, unfamiliar to any other dataset is the annotation “killing.” This participant correlates the imagery from this mage with death.

Other education level

Unique to this dataset is the annotation “act of desperation,” and “chinese intolerance to change,” which proves that the participant from this dataset is once again aware of Tiananmen Square’s history. They have also perceived the “anger,” in the image, annotating the tanks as being “aggressive.” Again, unlike other datasets, participants of other education have annotated “confront,” which states the action within the image,

10.3.2 Collocation – (*Appendix – Education – Image 3 - Collocation*)

Overlooking the results from the collocation analysis, it seems that a vast amount of participants from each cluster have frequently annotated the same concrete nouns. Some participants from the High school, Higher education, Undergraduate, Other education level and those without education have annotated abstract nouns. 'military bullying, standing up for rights, defiance towards government, peaceful man, individual looking on, depth of feeling, act of desperation, aggressive tank, brave man, power of the individual and no fear,' are intangible abstract nouns perceived from the imagery and history within the image.

Participants have also named concrete nouns that are a subset of the larger semantic field war, these being 'sub machine gun and armoured vehicle.' However, interestingly all clusters excluding PhD participants, other education level and those without education, have annotated the location of the image, which is Tiananmen Square. Some, particularly from the postgraduates and higher education clusters have used more collocations, annotating 'Tiananmen square protests of 1900, Tiananmen square protests 1989.'

10.3.3 Co-occurrence – (*Appendix – Education – Image 3 – Co-occurrence*)

Results show that most clusters excluding the without education dataset contain the same amount of correlating co-occurring words. In particular, the annotations 'solider, tank,' 'tank, war,' 'fight, war,' 'fear, tank,' 'death, tank,' 'fear, war,' 'ammunition, war' and 'oppression, Tiananmen square,' are interesting as again, most of these annotations are intangible objects and are therefore abstract nouns. Participants from each cluster therefore must correlate or perceive the concrete nouns within this image as being dark, war related abstract nouns.

10.3.4 Co-occurrence PMI – (*Appendix – Education – Image 3 – Co-occurrence PMI*)

PMI measures resulted with strong correlated annotations with high PMIs, with the Undergraduate and Postgraduate clusters containing the most frequent amount of correlating co-occurred annotations. Focusing on the Undergraduate cluster, the annotations 'bravery, fear,' and 'army, fight,' semantically correlate and have a high PMI proving they are mutual. Similar results occur within each cluster, where the annotations 'death, fear,' 'army, military,' 'fight, war,' etc. are mutually informative with high PMIs. There are again a number of co-occurring words that do not mutually correlate.

10.4 Image 4

10.4.1 Top 20 most frequent annotations – (Appendix – Education – Image 4 – Top 20 most frequent annotations)

High/ Secondary school

Unexpectedly, the annotation “tree,” was used most frequent by the participants of this dataset. It seems that some participants have different annotations for the “shed,” these being “summer house, cabin.” The annotation “coloured ball,” was given however no participant specified the colour of the ball.

Higher education (Year 12 & 13)

Similar to the previous dataset, this dataset has also annotated “croquet,” less frequently than what was to be expected. More participants used the adjective “old,” to describe the people in the image, as opposed to the six participants who used the single collocation “people.” More participants have focused on annotating the “man,” playing croquet as opposed to the spectators in the background. The participants from this dataset have also related the act of the elderly playing croquet with “retirement.”

University/ College (Undergraduate)

The Undergraduate participants have annotated generic visible objects. They have also annotated “retirement,” similar to the Higher education (Year 12&13) dataset. Eleven of the Undergraduate dataset specified the “spectators,” however more than double the participants from this dataset used the annotation “people.” Participants from this dataset have also perceived this image to be a relaxing environment.

University/ College (Postgraduate)

Similar to the Undergraduate dataset, this dataset has used the “shed,” and “tree,” annotations most frequently. Three participants from this dataset incorrectly identified the sport as being “cricket.”

PhD

The PhD participants are the first dataset who used an adjective to specify the ball colour which is “yellow,” and the “blue jumper over shed rail.” Unlike any other dataset, a participant from this dataset has specified that the sectors are “ladies.”

