Understanding Iconography: A Method to Allow Rich Picture Interpretation to Improve

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ABSTRACT

Information Systems for complex situations often fail to adequately deliver quality and suitability. One reason for this failure is an inability to identify comprehensive user requirements. Seldom do all stakeholders, especially those ‘invisible’ or ‘back room’ system users, have a voice when systems are designed. If this is a global problem then it may impact on both the public and private sectors in terms of their ability to perform, produce and stay competitive. To improve upon this, system designers use rich pictures as a diagrammatic means of identifying differing world views with the aim of creating shared understanding of the organisation. Rich pictures have predominantly been used as freeform, unstructured tools with no commonly agreed syntax.

This research has collated, analysed and documented a substantial collection of rich pictures into a single dataset. Attention has been focussed on three main research areas; how the rich picture is facilitated, how the rich picture is constructed and how to interpret the resultant pictures.

This research highlights the importance of the rich picture tool and argues the value of adding levels of structure, in certain cases. It is shown that there are considerable benefits for both the interpreter and the creator by providing a pre-drawing session, a common key of symbols and a framework for icon understanding. In conclusion, it is suggested that there is some evidence that a framework which aims to support the process of the rich picture and aid interpretation is valuable.

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Acronyms and Abbreviations

AR Action Research
AS: Appreciative System
CA: Content Analysis
CATWOE: Customers, Actors, Transformation, Weltanschauung, Owners &Environment
DA: Discourse Analysis
GT: Grounded Theory
GUI: Graphical User Interface
HCI Human Computer Interaction
IPA: Interpretative Phenomenological Analysis
KM: Knowledge Management
PSM: Problem Structuring Method
PT: Pivot Table
RA Research Area
RD: Root definition
RP: Rich Picture
SAGA: Subjective Assessment of Group Analysis
SSM: Soft System Methodology
SQL: Structured Query Language
TT: Triple Task

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Chapter 1 Introduction

The specific area within computing science that is being addressed in my work is the pre-analysis phase of software engineering looking at the way in which requirements are gathered for complex information systems. I discuss the importance of a requirement gathering and knowledge elicitation tool called the rich picture. The rich picture (Figure 1.1) is an unstructured way of capturing information flows, communication and, in essence, human activity. The rich picture uses untutored pictures and cartoon-like representations to aid thinking and to record ideas about a situation. The pictures are predominantly drawn by groups of stakeholders in a participative way but can also be drawn by individuals. The rich picture shows a diagrammatic depiction of what are perceived to be the problem areas requiring discussion. I use the word 'perceived' because problems are seen as problems by some and not by others. The rich picture, using small images, allows a multitude of problem situations to emerge within a single picture drawn by multiple authors. Although a popular tool amongst system practitioners there are problems, for some, with its lack of instructions and guidelines for both construction and interpretation.

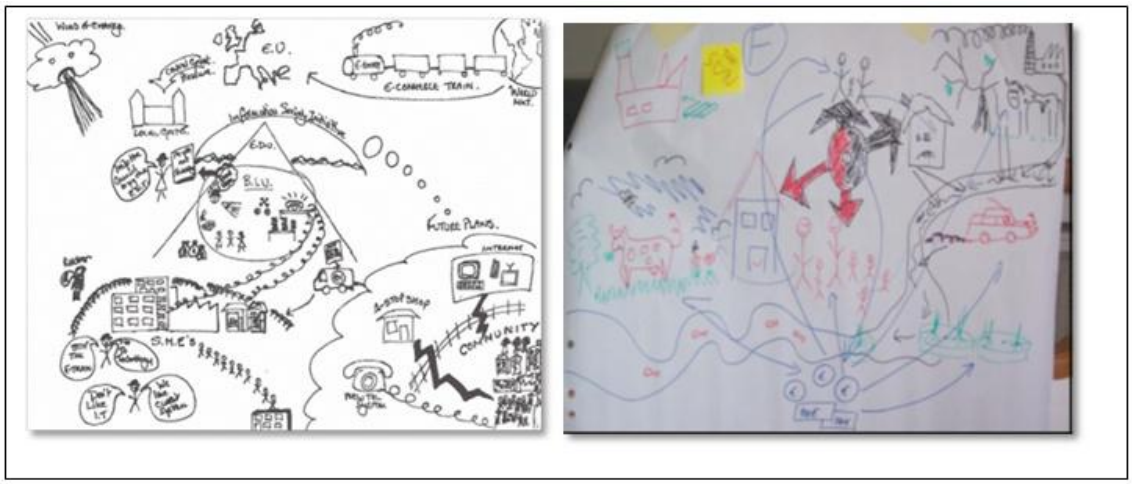

Figure 1.1 Example Rich Picture

In this thesis I discuss the value and interpretive risks when using iconography for system understanding. It is argued that rich pictures can produce both valuable and powerful outputs. I contribute new and unique understanding on the iconography used in both individual and group-work RP diagrams and suggest that comprehension could be enhanced by adding small

elements of structure to a picturing process. I argue that such structure can provide benefits for both the interpreter and the creator of a rich picture (hereafter: RP).
The following sections of this introductory chapter provide a background to this field of research and discuss the RP in more detail. The hypothesis is given in the statement of aims and objectives in section1.1. Sections 1.2 to 1.5 introduce the assumptions, methodology, testing practices and author's positionality, Section 1.6 will detail each ongoing chapter. A diagrammatic schematic is offered in section 1.7.

1.1 Statement of Aims and Objectives

Hypothesis:

For some individuals and in certain situations, the rich picture tool is enhanced by adding small elements of structure to both the facilitation and construction stage and a set of distinguishable enablers improves end user interpretation

My aim was to investigate the RP, concentrating on how the diagramming process could be partly formalised to enhance upon issues of participation, construction and interpretation. My research offers comprehensive knowledge and understanding into the icons used in RPs. Research has also been based upon devising, testing and evaluating new techniques to be used during the picturing process. There has been an extensive in-depth study on the three key hypothesis areas; RP facilitation, RP construction and RP interpretation.
It is suggested, and operates as an underlying assumption of my research, that for some, there might be a need to provide a selection of appropriate and relevant iconography to offer improved artistic communication and rich interpretation of these problem situations. My research indicates a natural intrinsic grammar belongs to the RP in terms of relationships, shape, context and sub-boundaries. I argue that knowledge can be gained by reading the picture through such understandings. It is further evidenced, and supported by the research findings, that there are some 'common symbols' derived from a significant number of repetitions and similarities in the samples tested. Emphasis is placed upon the interpretation, order and direction of events within a singular RP. The starting point for this work is that certain icons are likely to be ambiguous in cultural and geographic meaning and therefore are

unlikely to be universal but other icons are perhaps generic when placed in context within a domain.

In essence, I am trying to discover if the participatory process of a RP can be significantly enhanced by a more formal appreciation of the way RPs are facilitated, constructed and interpreted. Thus, my work also looks at how we think and act in groups and how this impacts upon style of communication and delivery of information. For some, participatory group work using pictures can be difficult causing anxiety, concern and even isolation whilst for others it is easy, fun and effortless. Some cannot see the relevance whilst for others it hones ideas and gives clarity of meaning.

Little is known about the RP in terms of group dynamics and the icons drawn. Therefore, it is perhaps beneficial to consider the possibility of emergent behaviour pertaining to the drawing of such pictures. Thus, this work collates a significant amount of pictures and looks for patterns in the drawings. In studying the RPs I seek to find out if there are possibly some 'unconscious rules' or 'self organisation' being applied in participative drawing? And if so, what are they/ is it? To simplify my understanding of the RP I offer a framework to guide interpretation.

I fully acknowledge and appreciate that the actual function of a RP is to be structure-less and therefore it could, for some, seem an anathema to change a core purpose of the tool. Arguably, it could be said that the RP tool requires some guidelines for construction with some possible parameters for evaluation. Hence, I am not suggesting that my framework will be of use to everyone. Those who prefer a degree of direction when working within a complex situation might find some solace with the guidance suggested in a framework. It does seem that many practitioners using the RP add their own style and practice of delivery but insist upon it being a structure-less tool. Thus, there seems to be a separation when discussing the RP and the actual use of the tool.

One function of my research is to act as a catalyst for debate concerning the role and interpretation of the RP, a debate which I believe is overdue. I will return to this issue later in the thesis.

1.2 Objectives

The RP is, in my opinion, a powerful 21st century knowledge elicitation tool, and it is therefore important that we better understand why, when and specifically how it is used by practitioners. The main purpose of this study is to develop an understanding of the RP in

terms of how it is introduced (facilitation), how it is constructed, and if there is any way of understanding the iconography without any form of dialogue with the artist (interpretation). To achieve this I will;

1. Determine RP facilitation process styles and the materials offered to participants.
2. Isolate, through the collation of the iconography, the specific images that occur and indeed re-occur over many rich picture samples
3. Analyse the above collation looking for similarities, duplications, emergent themes, grammar associations and relationship dependencies.
4. Isolate the most common non domain specific icons gleaned from the above analysis to be used in a key symbol legend
5. Use the legend to investigate areas in which structure may increase usability and robustness of the tool.
6. Determine, using the results of the prior investigation (objectives 1-4), what can provide insight on how best to use RP to explore the group mindset.

Thus, to clarify the link between the hypothesis and the objectives and determine the potential advantages of adding structure to the RP there has to be a series of interrelated but singular steps of discovery. These steps are set out as objectives which, when answers have been established, will allow both author and reader to conclude upon the hypothesis claim. Objectives 2, 3 and 4 are broken down further within a Typology of Questions in section 1.5.2. In summary, I will prove the hypothesis by bringing together the exploratory themes of the objectives and provide responses resulting in a guideline framework.

1.3 Research Background

There are expectations upon 21st century information systems to be robust, reliable, and secure as well as being able to adapt to any amount of new changes that are levied upon them (Castells, 1996). 21st Century societies of all kinds expect our systems to cope, not only in terms of hardware and software, but also to accept human involvement in system structure and operation (Ibid). The term socio-technical systems came about in the late 60's due to a dissatisfaction with the hard traditional design methods as systems were not coping with real world issues involving human activity (Mumford, 1996). Examples of application with hard

system approaches can be seen in the agricultural research centres such as IRRI (International Rice Research Institute) and ICRISAT (International Crops Research Institute for the Semi-Arid Tropics) in the late 70's. Hard system problems (Ibid) were well defined and specific in their technical and scientific nature but this is not always the case in practise and there became a need to develop methodologies and design systems that take into account human perspectives. Socio-technical systems in both their design and operation not only deal with software and hardware components, but also take into account human factors. Soft Methodologies such as SSM (Checkland, 1981), ETHICS (Mumford, 1996) and Multiview (Avison & Woodharper, 1990) sought to understand problem situations within complex systems where clients do not know specifically what the problem is or what they want done about it.

The soft system approach came about due to the realisation that not all problems are clear cut and are sometimes, "*ill structured and messy*" (Khisty, 1993). Peter Checkland and his team in Lancaster developed the Soft System Methodology or SSM as a way of analysing complex problem situations looking at 'emergence', and suggesting that an entity will exhibit properties that are only meaningful when attributed to the whole (Checkland, 1985). SSM can be defined as a socio-technical system methodology offering tools for analysing complex situations. This modelling approach identifies differing worldviews of the system by encouraging discussion and debate initially through a tool called the RP. The RP has been applied in many different fields, both in academia and in practice and is seen, although arguably, to originate from Checklands work in the mid 70s on Soft Systems. The RP lies at the heart of Checklands 'human activity system' illustrating how people are involved in the system. There does seem to be a division in academia (Bronte-Stewart, 1999) on what the RP actually is. Whilst some suggest the RP is a process others advocate it is a tool and for some it is seen as a technique, expression or a devise. Table 1.1 gives a synopsis of differing academic RP descriptions. It should be noted however, that these authors will often discuss the RP using many of the following descriptions. I suggest that these descriptions are the most frequently used by the following authors but I accept possible criticism in this table.

Table 1.1 RP Descriptions in Academic writings

Description of a RP	**Authors who use this Description**
Situation summery	(Checkland & Scholes, 1991); (Daellenbach, 1994); (Waring, 1996)
Expression	Checkland (1981)
Technique	(Lewis, 1992, pp. 351-360); (Jayaratna, 1994, p. 79); (Skidmore, 1987); (Sidhu, Jani, & Ramesh, 2001)
Device	(Patching, 1990, p. 45); (Pidd, 1996)
Tool	(Avison & Fitzgerald, 2003, p. 245); (Jayaratna, 1994, p. 79); (Bell & Morse, 2010, p. 4); (Monk & Howard, 1998); (Avison, Golder, & Shah, 1992); (Bell & Morse, 2012a)
Process	(Darzentas & Spyrou, 1994); (Bell & Wood-Harper, 2003, pp. 59-66)
Representation	(Armson, 2011, p. 57); (Checkland & Scholes, 1991, p. 288)
Diagram	(Stowell & West, 1994); (Harry, 1994)

The RP can be seen as a representation, diagram or a tool within a methodological process or equally can be a freestanding process or tool in its own right; it ultimately becomes what it is depending on what it is being used for. It seems clear to me that the RP has two main elements; structure and process. I find it acceptable to use the word *tool* or *device* but find *expression* to be too weak and *technique* to be too structurally strong, suggesting a definite set of rules. Bronte-Stewart, writing an extensive literature review on RPs, suggests confusion, *"it seems that rich picture diagrams are being used as a technique in themselves*" (Bronte-Stewart, 1999). So, for the sake of making a decision I will concede to the majority in table 1.1. Thus, for the purposes of this research, I shall consider the RP as a free-standing tool rather than a tool that belongs to a specific methodology and this tool is used in a process of facilitation, construction and interpretation. I do, however, acknowledge that SSM is the likely birthplace of the RP thus the SSM methodology is discussed in more detail in the literature review. The RP is a diagrammatic means of identifying differing world views with the aim of creating shared understanding of the organisation. The RP identifies 'issues'

(Checkland & Scholes, 1991) 'concerns' (Monk & Howard, 1998) and 'wicked' problems' (Rittel & Webber, 1984). Words can be too powerful and open to abuse whereas a picture can encapsulate meanings, associations and non-verbal communication such as emotions and feelings. The sensitive and yet powerful nature of the RP has been seen on a first hand personal basis (Figure 1.2).

