Verbal language and sketching

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Abstract

This paper attempts to identify designers’ sketches in different forms for a classification system by use of verbal language. Designers have a creative vocabulary, which has rich meanings in design communication. This study was carried out with the cooperation of 11 academic staff in the domain of industrial design. It was concluded that none of verbal language was found descriptive enough for the purpose of separating sketches into different forms to support a classification system. While this study has not produced a possible means for classification of sketches using verbal language, the methodology employed has proved interesting for future investigative styles of sketching and communication between designers.
Verbal language and sketching

Introduction
Sketching is an old form of communication, which has been used to visualise, record, and exchange information for thousands of years. People communicate knowledge and emotional feelings to others in many ways such as verbal language, body language, words, illustrations, symbols etc. (Horn, 1998). Artists and designers use a vocabulary, which has particular meanings in the form of information to communicate with others.

Birtley (1990) described the way that words such as ‘slippery’, ‘fluid’, ‘taut’ etc., formed a language of car studio, which described particular forms or implied ‘feelings’. This might be useful for classifying designers’ sketches into different forms. Tovey (1997, 2000) also stated that the use of such a vocabulary could be interpreted within a small group, where designers worked together for a quite long period of time. It would be worthwhile to study this sort of language, and to see if it could form a basis of classifying designers’ sketches.

Studies concerning the identification of concept sketches have recently occupied many researchers and several methods have been introduced (Mcgown, 1998; Purcell 1998). They have discussed different classification systems for concept sketches in different domains such as architecture, engineering, sculpture, etc.

The primary motivation for this study is to understand more about the verbal language of design in designers’ sketches and to explore the feasibility of classifying sketches using this sort of verbal language, and to find out whether such words have a common meaning.

Aims
The aims of the study are:

• To understand and explore the meanings and the use of verbal language by designers
• To investigate whether there is a common verbal language amongst designers
• To investigate whether a useful classification scheme can be based on verbal language

Methods
The data collection was carried out with the cooperation of 11 academic staff in the domain of industrial design at Coventry School of Art and Design. The workshop based session was carried out in the following stages:

The 11 designers were asked to bring sketches with them. The collection reached a total of 19 sketches which were from a wide range of design areas. There were nine from transport design, seven were general product design, one GA (General Arrangement) drawing, one illustration and one practising sketch. The sketches included the range from early concept sketches to detailed finished drawings.
Figure 1: Sketches were collected from academic staff in the domain of industrial design.

The designers were asked to contribute adjectives that they used to describe and discuss the style of sketches. The list of adjectives reached 58 words, and included such words as “Loose”, “Animated” etc. These were compiled into a data sheet that could be used to assign scores to the collection of 19 sketches.
The sketches were displayed one by one to all designers, and they were asked to score the applicability of every adjective to each sketch using the following scoring system:

<table>
<thead>
<tr>
<th>Scoring Figure</th>
<th>Meanings of the figure</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Keyword does not apply to this sketch</td>
</tr>
<tr>
<td>1</td>
<td>Keyword has slight application</td>
</tr>
<tr>
<td>2</td>
<td>Keyword has medium application</td>
</tr>
<tr>
<td>3</td>
<td>Keyword has strong application</td>
</tr>
<tr>
<td>4</td>
<td>Sketch is exemplar of this keyword</td>
</tr>
<tr>
<td>Blank</td>
<td>No opinion</td>
</tr>
</tbody>
</table>

Table 1: Designers used the key to fill data record sheets.

Analysis of adjectives
The aim of the analysis was to reduce a small list of the number of keywords, in order to obtain words suitable as a starting point for a classification scheme by following the three steps:

1. Elimination of the adjectives which were inconsistently used by designers
2. Identification of antonyms and synonyms. In the case of adjectives, which have similar or opposite meanings, one of these can be selected to represent all of the forms.
3. Selection of those words which provide clear differentiation between different groups of sketches

Elimination of inconsistent use of objectives
Inconsistency of use was gauged by the standard deviation of the score given by the 11 assessors, a high standard deviation indicating that the word was not being used consistently.