Other education level

A participant has perceived the “calm,” environment in the image, similar to the “relax,” annotation given by the Undergraduate dataset. Two participants have also observed the concentration of the man playing croquet, whereas no other dataset used this annotation.

10.4.2 Collocation – (Appendix – Education – Image 4 - Collocation)

Participants from each cluster have used a variety of colours in their collocations to describe the concrete nouns in the image. Interestingly, many more undergraduate and PhD participants annotated the ‘yellow ball,’ as opposed to the red. PhD participants have seemed to use an extensive amount of colours and collocations within their annotations.

There are also a variety of collocations used to describe the age of the people in the image, with the annotations 'old man,' and 'old people,' being frequently used. However, there are similar vocabulary patterns where participants from all clusters excluding those without education have used annotations such as 'elderly people,' 'elderly figure playing,' as a further description.

10.4.3 Co-occurrence – (*Appendix – Education – Image 4 – Co-occurrence*)

Not many co-relating co-occurring annotations appear to have been given by any cluster for this image. For those annotations that do semantically correlate, they have on average a very low frequency. The undergraduate, without education and other education level clusters have annotated co-occurring annotations that correlate and are semantically a subset of croquet. Most clusters have annotated generic concrete nouns, however three participants from the postgraduate cluster have annotated the abstract nouns 'enjoy, relax.'

10.5 Image 5

10.5.1 Top 20 most frequent annotations – (*Appendix – Education – Image 5 – Top 20 most frequent annotations*)

High/ Secondary school

Participants have used the adjective “old,” as opposed to the participants who used the single collocated annotation “map.” Participants have also related the compass to and map to the act of exploring, “adventure, direction,” and “discovery.” The annotation “compass key ring,” was given which is much more specific than using the single collocation “ring,” that was given by other datasets.

Higher education (Year 12 & 13)

A frequent amount of participants used the single collocation “ring,” as opposed to the previous dataset who specified the object with the annotation “compass key ring.” However, three participants from this dataset have specified the “compass point,” along with a frequent amount of users annotating “arrow.” Participants of this dataset also relate the “compass,” and “map,” to “direction, travel,” and “adventure.” Unlike the previous dataset, they have also annotated the “shadow,” produced by the compass and the “metal,” material of the compass.

University/ College (Undergraduate)

Similar to the High/ Secondary school dataset, participants from this dataset have also used the adjective “old,” to describe the “map.” They also relate “direction, adventure, travel, explore,” to the compass and map.

University/ College (Postgraduate)

Unlike any other dataset thus far, along with the frequent single collocated annotation “arrow,” they also have specified the colour of the arrow as “red.” Also, no other dataset have specified the cardinal direction the compass pin is pointing to which is “south south west.”

PhD

Similar to the Postgraduate dataset, a participant from this dataset has also annotated the letter “a,” however, another occurrence of this is the specified annotation “capital letter a.” A participant has proceeded to specifically annotate the direction of the compass pin. Unlike the Postgraduate dataset, this participant has annotated “compass pointing between south and south west.”

Other education level

They also relate the compass and map with “travel, adventure, direction.” Similar to the PhD dataset, this dataset also has specified the direction of the arrow with the annotation “arrow pointing between south and south west.” The annotation “choice,” was only given by this dataset, which could relate to their outlook choosing where to travel to.

10.5.2 Collocation – (*Appendix – Education – Image 5 – Collocation*)

A variety of collocations have been used to annotate the direction of the compass pointer. Whereas the overuse of collocations are used to give more information, the annotation 'compass pointing between south and south west,' has the same effect as 'south south west.' Most clusters have used cardinal directions within their annotations.

Another frequent use, similar to previous images, is the use of the colours to describe the compass point and case. Again, similar to image 1, more PhD participants have used the use of colour.

Another observation is each cluster has frequently defined the map as being old. Some participants from the High school and Higher education cluster have used further descriptive words 'antique,' and 'ancient,' which stress upon the age of the map.

10.5.3 Co-occurrence – (*Appendix – Education – Image 5 – Co-occurrence*)

The co-occurrence of correlating annotations appear to be similar to the previous images, with most annotations being concrete nouns. However, particular annotations such as 'compass, explore,' 'adventure, compass,' 'adventure, map,' 'journey, travel,' etc. prove that participants correlate the imagery with abstract noun.