My Personal Experience of the Power of the Rich Picture

Before commencing the PhD I went for an interview at a well-known and large software engineering house. The company wanted to know how soft design would help their communication issues so they asked me to run a rich picture exercise with a selection of their staff (around 10). Being a progressive contemporary company they had blank walls on which to draw. After 40 minutes there were 7 large pictures, both group and individually drawn, around the walls of a large open plan office depicting all sorts of issues that staff felt needed addressed within the company. As a typical part of a picturing process I asked each group, in turn, to discuss what they drew and what they felt were important areas of concern. The staff had drawn some powerful rich pictures with the majority showing management in a fairly poor light and others highlighting areas of staffing and communication problems. The after-picture discussion only lasted for 2 of the pictures because, after whispered discussion amongst management, the pictures were wiped permanently off the walls and the staff were asked to go back to work. Needless to say I did not get recalled for a 2nd interview but it served as a useful exercise for me to see quite how powerful the visual tool can be.

Figure 1.2 Personal experience

The RP can offer everyone an equal voice allowing for previously invisible system workers to be heard. For over 30 years facilitators have been using the RP as a way for groups and individuals to express concerns on a problem situation. More recently the RP is seen to be taught in academia as a relevant tool for problem structuring; for example the Open University course T552 (Open-University, 2009).The RP has predominantly been used as a freeform, unstructured tool with no commonly agreed syntax (Bronte-Stewart, 1999). The picturing process usually involves an introduction on what to do, creation of the RP and then, with group pictures, there is typically an after picture discussion. The RP process, as highlighted by Bell & Morse (2012), is often facilitated in an iterative way and more pictures can be drawn highlighting either specific areas of concern, or sometimes desirable solutions for a problem situation. RPs can often hold emotional content such as the one drawn by

Armson (Figure 1.3) concerning her mother's care home (Armson, 2011) and the group RPs of the 2011 New Orleans disaster[1].

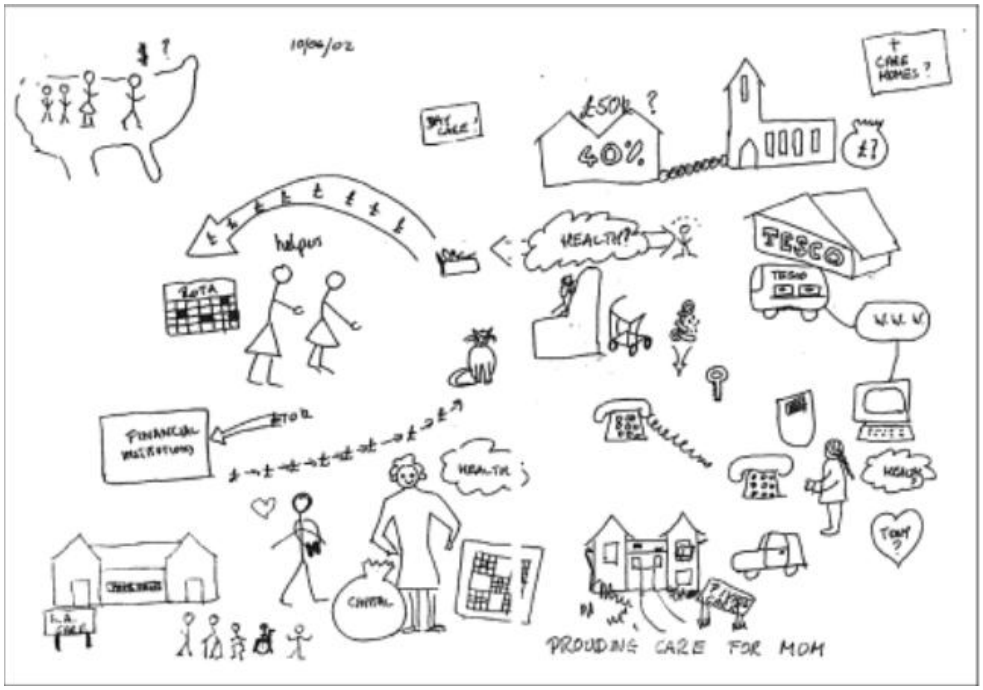

Figure 1.3 RP by Armson 2011

Unlike other models the RP can show environmental factors and their impact on the system as well as more personal emotions and experiences. In essence, the RP is a means for capturing hard to pin down ideas. In the discipline of Operational Research the RP has been adopted as a problem structuring tool. In the OR54 conference in 2012 (OR54, 2012) I presented a paper on the RP and there were two well attended workshops on RPs.

There has been dwindling research in the last 15 years on RPs and their uses within and out with the SSM field with the notable exceptions of (Bronte-Stewart, 1999); (Campbell Williams, 1998); (Monk & Howard, 1998); (Sidhu, Jani, & Ramesh, 2001); (Bell & Morse, 2010) and most recently Bell and Morse (2012); (Bell & Morse, 2012a). The literature review Chapter 2 in section 2.5 discusses this research into RPs in much more detail. Furthermore section 2.5.1 identifies problematic areas and suggestions for possible improvement from literature and highlights the most recent research activities in this field of study.

[1] I have still to procure copies of the New Orleans Disaster RPs. They were drawn in mixed groups consisting of aid workers, police, politicians, medics, military and in effect representatives of all involved in the aid process. These are highly sensitive pictures that are proving difficult to get hold of due to ethical constraints and data protection issues.

The next part of this Chapter will identify issues that surround the RP and what has already been done to resolve some of these problems. Section 1.4 will look at areas that, I suggest, require investigation within this thesis.

1.4 Problem Identification

What we know about the RP is largely based upon academic literature and observational studies and there has, until now, been no empirical study analysing the component parts of a RP. There are several major problems, identified by academics and facilitators, relating to the RP and its use. Chapter 2 (table 2.3) lists these problems but in essence they are based around issues of stakeholder participation and the interpretation of subjective data. Questions have been raised about the possibility of structuring the RP but there has been much opposition to this (Bronte-Stewart, 1999). The RP exists because it is not rule bound and it is traditionally seen, and used as, a rule-less expression. To express rules in the picturing process would be to take it out of its SSM role and for many SSM practitioners this would be an unacceptable mistake (Ibid). Checkland has never given any clear construction advice but other authors offer quite precise advice (Ibid). Some propose (Lewis, 1992); (Sidhu, Jani, & Ramesh, 2001); (Waring, 1989); (Wood-Harper, Anthill, & Avison, 1985); (Avison, Shah, & Golder, 1993); (Bell & Wood-Harper, 1992) that a common key of icons or symbols might enhance the tool whereas others are strongly opposed to such structure. Although these authors discuss the possibility of structuring RP icons they offer no empirical research into what the icons should be. Research in this area is limited. Guidelines offered for RP construction have been varied, are often contradictory and, to date, there has been no agreement on how one should facilitate or indeed interpret a picture. However, it should be noted that The Open University can be seen to offer the most comprehensive information on the RP in their course T552: Diagramming Primer. The RP is known to be a tool used in SSM but this research highlights the fact that it is being used by practitioners out with the methodology. Little is known about the iconography used in RPs and it is not clear what, if any, icons are being used repeatedly across differing domains and within differing cultures. In addition, no research has been found that surveyed facilitation of RPs in terms of how they are being introduced, delivered and styles of delivery. Perhaps this is not actually a problem? Should practitioners be coming to an agreement on some sort of ‘best practice’ facilitation? Consultancy for complex problem structuring can be a lucrative business especially for expert facilitators so, it is quite

possible that, individual style of facilitation is a practitioners unique property or USP[2] and therefore not up for sharing with the wider community.

It is further demonstrated in the literature review that although many academics and practitioners have suggested a key symbol legend (Bronte-Stewart, 1999) there has been no study done to determine what the symbols or icons should be within such a legend and once identified if they are of any use to people. There have been recent studies looking at group work using the RP as a process tool (Bell & Morse, 2012a). Bell and Morse offer a framework which is seen to rate pictures in terms of coherency using criteria such as mood, expression, colour and kinetics. Their research into RP appraisal on richness is well documented, analysed and evaluated but, even acknowledged by themselves (Bell & Morse, 2012a, pp. 54-62) can be open to criticism on their subjective interpretation. There has, to date, been no empirical study done on RPs which looks at data comparing icon elements across a large data sample. In short, there have been no studies to determine if RPs, without explanation, holds any value or usefulness.

The following section looks at the collection methods, data storage, research assumptions, sample testing and evaluation. This is just an introduction to the research explored in this work and is therefore discussed in full detail in the Methodology Chapter 4.

1.5 Exploration of Research work

There are several areas relevant to the RP that require investigation. It is beyond the scope of this study to examine all areas both in terms of time and access to enough relevant material. Most notably, I *will not* be looking at group discussions after the RP and nor will I be conducting a full investigation into group dynamics. Although perhaps an interesting prospect, I *will not* be investigating the possibility of RP software or indeed any automation of the RP with the use of, computer systems, smart pens or other such technology. I am solely examining RP iconography under three sets of criteria; facilitation, construction and interpretation. The limitations section in the methodology chapter discusses this further.

One aim of my research was to collate, analyse and document a substantial collection of RPs to build up a databank of RP iconography for this and future research projects. Other aims

[2] Unique Selling Point

look at how the RP is facilitated and how people think and act during the RP process. Thus, this research needs to be diverse in data collection and analysis methods in order to cover the conceptual ground. Whilst perhaps appearing ontological in structure it can perforce only to be epistemological, reflecting my particular view. All data collection and analysis techniques throughout the research have been laid out in detail in the methodology chapter and will therefore only be lightly touched upon in this introduction. Assumptions have been made within this research and they are identified in this section.

Investigation was achieved throughout this research by qualitative analysis techniques using an inquiry process called Action Research[3]. Elements of the methodological structure also relate to the Grounded Theory[4] framework. Robustness of the ranked data was achieved using intercoder reliability indices measuring homogeneity (extent of consensus) to strengthen the validity of the findings.

In Appendix A, my thesis examines the way in which the RP is presented to groups prior to drawing. The assumption being made here is that, the way the RP is delivered to groups can impact upon the emotion of the group, the way they set about the picturing activity as well as implicating upon the actual picture being drawn. It is not my intention to comment on whether different styles of facilitation are 'good' or 'bad' but instead to determine whether differences and similarities in facilitation impact upon the quality of the observed picturing process. This exploration has been accomplished by comparing the delivery and instruction style of 3 different annonymised workshop facilitators. These 3 workshops were chosen because they represent a variety of different styles of facilitation. This compare and contrast observational study was then used as a basis for a test that offers a possible way to ameliorate some of the issues that surfaced when comparing facilitation styles. This small investigation study test suggests a way of facilitating by incorporating a pre-drawing exercise. Results from this study have been analysed and evaluated but reside in the Appendix section because of the underdeveloped data resource and observational nature of the study. Results, although weak on empirical data, indicate that there is perhaps an opportunity for experienced practitioners and academics to combine expert knowledge to determine a 'best practice' for the facilitation of RPs. This small amount of structure might ensure non-expert and inexperienced facilitators and teachers a clear starting place for their own facilitation.

[3] According to Cohen and Matten (1996, p186) Action Research is "*a small scale intervention in the functioning of the real world and the close examination of the effects of such interventions*".

[4] Grounded Theory is "*the discovery of theory from data systematically obtained from social research"* (Glaser & Strauss, 1967, p. 2)

Chapter 3 looks at interpretation of RPs. As previously stated the iconography in RPs is an under explored field of study. So to get a better understanding of the RP I explore icons looking at universal meanings and cultural distinctions, domains, size, colour, boundaries, metaphors and connectors as well as investigating more abstract concepts such as richness, comprehensibility, orientation, humour and emotion. The possibility of a RP icon language is explored introducing the notion of iconic scripting[5]. I investigate a series of measures for icon interpretation in Chapter 3 ranging from formal art interpretation, illustration research and language structure with exploration into areas such as the tarot cards, comic book construction, colour theory, desirability studies, symmetry and spatial groupings and icon relationship associations. Using the knowledge gained from this research and adopting, adapting and merging many different style approaches for interpretation I suggest a method for RP appraisal.

In Chapter 5 my research examines how RPs are constructed using the icon dataset to support findings. My icon dataset holds nearly 300 RPs that have been collected from a variety of sources over a period of 3 years. During this time a substantial collection of pictures were taken from books and academic papers with many pictures coming from requests made to practising practitioners. Many pictures also came from test and workshops I personally facilitated. Requests for RPs were made on social networking sites, networking groups, via seminars and conferences. Data collection stopped in January 2012 in order to have time to analyse the samples but it should be noted that within the Soft System social networking groups this research work has become quite well known and I am still receiving RPs to add to my collection. In Chapter 5 I provide answers to a Typology of Questions. These questions have been devised to consider elements or areas of specific interest that aid understanding of the RP. The typology of questions relates to numbers 2-4 of the research objectives. The questions compare and contrast RP icons and RP elements to investigate for possible correlations. For example, I look at how colour affects richness and how boundaries affect comprehensibility. Due to the quantity and quality of pictures in the icon dataset it is impossible to answer some questions with any degree of surety. These questions are discussed in detail in the 'limitations of the research' in section 4.17. It is fully accepted that there are many other questions one could ask of the icon dataset but it was considered that these relate most directly to the core objectives. The questions have been split into 3 core themes; core structure, artistry and visual coherence.