The standard deviation of the scores given by the designers for each adjective for each sketch was calculated. The mean standard deviation was then calculated for each adjective. One examination of the results, a natural break was found around 0.9, and sketches with a standard deviation higher than 0.9 were eliminated as being inconsistently used.

Thirty-four adjectives were thus rejected due to the inconsistency of interpretation. These words were:

Energetic, Dynamic, Laboured, Atmospheric, Silhouette, Insensitive, Flat, Shaded, Bold, Overstated, Clean, Defined, Evocative, Realistic, 3-Dimensional, Cartoony, Impressionistic, Analytical, Powerful, Bright, Dull, Unresolved, Distorted, Sensitive, Crude, Graphic, Flashy, Informative, Smooth, Precise, Descriptive, Soft, Hard, Imaginative

Identification of synonyms and antonyms
Twenty-four adjectives remained, a Pearson Rank correlation was carried out to examine the relationship between these (See Table 3). A correlation of greater than 0.6 was used as an indication of common or similar meaning. Likewise, a correlation lower than −0.6 was used to indicate opposite meaning, as is common practice in statistics (Jain 1988; Sigel 1956). The results of the definition were shown the antonyms and synonyms as follows:

Synonyms (Correlation > 0.6)

- Loose, Free-spirited, Spontaneous, Vague, Grubby, Ambiguous, Fuzzy, Sketchy
Animated, Free-spirited, Amorphous

Antonyms (Correlation <- 0.6)

- Loose, Tight
- Free-spirited, Controlled
- Grubby, Crisp
- Fuzzy, Slick

After eliminating synonyms and antonyms 12 keywords were left which might be used as ‘axes’ of a classification scheme, these words were:

- Animated, Blobby, Blunt, Chunky, Exaggerated, Loose, Meaningless, Moody, Repetitive, Resonant, Subtle, Understated

The words above can be used as the basis for a classification scheme. This would yield 4096 different classes of sketches, which is too large a number to be useful.

Visual clustering analysis
To reduce these number, words which provided the clearest classification were selected, using a visual clustering analysis.

Two main properties in Cluster Analysis are compactness and isolation (Jain and Dubes 1988). Compactness measures the internal cohesion among the objects in the cluster whereas isolation measures separation between the cluster and other pattern. A Visual Cluster Analysis (VCA) in this experiment is to use the mean of each single keyword against others, to show the clusters via the pair of keywords in a two dimensional chart. If a pair of keywords is not useful at differentiating it can be abandoned. The clusters appeared to show keywords that do differentiate the characteristics between sketches.

If VCA gives a well separated cluster, the sketches in the group of that cluster can be picked out. The similar features among these sketches can be extracted forming the basis for classification of sketches in different groups. The classification could eventually be used to help software designers to specify appropriate means of handling different kinds of sketch.

Selection of Visual Clusters
Sixty-six VCA charts were produced using every combination of pairs of keywords, as pointed out earlier, every combination gives 4096, 40 pairs of keywords were rejected because there were no clearly differentiated clusters such as Subtle/Chunky, Understated/Animated Loose/Animated, Resonant/Chunky, Loose/Blunt, Understated/Repetitive, etc.

A further 23 combinations were rejected because there was only a single cluster such as Animated/Repetitive, Animated/Blobby, Subtle/Blobby, Meaningless/Repetitive, etc.

This left three pairs of keywords with visually separated clusters. The most valuable clusters are with obvious gaps arising between groups (See Figure 2). These pairs of keywords were:

- Loose and Blobby
- Understated and Chunky
- Subtle and Moody
Figure 2: the three pairs of keywords were valuable clustered

Four groups emerged via the Visual Clustering Analysis in keywords “Loose” and “Blobby”.

- Group A: Not loose and not blobby
- Group B: Slightly loose and not blobby
- Group C: Medially loose and not blobby
- Group D: Strongly loose and not blobby

Four groups emerged via the Visual Clustering Analysis in keywords “Understated” and “Chunky”.