Participants who have other levels of education have less correlated co-occurring annotations as opposed to any other cluster, with the participants of the PhD cluster proving to have no correlated annotations.

10.5.4 Co-occurrence PMI

A frequent amount of the co-occurring annotations given by the High school cluster semantically correlate and also have a high PMI. With only one or two correlating results for all of the other clusters, the PMI measurement has yet again failed to show how informative each annotation is to each other.

11.RESULTS

Dataset: Native language

Are there any patterns that occur when individuals of different native language label image?

26 (Arabic), 2 (Cantonese), 342 (English), 2 (French), 3 (German), 2 (Hindi), 2 (Italian), 1 (Mandarin), 20 (Other language), 1 (Patois/ Creole), 2 (Portuguese), 17 (Spanish), 2 (Tamil), 3 (Urdu), 80 (Welsh).

11.1 Image 1

11.1.1 Top 20 most frequent annotations – (*Appendix – Languages – Image 1 – Top 20 most frequent annotations*)

Welsh

The annotation “zebra crossing,” was frequently used more than the “pedestrian crossing.”

Spanish

The along with “taxi,” the English American concrete noun “cab,” was used by three Spanish speaking participants. Along with “zebra crossing,” unlike the Welsh dataset who had zero occurrence of the annotation “crosswalk,” two participants from this dataset used the American English term for a zebra crossing. This dataset also uses the annotation “avenue,” which is an American English term for alley or street.

Other spoken language

Other language speakers have also used the American English term and an adjective to describe the concrete noun “yellow cab.” Similar to the Spanish dataset, this dataset has also used the American English term “crosswalk,” as opposed to “zebra crossing.”

English

Similar to the Welsh dataset and unlike the Spanish, the English speaking participants have frequently annotated “zebra crossing.” Interestingly, more participants have used the annotation “yellow cab,” compared to the “yellow taxi,” annotation. This could be due to having a variety of American participants or participants who speak American English. Unlike any other dataset thus far, English speaking participants have acknowledged the location of the image which is “new york.”

Arabic

Unlike any other dataset, Arabic speaking participants have specified the gender of the people in the crowd. These concrete nouns are a part of the large semantic field “people.”

11.1.2 Collocation – (*Appendix – Languages – Image 1 – Collocation*)

The collocation results given by clusters of languages that had five or more annotations with more than two collocations show that there are vocabulary differences, particularly when it comes to annotating the zebra or pedestrian crossing. By looking at the Arabic cluster, it has appeared twice that they have used the collocation zebra crossing or zebra line, using the adjective 'overcrowded,' to describe the state of the image. However, many more Welsh and English speakers have frequently used the collocation zebra crossing. This was to be expected as it is considered as a British term, whereas German, Spanish and participants who speak other languages have on average annotated the English American term 'cross walk.'

Almost all clusters have used adjectives to describe the concrete nouns, mainly using colours. However, we see differences in the names or terms they use as concrete nouns. Interestingly, Welsh and English speakers have annotated the American English term 'cab,'

as opposed to the British term 'taxi.' This is understandable with the English cluster, as it could contain participants with their nationality being from the US. However, for the Welsh speakers who are obviously more exposed to British terms, it is a strange result to have found. Participants who speak other languages also have frequently used the American English term; however Arabic speakers have annotated 'taxi.'

Fewer English speaking participants have annotated clothing items. German, Spanish and other language speakers seem to have specified exactly who is wearing these clothing items, increasing the amount of collocations used.

11.1.3 Co-occurrence – (*Appendix – Languages – Image 1 – Co-occurrence*)

When analysing the semantic correlation between the co-occurring words for each cluster, it shows the Arabic, Urdu and other language speakers have not annotated labels that correlate.

English and Spanish speakers have frequently annotated simple correlating concrete nouns which relate as they are subsets of the larger semantic field road traffic. Both of these clusters have annotated the traffic light, taxi and zebra crossing together frequently. We again see the use of the English American term cab used by the Spanish cluster, as opposed to the English who have used taxi.