[5] An icon script is a system of writing constituted by iconic symbols (Berniker, 2003)

Chapter 5 investigates how pictures are constructed and the possibility of repeating iconography in RPs. Therefore Iconography from various domains is examined looking to identify modern RP standard iconography for use in a key or icon legend. The assumption here is that a legend might, for some, improve the RP process, reducing issues of interpretation, artistic ability and participation. From a deep analysis of the pictures and their iconography within the icon dataset a legend is developed. Evaluation of the proffered legend ranges from a variety of forms such as interviews with expert facilitators, workshop studies and observational exercises.

In Chapter 6 I present a framework which aims at supporting the whole process of the RP which takes into account facilitation and construction guidance with emphasis on interpretation assistance. It is fully acknowledged that the framework will not be useful for every facilitator but instead it could be taken as a preliminary guide for non-expert facilitators and teachers. The framework suggests there could possibly be an advantage to the artists and interpreters if there are small areas of structure introduced to the picturing process. Such structure might include a pre-drawing session at the start of facilitation or a legend of icons offered to participants.

1.5.1 Authors Contribution and Positionality

I discovered the RP within the SSM literature during my 2010 BSc degree research. I had initially wanted to look at the possibility of building ontology's from RPs for my dissertation but quickly abandoned this idea in favour of the more interesting study of icon investigation. The BSc dissertation looked at how the icons in the RP have changed over the last 30 years and identified the contemporary icons that are seemingly becoming more relevant in our current technological and global business practices. This relatively small background research in 2010 on RP iconography ended up having more unanswered questions than answered ones by the end of the dissertation. Thus I sought PhD funding to enquire further into the RP as a useful tool for system understanding. I was awarded internal scholarship funding from my department to complete a 3 year PhD.

I believe that this PhD thesis not only makes a significant, and much needed, contribution to RP literature but also plays an important role in examining the multifaceted opportunities the RP tool offers within a wide range of applications, processes and services. There is a real

dearth of literature on RPs with no research into the RP iconography. The tool has, to date, been seen simply as an enquiry or discussion aiding tool and its real usefulness expires after completion. This work identifies the unique iconography used in RPs and shows how simple interpretation guidance can lead to enlightened understanding of the pictures. There are three major contributions this research work can claim. Firstly, two in-depth literature reviews spanning many wide and diverse fields of relevant research. Secondly a compare and contrast analysis of RP iconography looking at areas such as richness, coherence and kinetics whilst considering colour and boundary compared with gender, age and domain. Finally this thesis offers a framework for RP understanding based upon the literature review and icon dataset results. The framework provides a significant advancement towards RP knowledge and understanding and offers a major contribution to enhanced RP icon awareness. It is my belief that this framework, providing icon understanding, will promote the value and effectiveness of the RP tool by supplying a level of structure that is simple and straightforward to use.

1.5.2 Structured Typology of Queries relating to 3 core themes

1. **Core structure** (coherence, richness, kinetics, boundary, syntax)

    1. What are the repeating icons in RPs independent of domain?
    2. Are there any domains that show repeating icons and if so what are they?
    3. If a legend is provided does it produce a richer picture?
    4. Is there any difference in richness in RPs drawn in groups or by individuals?
    5. Does a RP showing good connections between icon elements equate to being a richer picture?
    6. Does a rich RP have clear boundaries drawn within it?
    7. Do groups draw more boundaries (including sub-boundaries) than individuals?
    8. Is there any correlation between gender, age and boundary drawing?
    9. Does a highly coherent RP have boundaries?
    10. Are there certain age brackets that draw rich RPs?
    11. Do the RPs rated high on both richness and coherence suggest an optimal amount of individual icons?
    12. Does the RPs that has no boundary have a low score on kinetics?

2. **Artistry** (gender, icons, age, colour, metaphor, emotion, humour)

1. In individually drawn RPs are males or females drawing the richest pictures?
2. Are computer generated RPs as rich as hand drawn RPs?
3. Is a rich RP a highly colourful RP?
4. Is a RP which is scored high on kinetics a more colourful RP?
5. Is a humorous RP usually a colourful RP?
6. Do groups use more colour than individuals?
7. Are there certain age brackets that prefer to use colour?
8. Do female or males prefer using colour in RPs?
9. Do humorous pictures correspond to certain domains?
10. Do RPs rated as 'not acceptable as RPs (highly texted with few or no icons) correlate to and age or gender group?
11. How are females represented in RPs? Where are they placed and what are they seen to represent?
12. What icons are seen to represent management?
13. What are the common metaphors seen in the RP?
14. Do different types of speech bubbles represent different thoughts?
15. What are the types of icons that provide soft or conceptual emotional content?
16. What are the types of icons that provide strong emotional content?
17. Are the RPs that show interaction between people and objects high on comprehensibility?

3. **Visual coherence** (narrative, visual coherence, icons, style, background)

1. Is a highly coherent RP a rich RP?
2. Based on the different rating scales of coherence. Are groups or individuals drawing the most coherent RPs?
3. Is a very coherent RP a highly colourful RP?
4. Do males or females draw the most coherent RPs?
5. Are there age groups that draw more coherent pictures?
6. Does a legend drawn by the RP designer (s) increase coherence?
7. Is a computer generated RP more coherent?
8. Do RPs displaying 'full figure images' (more than just stick figures) provide more richness and coherence?
9. Does the white or background space communicate in a RP?
10. Is a highly coherent RP highly connected with variation of lines and arrows?

1.6 Structure of Thesis

The following Table1.2 delivers the full structure of the thesis explaining the key areas under discussion that are focal to each Chapter.

Table 1.2 Thesis Structure

Chapter 1 Introduction: Introductory discussion to the research field with sub-sections being Background Research, Problem Identification, Motivation behind literature review, Exploration of Research work, Statement of Aims and Objectives, structure of thesis and diagram schematic of thesis.
Chapter 2 Literature Review: Background Related work An exploration into the following main areas: system thinking and system problems, SSM, Knowledge Management, Elicitation techniques Semiotics, History of icons, Participatory Group work and RPs
Chapter 3 Literature Review: Interpreting Icons An extensive exploration into RP interpretation looking specifically at areas of iconography, language, aesthetics, mood, emotion, comprehension, colour, boundary, connectors and richness.
Chapter 4 Methodology: A full explanation on how the Aims and Objectives were accomplished using a variety of qualitative and quantitative methods and analysis tools.
Research: **Appendix A: RP Facilitation:** An observational exploration into facilitation techniques and participation feedback. A new technique involving a pre-drawing session to aid the facilitation process is introduced, tested and evaluated upon. **Chapter 5 RP Construction:** Detailed analysis into construction techniques and emphasis predominantly focused upon the iconography found in rich pictures. A new technique to aid construction using a legend key is introduced, tested and evaluated upon. A detailed cross comparison of rich picture elements are analysed using a large comprehensive icon dataset of rich pictures.
Chapter 6 Discussion and Conclusion: This Chapter will answer the initial hypothesis question by relating the sections in Appendix 4, and Chapter 5 cumulating with a framework to aid RP interpretation.
Bibliography Alphabetical library of resources presented using the APA Standard (5th edition)

Chapter 2 Literature Review: Background Related work

2.1 Motivation behind this Literature Review

In order to understand the RP as a problem-structuring tool in its entirety it was clear that the background literature review required a diversity of exploration within various domains. Initially readings centred around system literature looking at soft methodologies with emphasis on SSM as that is where the RP seemed to initiate from (Checkland, 1981,1991,2000). From this, I started to investigate system thinking literature because these readings explored concepts such as definitions of a system and how to deal with complexity. The system thinking literature relates to this thesis work because it deals with modelling of social systems and solving problems in a holistic manner which, according to Avison et al (1993), is what the RP seeks to achieve. This led me to study some management literature on system complexity and learning organisations because the RP is often seen and used as a management tool (Ackoff,1978-2006); (Argyris & Schon, 1978); (Barnard, 1938); (Senge, 1990). From reading about organisational knowledge my studies fell towards Knowledge Management (KM). KM is highly relevant to the RP because the use of the tool is all about people and how they react and experience their working environment. From looking deeper into the Knowledge Management literature the concepts of hard and soft knowledge are introduced (Hildreth & Kimble, 2002); (Nonika, 1991). This relates directly to my work as the RP offers a platform to discover both explicit and tacit understanding of a problem situation. At this point in my readings I decided to create a comparative analysis table of different knowledge elicitation/ problem identification techniques to show the diversity and often varied ways in which system and management practitioners attempt to gather information in complex problem situations.

It became apparent that I could potentially go off on a tangent of different KM techniques which moves away from my thesis questions and I must centre further study on the RP as, although it is good to acknowledge other problem structuring tools, it is not the focus of this research.

As stated at the beginning of this section the RP has roots within SSM but this is not entirely true because using pictures as a form of description, enquiry and communication has been around for thousands of years. Thus, my readings upon relevant literature and relevant media

libraries (Herzog, 2010) took a significant change and I started to look at the history of signs and symbols. Section 2.4 delves deep into the earliest evidence of graphics used to record data with exploration into the Chauvet cave paintings of Southern France (Marshall, 2011) and the possibility of Neanderthal pictorial discoveries in Spain this year (MacErlean, 2012). These early forms of cave paintings were of interest because they, as with how I am investigating RPs, are using art as a form of communication without explanation.

Although not possibly seen as a conventional academic discipline I looked at the tarot card as a cross cultural ancient form of meaningful symbols which, perhaps surprisingly, can be dated back to the mid thirteen hundreds (McCormack.K, 1998). The tarot card has survived as a counselling tool for centuries and yet has changed little in its taxonomy of symbol structure. Even at a cursory glance it was possible to see potential similarities in major arcana tarot characters, such as the tower, fool, hierophant and death which correlate with major icon characters in the icon dataset of RPs. So too, issues of minor arcana card symbols such as money, love, health, conflict are also reflected in many RPs. I argue that the tarots ancient folk images of common ideas and themes are almost a conventional equivalent to the RP and thus, to some extent relate to the reading of the RP. The symbol taxonomy relevance of the tarot card and the symbols of the RP are explored in detail.

As I was going to be investigating the possibility of standard icons for the RP I decided to examine other standard pictorial representations within an international context. The highway code and the 2007 International graphical standards were examined as well as the renowned 'symbol sourcebook' of Henry Dreyfuss (DSA, 2001); (ISO,2007); (Dreyfuss, 1972). Through studying standard international iconography I then went on a journey investigating a variety of illustration authors (Goldsmith, 1984); (Horn, 1998); (Horton, 1991); (Horton, 1993); (Tufte, 1990) with a special interest in the symbols and scripting within comic books (McCloud, 1993). I suggest the comic book is relevant to RP in a number of ways ranging from directionality of reading, connections between sections, boundary between sections and notwithstanding the similarity with cartoon-like stick figure characters and their interaction with artefacts. From this, an exploration into semiotics occurred as described in detail in section 2.4 of the literature review (Saussure, 1916); (Peirce, 1931-1958). Semiotics is the study of signs and symbols and how meaning is formed through cultural perspective. I was disappointed to discover that semiotics is not, in my opinion, specifically relevant to my studies. This thesis is investigating RPs in terms of the actual pictures or icons produced but 'signs and symbols' in semiology are, in the most part, related to text and language

communication with modern application being focussed on linguistics, marketing and even ergonomic design.

The background literature review finishes with an in-depth review of RP literature much of which I have highlighted in the previous 2 sections. The RP is traditionally a participative form of enquiry so a study of group dynamics is also be included in the literature review. My readings on group phenomena took me on an investigation into how groups achieve consensus and the pitfalls that can often ensue during collaboration exercises. From this a review of ethical studies of moral philosophy transpired because the RP, used as a participative tool, is perhaps subject to groupthink syndromes (Janis, 1974). This thesis looks areas of perception, beliefs, norms and attitude. Therefore a review of morale philosophers such as Kant, Bentham, Mills, Rawls, Locke and Smith comparing ethical and fairness principles to requirement gathering in groups was undertaken (Berg, Pooley, & Queenan, 2011).

The diverse field of art interpretation has been of considerable interest in this research. Art interpretation is a tricky and subjective area to explore due to the controversial nature of aesthetics. The RP, in my opinion and as with many forms of art, seeks knowledge of the 'inner' by way of the 'outer' or put simply there is perhaps more to a RP than just what is seen at first glance. The RP has forms, shapes, boundaries, colours and kinetics that both correlate and contend with certain art appreciation styles. The RP is, in essence, a tool that outputs both individual art and group art so therefore areas such as art appreciation, aesthetics and appraisal are of great consequence. Thought was given to including a section on art interpretation styles and classification studies into the literature review in Chapter 2. However, I decided to fully expound upon this field in Chapter 3 within the interpretation section as this would make more sense in terms of an orderly thesis structure.

2.2 Introduction to System Thinking

As established in literature (Bronte-Stewart, 1999), the RP is used as a tool to gain understanding of complex systems which involve human interaction. Understanding what the RP can and cannot offer to complex system development will aid better comprehension of the value, if any, the tool has. Before investigating the tool it is important to understand what are the major problems in complex information systems and where the RP could fit into this.

Therefore, this section will look at issues preceding and surrounding the context of the RP so as to offer better understanding of the wider research field of system understanding.