- Group A: Medially chunky and not understated
- Group B: Slightly chunky and not understated
- Group C: Not chunky and not understated
- Group D: Not chunky and slightly understated

Three groups emerged via the Visual Clustering Analysis in keywords “Subtle” and “Moody”

- Group A: Medially moody and slightly subtle
- Group B: Slightly moody and slightly subtle
- Group C: Not moody and not subtle

**Extraction of common features**

The aim of this study was to pick out if there were common visual features, which would be associated with the groups identified above. The study focused on the following aspects:

1. The drawing techniques:

   This concerns the basic visual graphic techniques used in the sketches and the fundamental drawing elements used to describe an object. They can be divided into two aspects:

   - Expression of sketching forms, e.g. the use of form line, shading, composition, colour, template etc. to describe the shapes physically
   - Applied artistic techniques, e.g. abstractionism, impressionism, realism, and the use of ‘artistic license’ such as exaggeration, stretching, rotation.
2. Level of finish of the sketches

This is concerned with the sketch in different design stages, which have obvious different features. At the very early concept stage, designers may only use line to capture the ideas as quickly as possible, but in the design development stage, they are involved with detailed descriptions by using a variety of media.

3. The communication of intentions

This relates to the intention of the designer when sketching. The techniques that the designer uses in sketching to describe the form of design objects must have some meaning for conveying information to others. For example, the concept sketch mostly uses brief form lines without much shading which does not convey the surface details an observer, but a finished sketch usually will have detailed shading and tidy clean lines, which communicates to an observer a lot of information about the shape, surfaces and even the suggested materials. This part of the study aimed to discover whether the different groups would be related to different intentions on the part of the designer.

Results

We summarise the three sets of keywords in the following tables:

<table>
<thead>
<tr>
<th>Used keywords</th>
<th>Separated groups</th>
<th>Drawing techniques</th>
<th>Expressive level</th>
<th>Communication of intention</th>
<th>Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Detailed stage</td>
<td>By using form line and form shading</td>
<td>Sketches were used in obvious different drawing techniques, and in different finished levels in both groups B and C, which were difficult to categorise into the four groups,</td>
</tr>
<tr>
<td>Group A</td>
<td>1 illustration, 1 GA, 2 rendering</td>
<td>Detailed stage</td>
<td>Detailed stage</td>
<td>By using form line and form shading</td>
<td>Sketches were used in obvious different drawing techniques, and in different finished levels in both groups B and C, which were difficult to categorise into the four groups,</td>
</tr>
<tr>
<td>Group B</td>
<td>Many different techniques were used</td>
<td>Sketches went to different stages</td>
<td>Different levels of information to observer</td>
<td>Sketches went to different stages</td>
<td>Different levels of information to observer</td>
</tr>
<tr>
<td>Group C</td>
<td>From brief line to detailed shading</td>
<td>Sketches went to different stages</td>
<td>Different levels of information to observer</td>
<td>Sketches went to different stages</td>
<td>Different levels of information to observer</td>
</tr>
<tr>
<td>Group D</td>
<td>Using form line and little shading</td>
<td>Beginning stage</td>
<td>Giving suggested shape without details</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2: The summary of set one
<table>
<thead>
<tr>
<th>Used keywords</th>
<th>Separated groups</th>
<th>Drawing techniques</th>
<th>Expressive level</th>
<th>Communication of intention</th>
<th>Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understated / Chunky</td>
<td>Group A</td>
<td>Tidy form lines and simple shading</td>
<td>At the middle of design stage</td>
<td>Well conveyed the shape and depth</td>
<td>Set two has very close drawing techniques and similar finished levels between groups B and C which was difficult to distinguish sketches from the two groups.</td>
</tr>
<tr>
<td></td>
<td>Group B</td>
<td>Detailed shading and form lines</td>
<td>Detailed stage</td>
<td>Well conveyed the shape and detailed surface</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group C</td>
<td>1 GA, 1 Illustration, the rest are same as Group B</td>
<td>Detailed stage</td>
<td>Well conveyed the shape and detailed surface</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group D</td>
<td>Using form line and little shading</td>
<td>Beginning stage</td>
<td>Rough shape without detailed infor.</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: The summary of set two.