11.2 Image 2

11.2.1 Top 20 most frequent annotations – (*Appendix – Languages – Image 2 – Top 20 most frequent annotations*)

Welsh

More participants have annotated the optimistic term “half full.” Few Welsh speaking participants have also used the concrete and abstract nouns “liquid, drink,” and “fluid,” which are a part of the larger semantic field and synonym of the concrete noun “water.”

Spanish

Participants from the Spanish dataset have also frequently used the annotations “glass, water,” and “table.” This dataset has also similar to the Welsh used the optimistic term “half full, and liquid.” However, Spanish speakers have used the adjective “transparent,” which is more scientific than “clear.”

English

Many English speakers, similar to other datasets, have frequently used the optimistic term “half full.” They also have used the concrete noun “liquid,” a subset of the larger semantic field water. All datasets thus far have annotated the colour of the background in the image as either brown or in this case “beige.”

Arabic

One annotation stands out from the results, this being “hope.” This shows that participants perceive water with hope. Also, unlike any other dataset, Arabic speakers have annotated the glass in the image as a “cup.” In the English language, this object is commonly known as being a glass. Therefore there could potentially be a translation difference.

11.2.2 Collocation – (*Appendix – Languages – Image 2 - Collocation*)

As to be expected, all clusters have annotated the state of the glass of water. All clusters have frequently annotated the optimistic outlook that the glass is half full. A variety of different collocations have been used to describe this. Most clusters have simply used two words 'half empty,' or 'half full.' However, specifically the Arabic and Tamil speakers, datasets have used more collocations within their annotations to define this object, its state and that it contains water. Interesting results appeared in the Arabic cluster where a participant has actually annotated 'optimism,' and 'pessimism,' proving that they fully understand the concept of this debate.

All clusters again have used colours within their annotations, focusing primarily on the white wall and the brown colour of the table.

The remaining most frequently used collocations focus mainly upon the shadow produced by the glass and the light reflection produced from the water.

11.2.3 Co-occurrence – (*Appendix – Languages – Image 2 – Co-occurrence*)

Correlating co-occurring annotations primarily describe the state of the glass. This shows that when annotating the glass participants also annotate its state.

11.3 Image 3

11.3.1 Top 20 most frequent annotations – (*Appendix – Languages – Image 3 – Top 20 most frequent annotations*)

Welsh

Welsh participants have used abstract nouns such as “war, death, fear, protest,” that co-relate to the scene in the image. The concrete nouns “tank,” and “gun,” and abstract nouns “death, fear,” and “protest,” are therefore members of the large semantic field “war.”

Spanish

Similar to the Welsh dataset, the Spanish speakers have used the abstract noun “courage, death” to define the action of the protester and the correlation from the objects in the image.

Other spoken language

Participants who can speak any other language have not seemed to annotate abstract nouns. Similar to the Spanish dataset, this dataset contains a participant who also recognises the history of the image and has used the annotation “communist, faceless destruction” and “authorities ruling people.”

English

Similar to the Welsh and Spanish dataset, the English speaking participants have also annotated the abstract noun “war.” The concrete nouns “tank, gun, aerial, protest” and “army,” are subsets of the larger semantic field “war.”

Arabic

Arabic speakers have also co-related the actions within this image with the abstract nouns “blood,” and “bloodshed.” Along with the most frequently annotated concrete noun “tank, battle tank, weapon, antenna, army tank” and “army,” these nouns are a subset of the larger semantic field “war.”

11.3.2 Collocation – (*Appendix – Languages – Image 3 - Collocation*)

Most collocations describe the concrete nouns that can be seen within the image. Some of the concrete nouns have been further specified along with their colour.

From the Arabic cluster, the annotations 'lack of hope,' and 'sign of war,' are not frequently used, but are powerful abstract nouns describing the imagery perceived from this image. The participant who annotated these labels could have simply used the singular collocated annotation 'war,' or 'hopeless.' But using more collocations here seems show some emotion behind the annotating.

The English and Spanish speakers seem to be disconnected from the meaning of the image and have purely annotated the location or that it is a famous picture.