It is argued by Checkland (1981) that we live in a world of complex adaptive systems. These systems range from natural systems such as the rain forest to the largest of man-made systems the World Wide Web. It is a world of ambiguity where nothing is black and white and confusion over continued existence is ever present. RPs are tools within systems literature and to understand what they are we need to understand this literature. Checkland describes a system as,

"A model of a whole entity; when applied to human activity, the model is characterised fundamentally in terms of hierarchical structure, emergent properties, communication and control" (Checkland, 1981, p. 317).

It would appear that systems are defined by functions and the interactivity of their parts rather than the sum of the parts. It should be noted here that there seems to be systems and sub-systems that can be mutually agreed upon to exist and also systems that are in our mind or constructs of what we believe to be true. It is quite possible that there are no systems and what we perceive to be a system is just a way of us making sense of our world. Within systems literature this is a highly contentious debate and, although I acknowledge the controversy, I do not intend to enter my research into this debate as my work is solely with the RP, as a pre-systemic tool.

Systems theory was proposed in the 1940's by the biologist Ludwig von Bertalanffy (1901-1972) as a reaction against reductionism. System thinking is basically a holistic way of viewing a system from a wide or broad perspective thus allowing patterns, structures and movement to be seen rather than viewing specific areas or single events. System thinking is a useful resource within system analysis and design and the RP is a good example of a tool that epitomises the holistic nature of system thinking. The RP allows one to see subtle changes and unusual patterns thus potentially enabling the possibility of predicting future events and emerging shifts. The RP tool is used to model and understand socio-technical systems that are usually of a complex nature. So, what is complex problem?

Complexity is usually associated with something that has many interrelating parts which can be difficult to comprehend (Jackson, 1975). Complexity can be predicted and prepared for, ensuring a harmonic acceptance of any change (Ashby, 1956). Thus, complexity is not the same as chaos. Chaos, by its very nature, produces unexpected disorder (Kellert, 1993). The way we think and deal with complexity in IS has changed over the years. Previously, system engineers and analysts took a systematic approach to problem solving because, in effect, this

is the way it had always been done (Ackoff, 2004). Breaking things into manageable chunks for simplified understanding was seen as a reliable way to approach a problem (Bertalanffy, 1901-1972). Academic writing suggests that since the early 70's there was a realisation of the limitations such an approach when dealing with a complex organisational problem (Checkland, 1981, p. 144). In effect, the engineer's acceptance of specifications and requirements produced a limited understanding of the needs of the organisation as a whole. There was a shift away from previous reductionist or mechanistic viewpoints where system solutions involved analysing the component parts for meaning (Ackoff, 2003). System thinking is used to solve problems in a holistic and creative manner by, "*rejecting either/or choices seeking multiple options and blended solutions*" (Pink, 2008, p. 136). For example, when the US space program found that pens did not work in Zero Gravity (Curtin, 2007) they subsequently spent millions to develop a pen whereas the Russians just used pencils. To surmise, it can be futile spending time reducing variability in a system when answers can lie outwith the system environment. In essence, we must not let perfect solutions get in the way of 'good enough'. If the purpose of the pen in space was to make marks on paper then the pencil serves this purpose perfectly well enough. Acoff neatly stated when arguing transformation through reformation, "*our global problem is our continuous effort to improve the wrong thing*" (Ackoff, 2004).

Visualisation is a key skill of a system thinker. Sean et al, citing Ekstrom, French, and Harman, defined visualisation as, *"the ability to manipulate or transform the image of spatial patterns into other arrangements*" (Sein, Olfman, Bostrom, & Davis, 1993, p. 600). Visualisation is more than the 'power of sight' as it is the ability to convert complex multidimensional data into patterns that make sense in a wider image: allowing relationships within relationships to emerge (Goldsmith, 1984). Senge (Senge P. , 1990) states, in the Fifth Discipline, that one of the five component technologies that create a learning organisation is the ability to build a 'shared vision'. He further states, "*in mastering this discipline, leaders learn the counter productiveness of trying to dictate a vision, no matter how heartfelt*" (Ibid, p9).

2.2.1 Purposeful Systems

In rich picturing the purpose is to make a pre-systemic mess which can offer some insight, often through contradictory multiple perceptions, what the system does and what the perceived problems are. It is imperative to understand what any system is and does before

any degree of fixing solutions should be implemented. The purpose of a system is the 'why' of a system. In the words of Simon Sinek, from 'Inspiring Organisations and Leadership', "*it is not what you do... but why you do it*" (Sinek, 2010). For example, Apple Inc makes computers (the *what*) but their uniqueness in the marketplace is their purpose, "*in everything we do we believe in challenging the status-quo and thinking differently*" (ibid). Whether this purpose is truly honest or perhaps a way of disguising other motives it is still their perceived purpose from a marketing standpoint. Sinek, creator of the 'The Golden Circle model', codifying what makes the most inspiring people and organizations so successful and influential, maintains '*if we can understand why we do what we do then the how and what will fall into place*'(Ibid). This, perhaps naive marketing standpoint, could be seen to belittle the skill and creativity of the design engineer whose job it is to generate the cheapest and most efficient ingenious alternatives under the heading 'how' and 'what'. Sinek furthers his idea suggesting organisations fail because of lack of organisational belief in the "*why we do what we do*" (Ibid). Senge is in agreement, stating as part of his organisational learning disabilities, "*most people describe the tasks they perform every day, not the purpose of the greater enterprise in which they take part in.....most see themselves within a system over which they have little or no influence*" (Senge P. , 1990, p. 18). Checkland, it could be suggested, merges the concept by looking at the 'what' and the 'why' by the formulisation of a root definition within a human activity system. As explained later on in this Chapter the root definition is a verbal description of the system. In the SSM the primary task (the *what*) is identified in a root definition as well as an attempt to represent the issue based tasks (the why) or viewpoints. Checkland does however accept, that there can be no unique description and there will be, "*other feasible weltanschauungen*[6]*"*" (Checkland, 1981, p. 214).

Checkland furthers this discussion on 'purpose' by defining his five system classes; natural, designed physical, designed abstract, human activity and transcendental. The natural system is an "*evolution made irreducible whole*" (Checkland, 1981, p. 113) having within it humans who create the physical, abstract and human activity systems. For Checkland, the transcendental system lies outside the inner boundary and represents, if indeed possible to comprehend, conceptual knowledge. Human activity systems are different from natural systems because of the special characteristics that set humans apart; communication, tool

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6 Weltanschauung: Conception of the universe or world view

making, language, creativity, self awareness, freedom of choice (Ibid). Wilson describes human activity systems as "*an interacting set of subsystems or an interacting set of activities*". He furthers this description stating that it is a "*transformation process*" and the purpose or objective is not important (Wilson B. , 1984, p. 28).

Designed systems are purposeful systems. These systems are designed because the human activity system requires it. These systems can be both physical (tools, bridges, automated complexes) and abstract such as mathematics, language, philosophy (Ibid). Teleological design can be extrinsic (for others) or intrinsic (for one self) but acknowledges a conscious selection of choice ensuring freedom for the designer. Checkland uses the word 'purposeful' for these systems but accepts there are also natural systems that are not born of a human conscious action which he calls 'purposive systems'. Purposive systems allow one to attribute some purpose but this does not need to be goal directed. For Checkland the 'purpose' of an activity, or system, is multifaceted so to be able to assign agreed universal definition, or RD, there needs to be pedagogic discussion and debate.

Socio-technical thinking attempts to model problems and not systems. Socio-technical system thinking refers to the social and technical aspects of an organisation assigning joint equal weight when designing for organisations. Socio-technical authors such as Peter Checkland and Enid Mumford have designed their own soft methodologies based upon different criteria. The ETHICS methodology (Mumford, 1996) centres on participation and job satisfaction whereas Checkland looks at providing tools for analysing complex situations. Solutions to system problems can however create new problems. Senge states, "*well intended actions can lead to unintended consequences*" and "*today's problems come from yesterday's solutions*" (Senge P. , 1990, p. 57). This sentiment is beautifully demonstrated in the Jonny Cash track, 'One piece at a time' where in he attempts to build the perfect automobile by scavenging for individual parts to make his 'dream driving machine' only to latterly discover the lack of synergy between the parts (Cash, 1976). Strengthening individual parts of a system is not always the solution as the system is at optimum efficiency when all parts are in harmony with each other. As Ackoff states, "*the whole has properties that none of its parts have*" (Ackoff, 2003, p. 21). One of the main challenges for the acceptance of system thinking is the ability to focus upon the whole, accepting that the nature of the whole is always different from the mere sum of its parts. This is quite different from the usual cause-and-effect way of thinking. Acoff would suggest that, in the western world, people are educated using a linear analytical approach; if A is the problem than do B then C should happen (Ackoff, 1978).

In order to maintain the 'relationship harmony' that is required for a system to be of balanced equilibrium the cybernetic Law of Requisite Variety (Ashby, 1956) can be applied. This law states that the more complex a system then the harder it becomes to predict structure and behaviour. The solution is to reduce 'variety' by identifying subsystems and simplifying their interactions (Ibid). Stanford Beer (1926-2002) coined the POSIWID principle; the purpose of a system is what it does (Beer, 2002). This principle acknowledges the difference between what a system is supposed to be doing and what it actually does, i.e. the official intentions of an organisation might not be what is observed as purpose by those who are not involved in its leadership. Beer devised this principle as a guide for concentrating on actual behaviour rather than perceived outcomes. In a complex system the problem is made more complicated when outcomes or purposes are conflicting or contradictory. It is at this point where system thinking or seeing the bigger picture becomes a practical and valuable skill and this is where the RP comes in.

Through spontaneous hand drawn, cartoon-like drawings, a complex system problem can be viewed and discussed therefore seeing the bigger picture in a unique diagrammatic way. Interestingly, I have found no study that has ever looked at the properties of the group RPs in terms of the icons drawn. There is, of course, tons of material available on the social psychology of group decision making but only one book looks directly at the RP group process (Bell & Morse, 2012a).

Section 2.3 further explores the SSM and the process and tools adopted. As previously stated, this thesis explores one of the tools used in the methodology but does not take on board the whole SSM process. In effect this thesis looks to divorce the RP tool from the SSM and study it in a singular form. Thus said, it is respectively removed from the SSM and done so with high appreciation of the inherent usefulness and adaptability of the complete methodology. It would therefore, be amiss to not include a section within this literature review on the SSM and its usefulness in system problem structuring.

2.3 Soft System Methodology

Those who implement modern information systems, such as healthcare and banking system designers, look at ways of creating effective systems to not only maximise profit but to capture and store the knowledge of the organisation. The core component of all Socio Technical Systems relies on the activeness of the stakeholders (Ackoff, Emery, & Ruben,

2005). The soft system approach is widely and successfully used in a broad range of disciplines ranging across medical, military and educational (Checkland, 2000). In the 1960's problems were encountered, engendering dissatisfaction, with hard traditional design methods, as they were not able to cope with real world issues (Castells, 1996). Hard system problems are those that have well defined data and processing problems. Hard system problems are well defined and specific in their technical and scientific nature (Mumford, 1996). The solutions to these hard problems involve the following of clear rigid procedures with no allowances for human influence (Ibid). Peter Checkland and his team in Lancaster developed the SSM as a tool for analysing complex situations (Checkland, 1981). They looked into the concept of 'emergence', suggesting that an entity will exhibit properties that are only meaningful when attributed to the whole (Checkland, 1985). In short, the whole is greater than the sum of its parts. A reductionist would try to find understanding in the parts, whereas a constructivist or a soft systems thinker would take a holistic approach and see the whole picture with the relationships that lie among the parts. The SSM suggests that gaining many world views of a situation, analysing the information and encouraging debate on desirable elements can lead to the implementation of feasible change. The practitioners using SSM understand that people have different perspectives on a potential problem situation and they endeavour to represent these multifaceted opinions. The SSM approach has been very successful in social systems and systems with significant human interaction (Clayton & Radcliffe, 1996). SSM has been described as a, "*problem structuring methodology useful in probing patterns of systematic relationships*" (Friend, 1998, p. 11).

SSM involves taking an unstructured problem situation, describing it from the viewpoints of as many people as possible and using this as a basis for developing conceptual models of the system. These models are then used to identify changing requirements (Ralstom, 2000). By capturing a wide variety of stakeholder views, within a system, a knowledge map can emerge. This map will identify both tacit and explicit knowledge and also identify areas for improvement and growth. Qualitative and quantitative information can be elicited, analysed and documented using SSM in an organisation. Over the last two decades soft system methods have been used successfully in the public sector rather than just for use in industry. Checkland states that public authorities are a, "*complex network of delivering services*" (Checkland & Holwell, 1998, p. 174). Due to the flexibility of this approach, SSM can capture the flow of information and understand the relationships that do or do not exist.

Checkland devised a seven phase (Checkland, 1981) heuristic process to enable action for change. The processes are iterative as and when the problem changes. SSM is well suited to an information system as the stages require activity and evaluation and constant reflection. By the late 80's Checkland and Scholes were redefining the seven phases and talking about three streams of action; roles, norms and values (Checkland & Scholes, 1991, p. 49). Checkland and his Lancaster team, by 1998, focussed their work on interaction and less on intervention for example more on learning organisations. The seven phases at this point became five models of purposeful activity and there seems to be a shift away from humanism and more towards the learning organisation.

Napoleon suggested that a good sketch is better than a long speech (Fourcade, 1968, p. 48), i.e. a picture is worth a thousand words. Diagrams and drawings are an excellent way of an investigative prioritisation of a complex problem which has many conflicting opinions. The practitioner/analyst must represent as many different viewpoints of the organisation as possible. This is where the RP comes into SSM (Figure 2.1). The RP is broad in its constructs, allowing for a complete mix of notations such as arrows, pictures, stick figure and cartoon characters with speech bubbles (Monk & Howard, 1998). The RP will be discussed in detail in section 2.5.