<table>
<thead>
<tr>
<th>Used keywords</th>
<th>Separated groups</th>
<th>Drawing techniques</th>
<th>Expressive level</th>
<th>Communication of intention</th>
<th>Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subtle/ Moody</td>
<td>Group A</td>
<td>Detailed shading and form lines</td>
<td>Detailed stage</td>
<td>Well conveyed the shape and depth</td>
<td>The use of drawing techniques, finished and communication levels were quite consistent in same group with an exception of group C.</td>
</tr>
<tr>
<td></td>
<td>Group B</td>
<td>Shading and form lines</td>
<td>At the middle of design stage</td>
<td>Conveyed the general shape and depth</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group C</td>
<td>Form lines and little shading</td>
<td>At the beginning stage</td>
<td>Giving rough concept without details</td>
<td></td>
</tr>
</tbody>
</table>

Table 4: The summary of set three.

By comparing the groupings, which were obtained via three pairs of keywords, we found that sketches classified using “Loose” and “Blobby” were difficult to identify using similar sketching features within the groups, because there was too wide a range of characteristics within both groups B and C. They used quite different drawing techniques and were finished to different design levels.

Sketches classified using “Understated” and “Chunky” used similar drawing techniques within groups B and C, and were finished to the same levels in all of the different groups.

The sketches classified using “Subtle” and “Moody” were clustered into three groups, and most sketches in each group had a similar use of techniques, finish levels, and communication levels. These classification axes are interesting for further research, but the visual classification was not clear enough to support a classification system, which can be used to identify sketches into different groups for the purposes of software design. Eventually none of the sets of keywords was found that would be useful for classification of sketches into different groups for this purpose.

Although this study has not produced a useful classification system for the classification of sketches by using verbal language of design, there have been some significant findings:
First, designers use verbal language to describe the form of design in a quite individual way, which may not be commonly understood by others, and thus cannot be used to classify sketches.

Second, one interesting finding occurred in set three. Sketches in this set formed three groups and sketches in each group have similar drawing techniques and the same level of finish, except for two sketches, which visually appeared to be “out of place” in the group assigned by the analysis. Farther research based on this classification may reduce this anomaly and produce a more useful result.

**Discussion**

This experiment was carried out with 11 academic staff, but not with current real industrial designers. It was not clear whether the results would be the same if conducted using industrial designers, and whether the sketches would be representative of their work. On the other hand, academics are the ones who talk about sketching (have the vocabulary), designers do rather than talk, so perhaps academic staff are appropriate. Also, the reason for not doing it with designers was that the experiment didn’t seem to be sufficiently productive to justify the effort.

The other issue concerns the collection of sketches from a wide range of design drawings such as GA drawing and illustration, while this may be a valuable experiment in categorising design drawings in general. It distracted attention away from the concept sketches, which were the intended focus of the investigation.

Only 19 sketches were examined, which is a small sample size. It is not clear whether this sample of sketches covered the whole range of design sketches or whether it lacks some types of sketch. However, despite the small sample size, an increased understanding of sketching vocabulary and its relationship to the classification of sketches was gained.

Following this experiment, there are two aspects of design verbal language, which warrant farther discussion. One is the discussion about the language of designed objects, that is the language that makes it possible to communicate information from designers to users, and even from users to other users. The other is the language used by designers to understand each other. This sort of verbal language needs to be specialised (as is the language of medical doctors, and other professions) because it has to address specific problems, techniques and characteristics in the design process.

In both cases we need a language of design and they are both problematic. In the first case, the language is generated by the interaction between designers and users. In the second case, which this experiment focused on, the specialist language is already in place, but it has proved to be very difficult to recognise.

**Conclusions**

It was concluded that none of these sets of keywords was found strong enough for the purpose of separating sketches into different groups to support a classification system.

While this study has not produced a possible means for classification of sketches using verbal language, the methodology employed has proved interesting for future investigation of styles of sketching, and communication between designers.

Maybe more important than design language is the idea of verbal communication of the visible characteristics in products and sketches. The outcome appears to indicate the verbal communication is not clear or consistent. This leads to a conclusion that the visual communication is more likely to be successful, leading to the future experiment, which concerns the visual analysis of sketches and the extraction of common visual features.
Acknowledgement
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References


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