Each cluster, excluding those who can speak other languages have annotated the four tanks or have related the concrete nouns with the larger semantic annotation war. Another interesting result here it that Arabic speakers have annotated 'four killing machines,' again showing their perception of war and killing. Another interesting result is the highly informative collocation 'four Chinese type 59 tanks,' given by a participant who speaks Patois/ Creole. No other cluster has been so specific when annotating the tanks, proving that this participant potentially is more aware of the history of China or of military vehicles.

11.3.3 Co-occurrence – (*Appendix – Languages – Image 3 – Co-occurrence*)

The co-occurrence of annotations have produced some interesting semantically correlating results, again specifically given by the Arabic and Welsh speakers. The most frequently semantically correlating co-occurring annotations given by Welsh speakers are 'protester and tank.' These annotations would not generally correlate, however they do in this image.

11.4 Image 4

11.4.1 Top 20 most frequent annotations – (*Appendix – Languages – Image 4 – Top 20 most frequent annotations*)

Welsh

Participants from this dataset annotated the concrete noun “ball,” however failed to identify its colour. With the most frequently used annotation being “shed,” four participants proceeded to describe the shed by specifying its use and location. Also, as opposed to using the single collocated word “man,” five participants have used the adjective “old,” to describe the person in the image. Participants of this dataset also perceived the environment in the image as being relaxed and associate the act of playing croquet with “retirement.”

Spanish

A very low frequency of this dataset has annotated the sport “croquet.” However, four participants have incorrectly identified this as “cricket,” with one participant annotating “cricket accessories.” Similar to the Welsh dataset, Spanish speakers also perceived the environment in the image as being relaxed.

Other spoken language

Unlike the Spanish and Welsh datasets, equal amounts of participants have specified the colours of the balls by using the adjectives “red,” and “yellow.” The annotation “colored pole,” appears for the first time, spelt as the American English “color.”

English

Compared to any other dataset, a large frequency of participants of this dataset has annotated “croquet.” They too associate the environment in the image as relaxed. The correct term “mallet,” has also been identified, as opposed to the “croquet stick,” that was annotated by a Spanish participant.

Arabic

Again, many participants from this dataset identified the concrete noun “ball,” however; very little participants annotated “red ball.” Very few participants also identified “croquet,” with an equal amount of participants annotating “sport.” Similar to the Spanish dataset, the participants of the Arabic dataset have not used the annotation “shed.” They have identified this garden building as a “house, hut, cabin,” and “cottage.”

11.4.2 Collocation – (*Appendix – Languages – Image 4 – Collocation*)

Almost all clusters, excluding Tamil speakers have annotated the ball colours. Participants from the English, other language, Spanish and Welsh have seemed to frequently annotate the yellow ball, whereas more Arabic speakers have annotated the red ball.

When it comes to annotating concrete objects semantically correlating to the sport croquet, it seems that each cluster excluding the Spanish, Arabic and Tamil speakers have annotated

croquet accessories. These are frequently annotated by the English more than the other clusters.

There are also a variety of annotations describing the people in the image. The main adjective that is used is 'old,' however the annotations elderly and pensioner also occur.

An interesting result from the Spanish cluster is the annotations 'English domination.' The word domination is quite powerful and is commonly used in a threatening sense. However, here the acts within the image are not threatening at all and so this annotation seems to emphasize on fact that croquet is popularly played in England.

11.4.3 Co-occurrence – (*Appendix – Languages – Image 4 – Co-occurrence*)

No conclusive correlating co-occurring annotations appeared from the co-occurrence analysis.

11.5 Image 5

11.5.1 Top 20 most frequent annotations – (*Appendix – Languages – Image 5 – Top 20 most frequent annotations*)

Welsh

Participants of this dataset have used the abstract nouns “direction, travel, lost” and “adventure,” which co-relate and are a subset of the semantic fields “compass,” and “map.” Some participants have also used the adjective “old,” to describe the concrete noun “map.”

Spanish

Similar annotations have been used by this dataset as did the Welsh participants therefore there are not many differences.

Other spoken language

The participants of this dataset have specified the map as being a map of “morea.” As opposed to the single collocated annotation “a,” given by a Spanish participant, a participants from this dataset has specified further that it is a “capital letter a.”