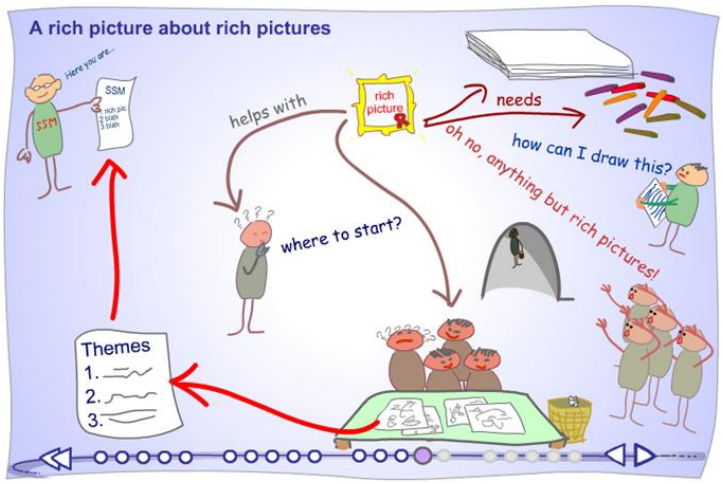

Figure 2-1 Example RP (Monk & Howard, 1998)

Evaluation and reflection are key issues in SSM to maintain quality and learn from mistakes (Boud, 1985). SSM is all about updating people as well as systems. It is accepted and encouraged that viewpoints will change as individuals travel through a learning process. The SSM approach is looking for a consensus of opinion through social learning. People will

learn in the context of their world view and there is no expectation for everyone to be an expert on all other fields. An individual's world view is formed and shaped by experience and the story of their life shapes their desire to learn. Differences in background will be inevitable, i.e. culture, class, politics and education. SSM endeavours to break down any barriers to enable a true organisational picture to be presented. Social learning is a collective learning process where individuals learn from one another. An effective system is a dynamic relevant system where outcomes and goals are superseded by processes.

So to surmise, SSM is methodology, not a method or technique. Hence, it is a flexible set of principles for problem solving, rather than a set of sequential steps. It is generalist rather than specialist as one can use it to address any kind of situation. The key principle is to start holistically, interpret the situation in an inter-subjective way allowing participation to lead to successful implementation. The RP is the SSM tool used for pre-analysis of a systemic mess or complex situation.

The following section looks at the discipline of knowledge management and how soft tacit and hard explicit knowledge are equal in value to a system investigator. I suggest that knowledge management is a subject area that is linked to my research because the discipline offers a variety of tools for knowledge elicitation. Section 2.4 looks at differing forms of knowledge elicitation tools. I offer a comprehensive compare and contrast table of different methods, approaches and tools looking at how the RP differs and compares with such approaches.

2.4 Knowledge Management

The RP gathers information in a unique diagrammatic way but it is not the only way to gather knowledge, depending upon situation, there are, of course, other elicitation methods and techniques that are both useful and reliable and well established in literature. Before discussing the RP it is necessary to discuss different types in information in terms of the knowledge they offer as well as styles and techniques of gathering information. Thus, the discipline of Knowledge Management and its understanding of types of organisational knowledge is an area which is, pertinent to the RP.

Knowledge Management (KM) (Nonika, 1991) is not all about technology and nor is it an Information Management System. KM, although many have tried, cannot be wrapped up in a software package. KM is about acknowledging that people are the knowledge bank of the

wisdom and information within an organisation (Ibid). Both Ruggles (1998) and Fahey & Prusk (1998) agree that human interaction is of considerable importance within the field of KM. It has been shown that, through good communication and interaction with staff, people will start divulging more about their work (Hildreth & Kimble, 2002). Workers need to be able to trust their organisation before they are willing to disclose their experience and knowledge (Ibid).

Hildreth & Kimble (2002) produced "The Duality of Knowledge" looking into the concept of hard and soft knowledge, focussing on the point that soft knowledge is what people know instinctively and inherently but is not often represented or spoken. KM is more than Information Resource Management as it must focus on the people within an organisation. Conklin discussed knowledge as being either informal or formal (Conklin, 1996). Formal knowledge consists of books, documents, emails, manuscripts, etc., and informal knowledge consists of the process that is undertaken to create this formal knowledge. Seely, Brown, & Duguid, (1998) discuss the distinction between tacit and explicit knowledge. Explicit knowledge focuses on the knowledge that can be captured, stored and documented, as opposed to tacit knowledge that is often unspoken and undervalued. Wenger suggests participation and reification are inseparable to the understanding of knowledge (Wenger, 1998). Participation is having experiences, interacting and communicating, with reification being the actual documents, forms, emails or books, etc., produced. Wenger further explains that the balance of knowledge types must be integrated, and that "*participation is indeterminate without reification*" and vice versa (Hildreth & Kimble, 2002).

The RP has the ability to show explicit knowledge and also, in some circumstances, tacit knowledge is portrayed in a picture. Bell and Morse are seen to acknowledge this concept, *"A theme arising from the very nature of the RP is the surfacing and exploratory element. RPs would appear to be a means to almost 'trick' individual or group into an examination of the cryptic (hidden meaning) arcane (pertaining to the inward or mystical) or occult (hidden secret) aspects of the individual or group."* (Bell & Morse, 2012a, p. 53)

Nonaka (1991) states that explicit knowledge is data that can be easily captured and externalised whilst tacit knowledge is "*highly personal and hard to formalise*". He is quoted as saying that tacit knowledge is "*Rooted in action, consisting in part of technical skills and also partly of mental modes, beliefs and perspectives*" (Hildreth & Kimble, 2002). There have been many papers and books written on the subject of KM and, in my opinion, they are all

stating a similar position. That is, KM is all about finding a way to make soft, informal and tacit knowledge hard, formal' and explicit, thereby providing a way of capturing and storing all elements of organisational knowledge. Hidreth and Kimble maintain that not all knowledge can be captured and sometimes only a percentage of tacit can be made explicit. It is recognised that it is not always possible to measure and quantify emotions, assumptions, preconceived ideas, beliefs and perceptions.

When gathering the information that needs to be documented or formalised, there must be an established purpose for why the information is being collected and who will ultimately be using it. The jargon (information/semiformal) and terminology that is in place needs to be understood. Optimizing the requirements into the most succinct order and working with the organisational staff to produce a 'real' scenario is needed. The use of diagrams to explain and justify situations is suggested as being helpful. Often a good way to discover tacit knowledge is to allow problems to occur so that the information can be gathered about how they were eventually solved. It is the process that must somehow be documented, not the actual product.

In KM there are many different ways to gather, store and analyse knowledge. I suggest that the RP is one such elicitation tool that works very well as a way to explore both the tacit and explicit knowledge. There are however other tools, techniques and methods that have their own distinct advantages and disadvantages. The following section explores the most contemporary and prevalent of these and offers a table to compare and contrast the differences.

2.4.1 Elicitation Techniques

There are a number of techniques that can be used in the elicitation of knowledge and information. This thesis will be focussing on the RP but it is of interest to acknowledge other elicitation techniques. Protocol-generation and analysis techniques (Magee, 1987) gather information by the use of interviews, self reporting and observation of the individual. Diagram based techniques are also very useful for visual learners. These techniques map events in a visual way that allows one to see who played a role in what activity and what their actual involvement was. In the next sections I will highlight and discuss some of the most common techniques.

2.4.2 Interviewing

The main and most obvious way to gather information is to simply ask. Interviewing is a common way to elicit knowledge by system engineers. Though a useful and informative technique the interview is not without its problems. Diaper states, *"It is based on the assumption that the interviewee has access to the knowledge and can put that knowledge into words…much human knowledge is difficult, if not impossible to verbalise*" (Diaper, 1989). Interviewing needs skilled facilitators and willing interviewees who are happy to impart what they know about a situation. In reality this is not likely, as interviewing relies on asking the right questions and interviewees can be reluctant and unenthusiastic to supply information. New systems and/or changes to existing systems are often undesired by some knowledge workers as such disturbances can lead to re-learning, training and even automation resulting in job losses. Interviews (Patton, 1980) can be a useful way of eliciting tactic and explicit knowledge but they can often create problems within themselves as they can be too formal and rigid. Another problem with interviews as a knowledge elicitation technique is the difficulty in gaining the more tacit knowledge such as feelings, emotions, beliefs, perceptions and assumptions (Ibid).

2.4.3 Card Sorting

A technique known as card sorting (Nielsen, 1995) is used to understand how the users of a system link different concepts. The idea of this internal process is to arrange a small group of people to sort a series of labelled cards into groups that make sense to them and then to rearrange the cards and to put them into different groups. The results of this are documented and analysed. Card sorting is a cheap and an easily implemented way of finding out what people think and the understanding of difficult concepts and terminology. By grouping in different ways it becomes possible to define a structure that allows the individuals to easily find the information they require (Coxon, 1999).

2.4.4 Contextual Enquiry

Contextual Enquiry technique (Magee, 1987) is performed through observing users at work, producing questionnaires and even video/audio recordings. Videoing staff at work or whilst being interviewed, is often not particularly effective. People generally do not like being

recorded and do not act naturally when the camera or microphone is on them. Questionnaires as a knowledge gathering device can also have similar issues. A questionnaire can be difficult to construct and there can also be problems getting them to be actually replied to, let alone finding out if they have been filled in accurately.

2.4.5 Affinity Diagramming

Affinity diagramming or brown paper mapping (Figure 2.3) is a useful way of getting groups to work together to discuss processes and handle a large amount of information at one time (Hart A. , 1985). The workers would write on paper an issue that is important in the smooth running of the organisation. Each member would post on a board their paper, and other members would group these papers in an order that they see as correct. The idea is that new groupings will be determined showing a genuine path of processes that might not always emerge in other techniques.

Figure 2.1 Brown paper mapping technique

2.4.6 SODA

SODA (Strategic Options Development Analysis) is a popular problem structuring method used in soft operational research (Eden, Jones, & Sims, 1983). SODA looks to gather multiple stakeholders understanding towards a particular problem. SODA is used for designing problem solving interventions in a process of mapping stakeholder views

(Ackermann & Eden, 2010). This is done by stakeholder interviewing to capture ideas using cognitive maps (Westcombe, 2002). The method itself is about helping people to refine their thinking about a particular problem in order to achieve understanding and agreement between the stakeholders.

"SODA is about reaching consensus and commitment to action. It is not wholly about reaching the 'right answer', but to enable the client group to develop a mutual problem definition so that they can move to action." (Mullekom & Vennix, 2008)

2.4.7 Drama Theory

Another soft problem structuring OR method is Drama theory (Howard, 1993). Drama theory is a relatively new method used to dissolve conflict by stakeholders becoming actors with differing roles. Drama theory is a theory about how people handle interactions with others. The actors take on, and act out, real situations by interacting upon different points of view. A drama with episodes emerges through the process with each action influencing a new episode. Resolution to conflict occurs when actors have exhausted all possible viewpoints and opportunities (Rosenhead & Mingers, 2001). Drama theory has had a mixed response from the OR community. Whilst some see considerable benefits to the qualitative role playing approach (Mingers & Rosenhead, 2004) others see barriers to its deployment (Bryant & Chin, 2000).Most recently Bryant (Bryant, 2007) has attempted to dispel the myths around this controversial theory.

The following table (table 2.1) offers some more of the common elicitation methods highlighting differences, advantages and disadvantages of each technique.

2.5 Comparative Analysis of Knowledge Elicitation Techniques

A look at common methods and techniques other than the RP that generate debate, learning and understanding in order to comprehend and identify complex system problems.

Technique	KeyAuthor (s)	Description	Relevance to complex problems	Group or Individual	Advantages	Disadvantages
Interviewing	(Weiss, 1994) (Seidman, 1998)	Most widely used technique by system engineers. 3 types of interview methods; structured, semi-structured and unstructured.	Difficult to apply to a complex human activity system. Requires knowledge of the existing system to enable the right questions to be asked. To be effective the interview needs to be highly skilled.	Can be group or individual	Builds understanding of other viewpoints. Knowledge from individuals can be gained on skills and experience Conducted well it can offer good communication and problem identification.	Information from multiple sources, hard to analyze Difficult to be a skilled interviewer May intimidate the interviewee Reluctance to be interviewed
Focus groups	(Merton, Fiske, & Kendall, 1956)	Common technique for gathering information from groups. Involves a group of individuals selected and assembled by researchers to discuss and comment on a topic.	A widely used way of gathering lots of information in a fast and effective manner. Requires highly skilled facilitation.	group	Good for gaining insight into attitudes, feelings, beliefs, experiences and reactions from many individuals at a single time.	Focus groups are not natural but instead are organised events and therefore can often give a false/incorrect indication of problem situations. Group dynamics can also be hard to manage and control.
Hypergames Analysis	(Howard, 1993) (Bennett & Cropper, 1986)	Metagame or hypergame analysis is an interactive method of analysing cooperation and conflict among multiple actors	Hypergame analysis is an interactive approach which focuses on complex problems in conflict situations that are under the partial control of multiple actors (Bennett & Cropper, 1986). Primary use is in	Groups of players. Can be individuals or organisations	Hypergaming explores the pattern and nature of interactions between the actors and the affects of the differences in perception awareness. Looks for the best courses of action to take in conflict situation. As well as a game it is also a	Very focused on competitive systems. Used mainly in military systems for role playing in a conflict situation. Emphasis is made by exploring players ability to stabilise outcomes. A game is described as a competitive situation as

Technique	KeyAuthor (s)	Description	Relevance to complex problems	Group or Individual	Advantages	Disadvantages
			modelling Information Warfare and biological systems.		model of a complex situation.	opposed to a problematic situation.
Repertory Grid Technique	(Kelly, 1955)	Based on the theory of personal constructs(Kelly, 1955). Looking at different viewpoints and similarities within these. RGT consists of two main phases: a knowledge elicitation phase and a rating grid phase. Different views are rated over a range of elements on a 1-5 likert scale, where a .1. rating is assigned to the emergent pole, a .5. rating to the contrast pole and a .3. being applied to those elements that are characterised by neither pole. A grid of comparisons is then produced that includes scored ratings for each element against each construct	An interviewing technique which uses factor analysis to determine personality type.	Focused on ascertaining individual personality types within a group.	Extension to interviewing allowing for an in-depth cluster analysis of personality types. Useful to determine personality types and preferences to problem solving.	Looks only at user cognition. Rules for new users can be complicated to learn. Interviewing difficulties of compliance and truth telling emerge.
Cause and Effect Diagrams	(Ishikawa,1990) (Hutson, 1992)	Also known as fishbone and ishkawa diagrams. They provide a structured way of identifying possible causes of a problem. The modern CED tends to look more like a tree with branches and notes for more efficient and manageable data collection.	A type of brainstorming that produces a diagram of results. The CE Diagram will lead to greater understanding of the problem situation.	Group	Good for knowledge elicitation and problem identification within a complex environment. Can reveal key relationships among various variables and the possible causes provide additional insight into process behaviour.	Primarily a quality control method. It only produces a comprehensive list of possible causes. Can be difficult to draw if user has limited modeling experience
Affinity Diagrams	(Beyer & Holtzblatt.K, 1999)	Also known as Brown paper mapping, card sorting and the KJ method Used within management. Allows large numbers of ideas, stemming from brainstorming to be sorted into groups for review and analysis.	Good to find patterns within large amounts of data	Group	Good for large volumes of data. Encourages new patterns of thinking and natural relationships.	Only seeks to find groupings of large data samples. Dominant group members can own task. Difficult to get 'true' participation from certain personality types

Technique	KeyAuthor (s)	Description	Relevance to complex problems	Group or Individual	Advantages	Disadvantages
Contextual Design/ Storyboarding	(Beyer & Holtzblatt.K, 1999)	This is a form of ethnography using observation and interviews as the primary tools. The Contextual Design process consists of the following top-level steps: Contextual Inquiry, Interpretation, Data Consolidation, Visioning, Storyboarding, User Environment Design, and Prototyping.	Useful to observe workers doing their work but can be seen as intrusive, subjective and counterproductive. Used effectively it can offer valuable information at the prototype stage of design. This information can show early design flaws and problems.	Group and Individual	A tool rich technique that offers different ways to elicit knowledge. eg, interviews, observations, questionnaires and affinity diagrams.	Great care has to be taken to avoid making inaccurate assumptions about mitigating circumstances and causality. Workers generally do not like to be observed. They will often work according to the 'company rulebook' rather than showing their own adopted working practices.
Appreciative Inquiry	(Stowell & West 1991)	AI is a way of asking questions and envisioning a future that fosters positive relationships and builds on the basic goodness in a person, a situation, or an organization. In so doing, it enhances a system's capacity for collaboration and change. AI utilizes a 4 cycle process focusing on: 1. **DISCOVER:** The identification of organizational processes that work well. 2. **DREAM:** The envisioning of processes that would work well in the future. 3. **DESIGN:** Planning and prioritizing processes that would work well. 4. **DESTINY** (or **DELIVER**): implementation	Good for complex system as it copes with a large volume of data.	Large group interviews and the appreciative Enquiry summit.	AI builds around what works, rather than trying to fix what doesn't. It is the opposite of problem solving as it does not focus on the inadequacies but rather on how to create more exceptional performance. Good for energising a depressed organisation.	Can be time-consuming. Might not work if you need to involve all key stakeholders – the method itself doesn't pay much attention to who is involved Need a motivated core groups to involve lots of people. Sometimes work needs to be done to get people out of the SWOT (strengths weaknesses, opportunities threat) mindset.

Technique	KeyAuthor (s)	Description	Relevance to complex problems	Group or Individual	Advantages	Disadvantages
		(execution) of the proposed design.				
PEST	(JISC, 2012)	**PEST analysis** stands for "**P**olitical, **E**conomic, **S**ocial, and **T**echnological analysis" and describes a framework of environmental factors.	Complex systems need to consider all such components that affect the system. Limited in it's scope as a technique.	Can be group of individual	a useful strategic tool for understanding market growth or decline, business position, potential and direction for operations	Mainly used as a marketing tool.
SODA	(Eden, Jones, & Sims, 1983)	Developed in the late 80s and used to understand differing viewpoint. Uses an 8 phase framework including interviews and meetings and causal mapping.	SODA develops a negotiated, action orientated, understanding of a complex problem that is rich enough in detail to negate the need for further problem solving	Group	Soda can aid negotiation. Individuality and subjectivity. Although it can be a basis for problem definition and solution creativity it requires a level of skill from the facilitator.	Difficult to evaluate success
Questionnaires	(Patton, 1980)	Questionnaires are useful for gathering large amounts of data from a wide audience. Computing technology in the last 20 years has made the technique very popular.	Not useful for complex specific problems. Unlikely that enough detail and specific information will be given.	Can be group of individual	Cheap, easy. Large data samples. Simple to compile data.	Limited in scope.Open-ended questions can generate large amounts of data. Misinterpretation of the question. Often disliked and answered superficially.
The Six Thinking Hats	(DeBono, 1985)	The Six Thinking Hats tool asks participants to wear hats (sometimes metaphorical hats) – white, red, yellow, black, green, or blue – they all must think a certain way at the same time depending on the colour	The process develops and promotes creative thinking	Group and individual	particularly useful for evaluating innovative and provocative ideas. While most of our thinking is adversarial, the six thinking hats technique overcomes these difficulties by forcing everyone to think in parallel.	Little evidence to support the process. Much of the research has been theoretical.

Technique	KeyAuthor (s)	Description	Relevance to complex problems	Group or Individual	Advantages	Disadvantages
		.				
SWOT Analysis	(JISC, 2012)	Discussion and agreement on the strengths, weaknesses, opportunities and threats in n organisation.	Takes a multidisciplinary style that is in keeping with the thinking approach.	Preferably group but can be single user	1. Good for isolating positives and negative issues. 2. Looks at outside and inside the system environment. 3.Can be ranked by priority	1.Difficult to get group participation 2.Unwillingness to purport weaknesses
Drama Theory	(Rosenhead & Mingers, 2001)	DT adapts the use of games to complex organisational situations, accounting for emotional responses that can provoke irrational reactions and lead the players to re-define the game.	Developed in the 90s and well adopted in fields such as defense, political, health, industrial relations and commercial applications	group	Good for resolving conflict in a fun and interactive way	Not respected by the game theory community as effective or robust enough.

Table 2.1 Investigation into relevant Techniques used in Problem Solving

2.5.1 Techniques used in problem solving compared with RPs

Table 2.1 highlights some of the main techniques used in 21 century problem identification. The RP has similarities with some of these techniques in terms of trying to gauge feelings within a whole situation as opposed to identifying specific areas of concern. For example drama theory, affinity diagramming and focus groups gather information by looking at the wider problem situation domain. Interviewing and ethnography can be an intrusive way to gather information and are often not well received by people whereas the RP is almost understated in comparison and does not seem, in my opinion, to provoke or irritate in quite the same way. I do highlight in Chapter 1 a problem with autonomy for the RP which can also be an issue with interviewing and focus groups whilst can be overcome in a questionnaire. The RP is a simple exercise to undertake that has few rules to remember whereas techniques such as AI, Contextual Design, SODA and Six Hats have considerable structures and procedures to learn. Questionnaires are notably effective in terms of time, effort required and analysis speed but response rates can be varied and quality of results is often disputed. RPs, compared with questionnaires, offer better quality, or more detail, of response but are difficult to analyse. The RP can be used by groups and individuals whilst other techniques are more specific in stakeholder participation. The RP draws attention to problematic concerns in a visual way which could be seen to be less conflictual than other techniques such as focus groups.

In summery to this section, I am not purporting that the RP is a better or more superior technique to the others I have discussed but rather, it is distinctive in its approach because of the use of drawing pictures. There are obvious advantages and disadvantages to using all of the techniques. The RP does have a unique visual approach therefore being different to other techniques as it offers stakeholders the opportunity to show not only structures and processes but also soft features of a situation such as thoughts, feelings and emotions.

The following section 2.6 looks at how signs, symbols and icons have been, and are still, a beneficial way to communicate. I discuss the history of symbols, signs and icons and to what extent the discipline of semiotics relates to the RP. As such, I include research topics that relate directly to the diagrammatic elements of the RP process such as ancient folklore images and illustration research.

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2.6 Symbols, Signs and Icons

Semiotics is the study of signs and symbols and how meaning is formed through cultural perspective and personal experience. There are two notable authors in this subject area; Saussure, Ferdinand de (1857-1931 and Peirce, Charles (1838-1914). Saussure's course on General Linguistics in 1916 (posthumous) is generally found to be the foundation of modern linguistics. Saussure developed a science of signs which we now call semiology. Peirce was an American philosopher known for his development of pragmatism and communication science. Peirce defines semiotics as the doctrine of signs (Peirce, 1958). Figure 2.4 is a pictorial representation of the philosophers who tend to lean towards the founding work of either Peirce or Saussure.

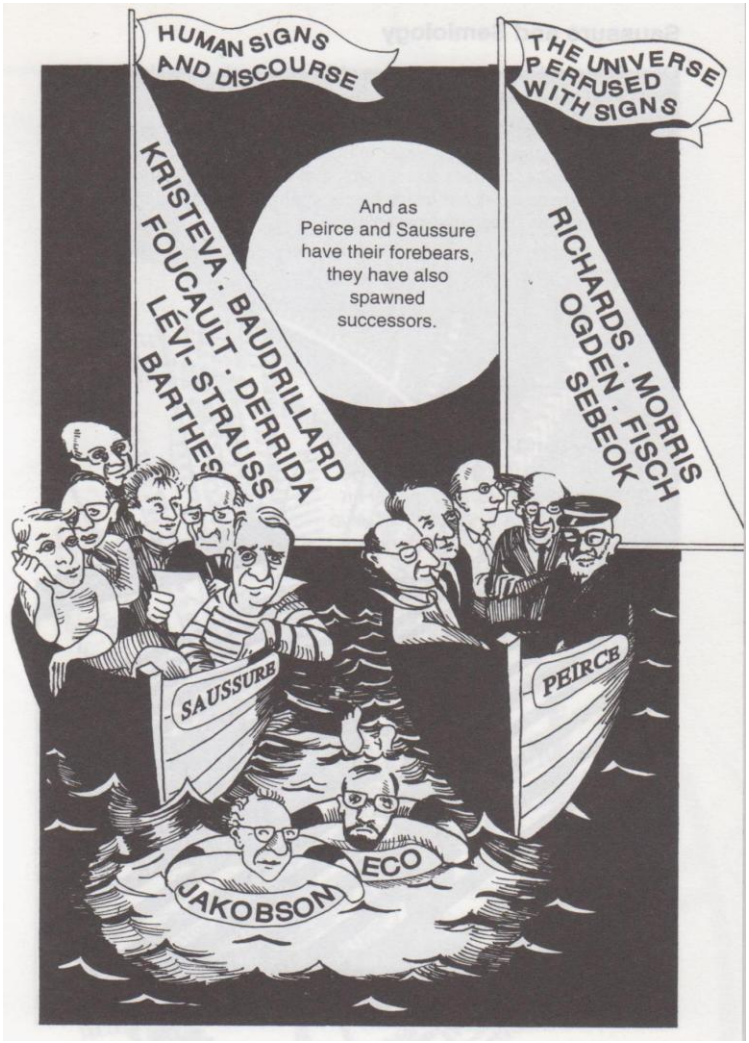


Figure 2.2 Semiotic boats (Cobley & Litza, 1997, p. 37)

Studying signs and icons is not a new concept; Aristotle (384 BC), Hippocrates (460 BC) and more recently Locke (1632-1704) and many others have queried how we communicate through at signs and signifiers. In semiotics signs are not just pictures but can also be words, body language and sounds. Eco, a leading author on semiotic signs, defines semiotics as, *"the discipline studying everything, which can be used in order to lie, semiotics is concerned with everything that can be taken as a sign. A sign is everything which can be taken as significantly substituting for something else."* (Eco, 1976). Barthes (1915-80) was also a recent influential author on semiotics, looking specifically at how popular culture, often in the field of advertising, displays connotations that are 'myths' (Barthes, Elements of Semiology, 1964). Barthes work, in the form of a collection of essays entitled 'Mythologies', was translated from French to English and is a popular study guide for those who study cultural and media studies (Barthes, 1957). Barthes takes the viewpoint that, "*semiology aims to take in any system of signs, whatever their substance and limits; images, gestures, musical sounds, objects, and the complex associations of all of these, which form the content of ritual, convention or public entertainment: these constitute, if not languages, at least systems of signification*" (Ibid). There can be many interpretations of what a single sign represents due to the way the reader reacts to the image.