Arabic

Unlike any other dataset, two participants have used the artistic term “countour,” to describe the outline of the country on the map. A participant has incorrectly identified the compass as a “clock,” however the annotation “Columbus,” proves that a participant co-relates these objects with Christopher Columbus.

11.5.2 Collocation – (*Appendix – Languages – Image 5 – Collocation*)

The collocation measurements for image 5 for each cluster have produced a variety of different annotations. The most interesting is the overuse of collocations to describe the direction of the compass point. Participants have a high tendency to use multiple collocations to describe this. Almost all clusters have used on average seven or six words to define 'the compass point is pointing between south and south west.' Fewer participants from the English and other language clusters have overused collocations and instead, have simply annotated the direction of the point.

Multiple clusters have also defined the map as being old.

However the most interesting results for this image is the concepts that have been perceived from the imagery of the compass and map. Participants from the Arabic, Spanish and other language clusters have correlated the image with the sense of direction or a wanting to travel. Other clusters have fixated on annotating concrete nouns that can be seen.

11.5.3 Co-occurrence – (*Appendix – Languages – Image 5 – Co-occurrence*)

The English, Welsh and other language speaking participants have annotated correlating annotations, specifically the English cluster that has a high frequency in annotating the word travel along with the concrete nouns map and compass. The Welsh speakers also have a high frequency in annotating map with explore.

12. Final conclusion

12.1 Genders

Overall, the top 20 most frequently used annotations given by both genders for each image show very little differences. Both genders have very similar frequency patterns, with either very similar or equal annotations used to identify concrete nouns.

Image 1, 2 and 4 have a higher frequency of Females using adjectives mainly colour to specify concrete nouns. This is particularly shown in Image 4 where no Male has annotated the red ball and very few annotating the yellow.

Both genders frequently use the optimistic term half full as opposed to the pessimistic, showing their hopefulness and positivity. Co-relations of co-occurring annotations also have little differences with both genders having similar frequent results.

When data is visually represented in a bubble chart, there are no substantial differences. Image 1 shows that more Males have annotated human attributes such a blonde hair and a bearded man.

12.2 Ages

Again, no significant patterns occur when participants of different ages annotate images. We see some very limited differences in vocabulary; however participants have frequently used similar annotations.

The 11-15 cluster showed interesting results in Image 1, 3 and 5. Image 1 proved that they acknowledged and correlated the taxis as being American. They also used the adjective 'neon,' to describe a shirt and associated the busy state of the image to the abstract noun 'life.' Image 3 showed they used the powerful abstract noun 'death,' perceived from this image of war. Some participants also used the adjective 'ancient,' to describe the map, which can be signified as a more descriptive adjective. They have also correlated the compass with the abstract nouns 'direction, discovery and navigation.'

A particular difference from the results of Image 3 given by the 31-34 cluster were they used the annotation 'demonstration,' proving that they understood the concept of the protesting man.

Participants of the 35-40 cluster showed particular differences when annotating image 1, 4 and 5. Image 1's results showed they focused on annotating characteristics of people in the crowd, naming the blonde haired woman with a red jumper and a man wearing glasses. They also used adjectives in image 4 and 5, describing the yellow ball and the red colour of the compass pointer.

The most interesting results for the 41-44 cluster was regarding Image 3. The annotations 'oppression, aggression, bravery, fear, history,' were prominently used, correlating with the acts of Tiananmen Square.

When focusing on collocations, all datasets, in particular the older generations, used adjectives such as colour within their annotations. Most clusters overused collocations, particularly in Image 2, 3 and sometimes 5 when annotating the compass direction.

Excluding Image 4, on average the PMI analysis produced conclusive high PMIs for correlating annotations for each cluster. It showed that older generations have a tendency not to annotate words that correlate, with the 55-60, 61-64 and Over 65 clusters having very little or no correlating stems with high PMIs.

12.3 Native language

Simple and slight vocabulary and slang differences occurred when participants who spoke different languages annotated images. Some variations appeared in the amount of words used in an annotation, with most Welsh and English results being clear and concise, whereas the other language cluster used more words to describe the same object or concept. Apart from generic and general correlating annotations, no particular results appear from the co-occurrences of annotations. PMI results also produced some results but none of interest.

Image 1 shows that Spanish, Arabic and other language speakers have a tendency to use annotations following the English American vocabulary. English speaking participants also have frequently used American terms; however this could be down to a large frequency of American participants.

All datasets have frequently annotated the optimistic term 'half full,' as opposed to a fewer frequency in annotating 'half empty,' to define the state of the glass in image 2. English and Welsh participants have frequently used synonyms such as 'liquid and fluid,' to further describe the water. Another result from Arabic participants is the annotation 'cup.' There is a possibility that this could be down to translation differences.

Image 3 and 5 showed the most interesting results, where each dataset used abstract nouns to annotate concepts and perceptions from the image. Annotations such as 'death, fear, protest, tank, gun, courage, army, war and blood,' have been perceived from the imagery. Participants also correlate the compass and map of image 5 with annotations such as 'adventure, travel, journey and explore.'

Participants from each cluster have also used colours and adjectives to describe their annotations. However, image 4 resulted in a lack of colour with only participants from the other language and Arabic cluster frequently annotating the red and yellow ball and some participants annotating the green grass. Image 4 resulted in Welsh and English participants frequently annotating 'croquet.' This simply could be because English is predominantly an English or British sport.

12.4 Education level

No significant patterns occurred when participants of different education levels annotated these five images with similar collocations and co-occurrences used by all clusters.

University undergraduates and postgraduates had very similar vocabulary and annotation frequencies. A particular interesting result was the use of the scientific annotation 'meniscus,' given for image 2 and frequently by Undergraduate participants. Other clusters had used simple shapes to describe this, such as 'oval,' or 'circle.'

Participants of different education level also annotated abstract nouns correlating to and perceived by the imagery of image 3 and 5 and fewer participants from the PhD and other education dataset frequently annotated the annotation 'croquet.'

PMI measurements produced some conclusive results, with image 2, 3, 4 and 5 producing high PMIs for correlating co-occurring annotations showing their high dependency on each other.

13. Future work

Firstly, the co-occurrence of annotations for each dataset would have to be queried again from the database. I realised when calculating the PMI results that the occurrence of singular annotations did not add up to their co-occurrence. It was unfortunately too late to re-query all of this data and this therefore affected the PMI and the co-occurrence analysis. This is possibly down to the query that was used to mine the database where the count was not distinct and so it was over counting.

The following SQL query is an example of what was used to query co-occurrences of annotations given by Females for Image 1.

```
SELECT COUNT(*) AS Count, a1.stem AS Stem1, a2.Stem AS Stem2
FROM Annotations AS a1
INNER JOIN Annotations AS a2 ON a1.user_id = a2.user_id AND a1.image_id = a2.image_id AND
a1.stem < a2.stem
INNER JOIN Users AS u ON a1.user_id = u.user_id
WHERE a1.image_id = 1 AND u.gender='Female'
GROUP BY a1.stem, a2.Stem
HAVING COUNT(*) > 1;
```

From this correction, accurate co-occurring data would be produced and analysed again, providing more accurate PMIs.

The data could be visually displayed in choropleth versions of the image so that a study focusing on what areas participants focus on in an image could be performed.

Data could also be re-normalized so that there are fewer variations of annotations that have the same meaning. Due to human normalization, this study seemed to contain multiple methods of annotating labels with similar meaning which significantly affected.

With the remaining data regarding participant nationality, religion and ethnic origin, analysis could be continued. The data has already been processed however patterns have not been analysed. The annotation co-occurrence would have to be re-calculated to increase accuracy. (*religion image 1, religion image 2 i, religion image 3, religion image 4, religion image 5, religion image 1 pmi, religion image 2 pmi, religion image 3 pmi, religion image 4 pmi, religion image 5 pmi, nationality image 1, nationality image 2, nationality image 3, nationality image 4, nationality image 5, nationality image 1 pmi, nationality image 2 pmi, nationality image 3 pmi, nationality image 4 pmi,nationality image 5 pmi, ethnic origin image 1, ethnic origin image 2, ethnic origin image 3, ethnic origin image 4, ethnic origin image 5.xls*)

Nationality data could be displayed in the form of a choropleth map. (*nationalities map.xls*)

Different text analysis could be performed looking into word meanings and linguistics.