"Human beings talk, write, blink, and wave codes of conduct. They put up signposts and erect barriers to communicate messages to other people. They produce and interpret signs. But even if no one intends to communicate anything, sign processes are taking place: A teacher interprets the symptoms of the poor achievement of the learner and a police triggers an alarm when he saw the thief. Then, what is not a sign? Almost every action, object, or image means something to someone somewhere or sometime. From our gestures to what colour dress we wear is a sign that has meaning beyond the object itself." (Uvaraj, Begum, & Gopi, 2011)

Within semiotics there seems to be many linguistic, lexicographer and semiotic constructions of the actual meaning of symbols and icons (Chandler, 2009). Most recognise that a sign indicates that there is something present in the environment whereas a symbol allows us to conceive an object even if it does not actually exist. Symbols are more than metaphors because they actually represent something rather than simply joining together unlinked things to represent conceptual meaning. The world is a system of signs wherein a sign is understood to be the relationship between a symbol and the meaning conveyed by the symbol. Within Semiotics, according to Peirce, there are three kinds of signs; icons, indexes and symbols. The icon sign resembles, or has some similarity, to its object. An index has connection to the

object but establishes meaning based upon some cause and effect relationship which makes the object conceptually present; the weathervane suggests certain meaning because of the wind. A symbol is a sign that stands for an object in the same arbitrary way that our natural language carries meaning. The symbol is collectively understood by a determinative relation of rule, law and convention or put simply it is just widely understood and used as the symbol. Within semiotics an important concept is that signs and their meanings are unlimited and constantly changing to reflect our modern world and interpretive understanding's. Although there seems much confusion and confliction amongst linguists and semioticans on absolute definitions, pictures, are generally separated into two categories; pictograms and ideograms (Cambridge-University-Press, 2010). Pictograms and ideograms do are language independent and therefore do not represent words or sounds.

Pictographs: These are pictures which resemble what they signify. In non literate cultures pictograms are still used as a medium for communication whereas in literate countries their simple graphical appeal is used for representing internationally recognisable instructions; airport signs, public toilets, road signs, laundry symbols, hazard signs. The International Standards Organisation in 2007 (ISO, 2007) set up a databank of international public information symbols; ISO7001.The ISO charge the general public for access to the databank. There is however free access to many of the ISO symbols. Dreyfuss (1972) produced a globally renowned source book of international signs and more recently there is an ongoing project by Xu Bing called a 'Book from the Ground Wiki' where the general public are being encouraged to add to the databank of pictograms (Frug, 2011).

Ideograms: These are usually symbols that represent ideas or concepts. A large number of pictographs eventually, over time and numerous simplifications, become abstract ideograms. For example the hieroglyphic house symbol  was derived from a floor plan and the Chinese river sign  was representative of a stream (Cambridge-University-Press, 2010). There is a distinguishable difference between the symbol and the thing that it represents so the ideogram is less evident as a picture and more abstract in conceptual form.

Semiotics looks at how we construct a visual language. Roland Barthews observed, through his work in cultural studies that,

"semiology aims to take in any system of signs, whatever their substance, limits; images, gestures, musical sounds, objects, and the complex associations of all of these, which form the content of ritual, convention or public entertainment: these constitute, if not languages, at least systems of signification" (Barthes, Elements of Semiology, 1964).

As previously suggested Pierce believed that signs can be divided into three categories.

1.  **Icon** – "*An Icon sign is a sign that resembles something, such as photographs of people. An icon can also be illustrative or diagrammatic, for example a 'no-smoking' sign*".

2.  **Index** – "*An Index is a sign where there is a direct link between the sign and the object. The majority of traffic signs are Index signs as they represent information which relates to a location*."

3.  **Symbols – "***A symbol has no logical meaning between it and the object. Unfortunately the web is littered with bad examples of this type of sign, but there are good ones - a homepage icon which is a house for example. Other off screen symbols which may help explain the difference are flags. Flags are symbols which represent countries or organisations*". (Boulton, 2005)

Peirce suggests that all individuals think initially in signs which then take form to produce words, pictures and objects. These signs have no real meaning until they have been assigned meaning through understanding, "*Nothing is a sign unless it is interpreted as a sign*" (Peirce, p. 172). Ferdinand de Saussure put forward a slightly different perspective than Peirce. Saussure proposed that a sign is a combination of the *signifier* or form the sign takes and the *signified* being the concept it will represent. The idea behind this theory is that to have a meaningful sign the signified and signifier have got to be joined together. For example,

1. The signifier could be the word ‘Model’
2. The signified could be the Data Flow Model of an IS system

Saussure suggests that the linguistic sign is the connection of a, “*concept and sound pattern*” (Saussure, 1916)[7] and not the link of the object and its associated name. A ‘sound pattern’ is not a physical noise but rather a ‘psychological impression’ of the sound (Chandler, 2009). This psychological impression is made up from our 5 senses. A contemporary approach to Saussure’s work suggests that the signifier is a physical or material image of the word as shown in Figure 2.5.

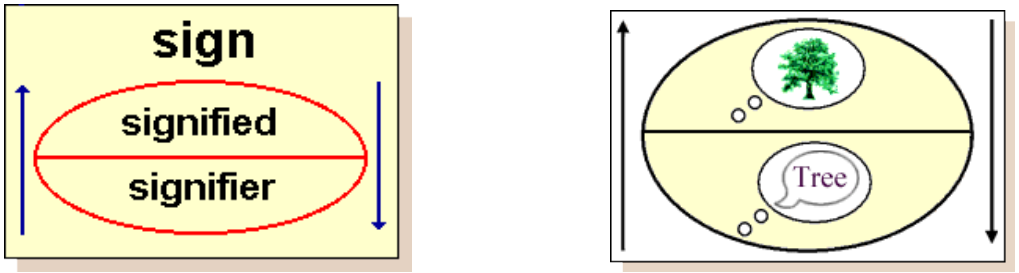


Figure 2.3 Saussure’s signifier/signified (Chandler, 2009)

Symbols and icons have been widely used to interpret social actions in anthropology, sociology and organisational theory. They have been used as visual symbols for computer systems (Horton, 1993) but rarely, with the exception of the RP and a limited selection of KM techniques, applied specifically to requirement gathering in system design. It could be argued that system modelling languages such as the Unified Modelling Language use visual representations to communicate understanding (Pooley & Stevens, 1998). I acknowledge the vast array of visual modelling for requirement and design purposes. It is my belief that the signs and symbols in system design techniques are minimal and limited, often boxes, arrows and words, and cannot be compared to the RP icon in terms of complex communication through art and metaphor.

2.6.1 Human Symbols and Icons

The RP is not by any means a new concept as images have been used for communication throughout most of history. Pictures and symbols have the unmistakable advantage over text

[7] Saussure's *Course in General Linguistics* was published posthumously in 1916 by former students Charles Bally and Albert Sechehaye.

of being language independent (Goldsmith, 1984). Before the printing press came into existence in 1440 artists were in demand by scholars (Hogben, 1959). Having visual, often colourful, treatises not only illuminated the written word but also gave disciplines such as medicine and botany a more critical attitude to what they were being told by scholars. Pictures of the human anatomy and of plant structures gave rise to dissection using illustration to show meaning (Ibid). In modern literature using diagrams to aid thinking is especially common in picturing techniques such as mind-maps, (Bulzan, 1992) icon modelling software such as MindGenius and Decision Explorer and several other diagramming forms (McCloud, 1993); (Gray, Brown, & Macanufo, 2010); (Pink, 2008); (Edwards B. , 2008). The earliest evidence of graphics used to record data can be dated around 38,000 BCE (Horn, 1998). Eighteen thousand years later we can date early cave paintings of man, animals and simple hunting tools whilst ten thousand years further on again we start to see the development of the written language. Around 3,200 BCE Sumerians had some 2,000 separate signs used as early graphic writing techniques and the Egyptian hieroglyphics, arguably, are also dated from around this period. The North Semitic Syrian alphabet, containing 22 letters, has been named as the earliest phonetic alphabet thus becoming the basis for Greek and subsequently all Western phonic written languages. The letters in these languages were all pictorial representations of objects. Highly disputed and open to expert scepticism it has been claimed that The Chauvet cave paintings of southern France are the oldest in the world. Evidence suggests that the images are as much as around 32,000 years old (Marshall, 2011). If found to be true then it adds to previous evidence suggesting that people living in Europe during the last ice age were perhaps more sophisticated than originally thought. Most recently there has been a discovery in Malaga in Spain of Neanderthal cave paintings dated to between 43,500 and 42,300 years old (MacErlean, 2012). Neanderthals were thought to have been incapable of creating artistic works so if the paint pigments are confirmed to be dated correctly in 2013/2014 it will be a significant discovery.

Language creation for literature and social experiments is fairly common; JRR Tolkien's languages of middle earth (Tolkien, 1954), Austin Wrights Islandian language (Wright, 1942) and even the more recent star trek language Klingon (Shoulson, 2012). A less common trend is the creation of artificial languages that allows communication across different linguistic backgrounds. Creations of such can be seen in the, Latin induced, twelfth century *Lingua Ignota by Hildegard of Bingen* (Higley, 2007) and more recently Frank Herbert's famous

fictional Dune novels (Herbert, 1965). There have been some earnest attempts however to produce genuine international auxiliary languages allowing humans from different nations to share a common second language. Ido, Esperanto and Volapuk are examples of auxiliary languages which are a combination of different known languages whereas Suma and Ro are artificially created languages (Cambridge-University-Press, 2010). Most recently, we have new languages such as Modern Indio European (2006), Sambahsa-Mundialect (2007) and Glisa Paiget (2010). No single auxiliary language has been adopted as the sole international language because, primarily, there is widespread disagreement on which language is best. The West tries to assert their dominance but many of their auxiliary languages rely on the Roman alphabet which is in a minority across most nations. Some criticise the motivation of an international language with worries of homogenisation and the loss of certain minority languages. There have been numerous proposals for using pictorial representations for international communication. Examples range from Bliss's Semantography, Alexander's Pattern Language, Neurath's ISOTYPE and PICTO by Jansen (Horton, 1991, p. 28). Success of such communication can be seen in areas such as music, mathematics, and certain branches of science.

Using art as a form of providing metaphor or showing organisational activity is also not a new concept. Back in 1938 Barnard, known for his work on organisational theory states, "*management is a form of art rather than science*" (Barnard, 1938, p. 325). Some regard this form of art to be performance (organisational) art (Goffman, 1959); (Mangham & Overington, 1987) ; (Vail, 1989), or more currently organisational story telling (Boje, 1991) ; (Forster, et al., 1999); (Denning, 2011). Hirschheim et al state, "*there is no set of universally accepted categories of symbols in organisations*" and further attempts to classify their understanding of symbols into 3 types; myths, metaphors and magic (Hirschheim & Newman, 1991, p. 33). Horton explores universal graphics as symbols and claims, "*graphics cannot replace words, however with careful design they can bridge barriers of language and culture*" (Horton, 1993). Goldsmith offers considerable contributions to the primary concepts of visual communication and although her work centres mainly on visuals in education, there are excellent observations that are relevant to many domains. In her book 'Research into Illustration' she presents an analytical model providing a solution to evaluating the comprehensibility or communication value of pictures stating,

"*there has been no widely accepted language in which to describe the elements of a picture which relate to its comprehensibility*" (Goldsmith, 1984, p. 6).

Dreyfuss produced a sourcebook wherein he proposed over 20,000 symbols that "*should be in the world of standardized, universally understandable graphic symbols*" (Dreyfuss, 1972). The sourcebook is not a dictionary as it is accepted that it is incomplete and in need of constant updating. Haramundanis (1996) argues that there are no icons that can be expected to stand alone without descriptive text to support them. Her interest in icons stems from her work in computer graphics and the icons used for onscreen applications.

The following section looks at the tarot card and its classification structure. The tarot is relevant to the RP as it is an example of an earlier form of visual sense capturing using both metaphor and image.

2.6.2 Ancient folklore images

Although arguably not considered a serious academic discipline it would be erroneous to not discuss the tarot card (Figure 2.6) when writing anything on early form of graphics used for communication. The tarot has an ancient symbol classification structure dating back many hundreds of years. The tarot is an example of visual iconic thinking with interpretation of collages made from cards often being mysterious and problematic. To overcome these issues the tarot uses an iconic key which is very similar to the one I am suggesting in my framework in Chapter 6.

Figure 2.4 Example of Tarot cards

The RP uses images to explore ideas and arrive at, either a negotiated or a singular, understanding of the perceived reality. The RP seeks to take a holistic approach to knowledge understanding offering a pictorial way of showing the important element of human issues.

Both the tarot and the RP use images to convey meaning and sessions are conducted in both groups and individually. Thus, although the tarot and the RP have much in common there is a clear difference in the way they are delivered; the tarot is structured in its imagery and the RP is not. A tarot querent is given different images and pictures to consider whereas the RP is unstructured and the querent is asked to construct the images to make up the picture. The tarot is ordinarily used as an independent tool for singular use whereas the RP is predominantly used in a group participatory way. What is however, remarkably similar when comparing the two is that both the tarot and the RP use images and symbols to provoke memory, encourage discussion, enhance perception and question reality. Giles speaking of the tarot states, "*it is a set of seventy-eight images which, taken together, depict all the forces that effect human life, along with all the characters, events emotions and ideas that provide the material of which human life is composed*" (Giles, 1992).