Future work could also include more analysis on the genders dataset, where more sexually suggestive images could be annotated to see if there are differences in the way genders perceive other genders. Sexuality could also be another demographic characteristic to include however; I very much doubt a large population of participants would respond as this characteristic is much more personal. Different images could be proposed to participants of different ages as not much difference occurred during this study.

The database could also be queried for samples of data as opposed to the entire set, so that an equal amount of data for each cluster are compared, producing more accurate results. Histogram graphs could also display percentages of participants as opposed to values to be able to analyse clusters of a variety of different totals more accurately.

14. Reflection

When reflecting upon this project, I cannot help but be highly critical.

Firstly, the project scope was unclear. I was not sure exactly what I was trying to achieve and therefore finding methods of reaching a result was hard. My research and ideas seemed to vary consistently, as a multitude of angles of science and psychology all seemed to be relevant. I should have declared and specified my exact ideas, intentions and committed myself to specifically completing them. These issues could have been resolved by simply meeting my supervisor and discussing them so that the project scope was clear.

From the unclear project scope the methodology became too extended and possibly too repetitive. I underestimated exactly how much time and work it would take to complete analysis on a vast amount of data and therefore could not complete work on the nationality, ethnic origin and religion datasets. I should have set a reasonable target of participants and perhaps then I would not have exceeded it.

When researching into ways of collecting data, I believe I chose the most drastic and time consuming method which was to build my own web form. I had a strong urge to build and test my web skills. I overestimated the amount of images to be analysed and so using Google spread sheet to analyse one image with five annotations might have been a better scope for the project. Using Google spread sheet and reducing the amount of images and annotations would have provided me with much more time to complete the analysis and also be able to visually display the data.

When it came to querying the database, I felt I mostly succeeded in returning correct results. However, I should have designed the database better and have used my supervisor's support earlier to restructure it correctly. On top of this, I should have tested the co-occurrence queries were producing correct results, as this then affected the PMI. This has affected the study significantly as results are incorrect.

With the analysis, I felt it was too manual and lacked accuracy. This is down to my lack of research and preparation. The normalization of the data took a significant amount of time as I had to check and evaluate the results from using the Porter's stemmer and also normalize most data myself. This led to human error, misspelling and similar annotations being normalized into various ways. This did not help reduce the amount of data and so significantly affected the results, as annotations that should have been normalized into tighter categories were appearing multiple times when they had the same meaning.

When researching into PMI, I should have tested it on a sample of data as multiple times it produced inconclusive results. However, it proved that it does not provide sufficient values when a range of different data is given. This could be because the normalization of the data had been completed poorly.

I also believe that this study was not scientific, particularly when it came to semantic correlations as annotations were related from my own perspective. Therefore, some results could well semantically correlate but because I followed the basis of my own opinion and outlook on the annotations, some correlated annotations could have been missed.

I feel that the analysis on the annotation frequency graphs was too detailed. There was no need to analyse every annotation that appeared in the top 20.

The images that were chosen for this project could have benefited from being more thought provoking. Results from the image of the glass of water and Tiananmen Square were great, showing abstract nouns, concepts and perceptions. The remaining busier images seemed to have more participants annotating concrete nouns. However, this could be down to the unclear instruction that was given on the web form, which asked participants to name what they could see. I had not considered that some people would take this literally.

I feel that I lacked sufficient communication with my supervisor. I would use communicational methods such as Facebook to discuss my ideas and my achievements however, I strongly believe I should have taken more of an advantage and used the meeting slots.

From this project, I have learnt that I need to be clearer when writing and defining the scope, methods and ideas of my projects. I need to be certain of exactly what I am trying to achieve and research correctly before starting the project.

I have also learnt that however ambitious I am, I do have strong organisational skills. I have an attention to detail when it comes to dealing with a vast amount of data, although being over analytical can sometimes be a disadvantage. My time management was good throughout the project, even if I did underestimate the amount of work I could achieve. I was able to evaluate and decide a cut-off point of how much analysis work there was to be completed and what I realistically could achieve soon after receiving the participant information.

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