The tarot, to some, might be seen as a counselling tool upon which is shrouded in questionable psychic mystery but what cannot be denied is the incredible illustrated imagery held within the 78 cards and the diversity of cross cultural contemporary tarot decks that have continued popularity. The tarot card can be dated back to the 1350's when it almost certainly preceded playing cards designed for entertainment. Tarot cards are said, by some, to be coded symbols drawn from Albigensian books of learning whilst others suggest the mnemonic system originates from Greece. There is much speculation on whether the tarot comes from ancient Egypt or whether it has origins in India and China whilst some suggest the Greek mystery religions such as Gnosticism, Neoplatonism, Catharism and even the Jewish cabala have been detected in the cards symbols (McCormack.K, 1998). Alternatively, the association of the tarot with the Gypsy communities is well documented. The tarot cards have always managed to survive extinction despite deep-seated religious opposition throughout history pertaining to the precognitive use of the cards. The tarot has served scholars and seers for centuries and there is, even, now an incredible diversity of tarot decks available to purchase. Interpretation of the symbolism in the cards has long been associated with psychic abilities which, although fascinating, is not an area that will be explored further in this thesis. What is recognised though is the symbols in the tarot are a form of divination which can allow some people to gain a better insight into theirs and others lives and areas of concern. The tarot is highly structured and has a very specific taxonomy of symbols and meanings which allows the cards to be marketed in many forms such as the Egyptian, Greek, Cosmos, Aquarian and Dragon decks. The most revered and informative book which is attributed the art of tarot reading is 'The Tarot of Bohemians' (Encausse, 1896). Encausse,

more commonly known as Papus, states that the tarot represents a symbol, number and an idea (Ibid, p76).The tarot symbols have, throughout history and across countries, been passed through many stages of modification but still to this day stay true to form to the major and minor arcana. The most revered amongst all tarots are the Marseilles and Wirth decks (Ibid, p76). The tarot has a long history of classification of symbol meaning and offers a very clear platform of structure regardless of the differing domain of the cards. As with all interpretation of imagery the tarot reading is open to perception of meaning by both the reader and querent. All modern tarots have 78 cards with 22 major arcana and 56 minor arcana. The major arcana, meaning 'greater secrets' (Giles, 1992), are made up of common individual archetypal units as seen in art, mythology and literature. Each card or image is heavy in symbolism and, like many RPs, resonates a richness of meaning and a vivid portrayal of importance. The minor arcana or 'lesser secrets' (Ibid) has four substructures and are generally not considered to be as powerful as the major arcana. They often represent day to day events and concerns. Figure 2.7 describes the tarot symbol classification.

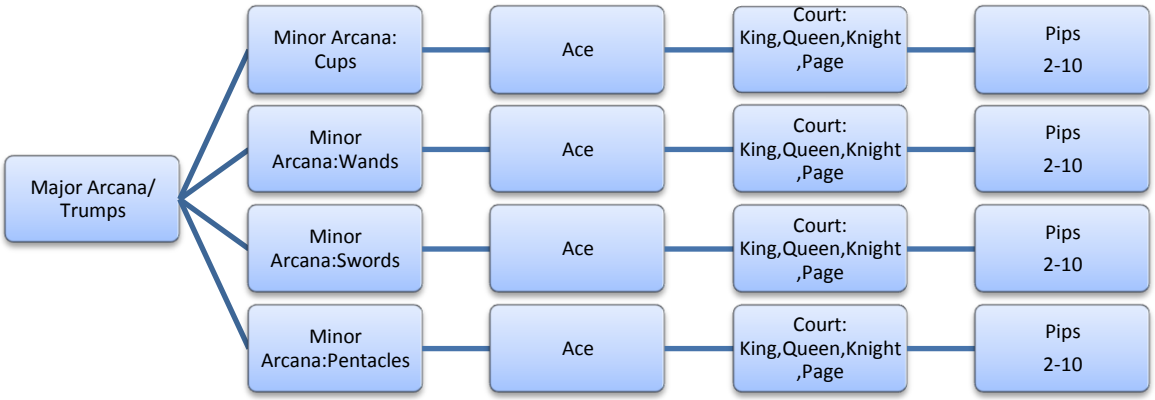


Figure 2.5 Tarot classification

The minor arcana are divided into 4 categories. Each category has 3 parts; aces, courts and pips. The pips are the number cards. The major arcana provide the strength to the reading whilst the minor arcana cards offer better clarification. Some of the most well known major arcana cards are the fool, death, the hierophant, the Emperor, the hanged man and the tower. There are several methods of how to lay the cards out ranging from a simple 3 card spread to a complex 42 card spread. The most effective and widely used spreads are the circular, pyramid, hexagram and Celtic cross (Giles, 1992).

So, it can be seen that the tarot is highly structured and classified in order to aid interpretation and meaning. This is in direct contrast to the RP which is rule-less and unstructured. It could therefore be assumed that there is little point to compare such dissimilar expressions but I would argue differently. As previously stated in the introduction the tarot card symbols, both in major and minor arcana, have several similarities with the RP icons. The RP is a single picture that holds within it many icon symbols that convey messages. These symbols, on the outset, represent people or objects and their relationships with other people and objects. However the symbols also resonate emotion and express feelings in a way that is special with images. Therefore the RP, as with the tarot card, is a type of narrative telling a story. Both the tarot and RP pictures have within them a language which is incredibly subjective in form. Such similarity is shown in the way the tarot and RP is read. There is no one starting place to begin and no definite direction. They are read in their whole allowing the readers eyes and brain to decide how they should be understood. Thus, the interpretation will always be different depending on the reader's comprehension. The language of communicating symbols, using images to convey meaning, is universally understood but does have limitations when taking cultural distinctions into account.

It could be argued that there is little in common with the tarot and the RP as the tarot has fixed images and the RP requires participants to draw the images. I would argue, however, that there is much similarity in the images and as such an investigation into RP iconography looking at the possibility of offering pre-drawn icons would benefit from the inherent structure offered by the tarot. The tarot has a visual key to aid understanding. I am suggesting that a similar key might be of use to RP understanding. The RP does seem to emulate the tarot in terms of the inter-relationships between major and minor arcana. Many of the major arcana characters can be clearly seen in many RPs; The Magician, The High Priestess, The Empress, The Emperor, The Hierophant, The Lovers, The Chariot, Strength, The Hermit, Wheel of Fortune, Justice, The Hanged Man, Death, Temperance, The Devil, The Tower, The Star, The Moon, The Sun, Judgment, The World and The Fool. Examples of these will be discussed further in Chapter 6.

The minor arcana are also clearly depicted in the RP. There are 4 suits to the minor arcana that represent 4 elements:

1. Wands symbolise fire, life, growth and work
2. Cups denote water, emotions, love, pleasure, subconscious, fertility and beauty
3. Pentacles represent the earth, the five senses, money , magic and trade

4. Swords stand for the element air representing spiritual struggle, physical conflict and courage

The tarot is essentially a counselling tool using pre-drawn images on cards to symbolically represent an aspect of life. The tarot is an example of visual iconic thinking with interpretation of collages made from cards often being mysterious and problematic. To overcome these issues the tarot uses an iconic key which is very similar to the one I am suggesting in my framework. The tarot and the RP have, on the outset, little in common. The icons in the RP are hand drawn, spontaneous and usually crude in aesthetics whereas the icons of the tarot are over 600 years old and carefully created to portray and evoke feeling. The 78 cards of the tarot are very highly structured with a hierarchy of symbolic representations that, when put together, represent all aspects of human life. The RP has little or no structure and the pictures represent complex or problematic situations as seen from a particular viewpoint. The tarot cards have been purposely constructed and created with intent by skilled artists whereas the RP has been created quickly, often as a collaborative exercise, utilising no rules or structure and there is little skill expectation. The tarot and the RP are juxtaposed, one requires looking at pre-drawn pictures and the other involves the drawing of pictures.

There are however, similarities between the RP and the tarot. Both seek to communicate meaning, evoke reaction and necessitate interpretation. Both are a tool of enquiry and use symbols for communication. Note, I am interested in structure and the hierarchy of icons or card types in the tarot and not the mystical, spiritualistic or even divinatory elements. The tarot icons have been around since the 13 century, they have been modified over that time depending on deck style but essentially have been consistent in structure; i.e. major arcana, minor arcana and trumps. What is remarkable is that the tarot has survived throughout history and has remained popular as a counselling tool. In essence it has not withered away nor has it remained frozen in time. Thus, the icons that depict "*almost all human drama*" (Giles, 1992, p. xiii) remain the same and are still relevant to people in the 21century. Surely, there is something to learn from these icons in relation to the icons being drawn in a RP. Both the tarot and the RP are pictures of things, people, events, ideas and emotions. The tarot has an iconic key to aid interpretation and it is this interpretative key that I am interested in researching. I have stated in the literature review that there are tacit esoteric associations to the symbolic representations of the RP or as others would describe as being cryptic, arcane or occult (Bell & Morse, 2012a, p. 53). The way the tarot is used as a deck of cards could also

be seen as similar to the RP. There is a haphazard laying of cards in patterns which is then interpreted to tell a story by use of colour, association and through a combination of elements. Thus, like the RP there is a non-literal story of meaning being sought and told.

I suggest the arcana structure of the tarot is one way to address the hidden or secret meaning aspects that might be within a RP. The major arcana are common individual archetypes that are replicated in RP drawings. RP icons are perhaps not represented with quite the same symbolic exactness or even the same icon representation but they do often resonate similar emotions or message. Examples of the major arcana and their potential meanings are:

1. Magician: not to hold back, to tap into one's full potential, the intoxication of power, both good and bad
2. The High Priestess: associated with secrets and mystery. Represents powerful feminine influences
3. The Empress: The Empress is mother, a creator and nurturer
4. The Emperor represents power and apparent stability. Often thought of as something to overcome
5. The Hierophant: stands for religion and orthodox theology. Can suggest to seek guidance or find/ keep faith,
6. The Lovers : represent relationships and sexuality and choices
7. The Chariot: A complex card to define a union of opposites. the chariot seeks victory but the route to such victory may be either motivational through loyalty and faith or ruthless with a desire to win.
8. Strength : represents discipline and control
9. The Hermit: isolation, solitude, reflection, retreat
10. Wheel of Fortune: opportunities, possibilities, movement , fate, destiny
11. Justice|: Impartiality and responsibility and decision making
12. The Hanged Man, sacrifice, letting go, acceptance
13. Death: ending, change, loss, conclusion
14. Temperance: harmony balance unification
15. The Devil: temptation, hedonism, anger, materialism
16. The Tower; sudden change, chaos, ruin, catastrophe
17. The Star: peace hope serenity, calmness and optimism
18. The Moon: doubt, anxiety, confusion, fantasy, deception
19. The Sun: positive outlook, optimism, assurance happiness
20. Judgment: decision, restart, renewal, new beginning
21. The World: fulfilment, accomplishment, satisfaction.

(Giles, 1992)

The minor arcana highlight the more practical aspects of life and can refer to current issues that have a secondary or related influence. This too can be seen in the RP by the linking aspects of major arcana with supporting elements such as finance, power and emotional feeling.

Table 2.2 Minor Arcana

Suit	Element	Keywords
Suit of Cups	Water	Emotions, feelings, creativity
Suit of Pentacles	Earth	Finance, material possessions, career
Suit of Swords	Air	Power, intellect, thoughts
Suit of Wands	Fire	Inspiration, spirituality, idea

The 'fool', often associated with the major arcana, is an interesting and controversial card within the tarot and I would argue that it too is related to RP understanding. The fool is the ever-present element of the tarot and suggests possibilities of things to come, wastage of time, knowledge of commitments and the constraints and free will for the future. The fool could be seen in a RP to be the overarching mood, zeitgeist or outlook as shown by the RP creators at time of drawing. The fools can be depicted in a RP as the creator(s) themselves showing their belief of their own potential, the possibility of new beginnings and their innocence in trying to convey a message. The fool, especially in a group RP situation, can be likened to a nagging voice in our head. On one hand there is the thought to not get involved because we might be conceived as foolish and the other position is to be brave and introduce ideas that could be contentious or ridiculed. Within tarot, without acknowledging the fool we learn nothing i.e. bravery and foolishness are intertwined. I would suggest the fool can be the interpreter and/or the creator (s) of the RP. The fool is needed for both the drawing of a RP and understanding of a RP. Being irrational, groundless, probing and possibly even ridiculous or infantile is exactly what the RP requires to be successful as a tool for gathering knowledge. The RP, although not having the tight structure of the tarot, does contain many elements of the tarot symbol configuration. Thus, in Chapter 6 the tarot construction and its organisation is considered relevant when creating a framework for RP interpretation.

So, to summarise upon this section, it can be seen that symbols, pictures and icons have deep and strong roots in history for recording, communicating and even predicting. Drawings can attract, reflect, disgust, please, reveal, imitate and quantify but are always going to be subjective in interpretation and open to perception of meaning. Thus, the RP is not ever really a new phenomena, it has actually been around since the beginnings of communicating

man in one form or another. The following section 2.7 is a literature review on the RP tool which is the specialism of this entire thesis.

2.7 The Rich Picture

As human beings we are able to communicate using pictures and symbols far more easily than words, enabling us to break down barriers of language, education and culture (Goldsmith, 1984). Drawings can both induce and record insight into a situation (Horan, 2002). Using art as a form of communication has, of course, been around for thousands of years; as previously stated perhaps as far back as the Neanderthals if recent cave painting discoveries are proved to be correct (Alok, 2012). The RP is an unstructured way of capturing information flows, communication and, in essence, human activity. Words can be powerful and open to abuse and misunderstanding whereas a picture can encapsulate meanings, associations and non-verbal communication such as emotions and feelings. Figure 2.8 is an example of a RP. Jargon and terminology are often associated with-in different enterprises and specialist groups. If a computer scientist was asked to draw a 'Model' then the chances are they would sketch out a sense making diagram such as the Unified Modelling Language, Entity Relationship or even a Data Flow Diagram. A child asked the same question might draw their favourite Lego model, a teenage girl might depict the latest catwalk star and an architect would probably represent a model of a building. In essence, words are far too restrictive and uncertain in their exact meaning. Societal norms of religion, politics and culture can be portrayed through a model that is not rigid and formalised.

Avison and Fitzgerald state "*The act of drawing a rich picture is useful in itself because:*

1. *Lack of space on the paper forces decisions on what is really important*
2. *It helps people to visualize and discuss their own role in the organization*
3. *It can be used to define the aspects of the organization which are intended to be covered by the information system*
4. *It can be used to show up the worries of individuals, potential conflicts, and political issues*" (Avison & Fitzgerald, 2003).

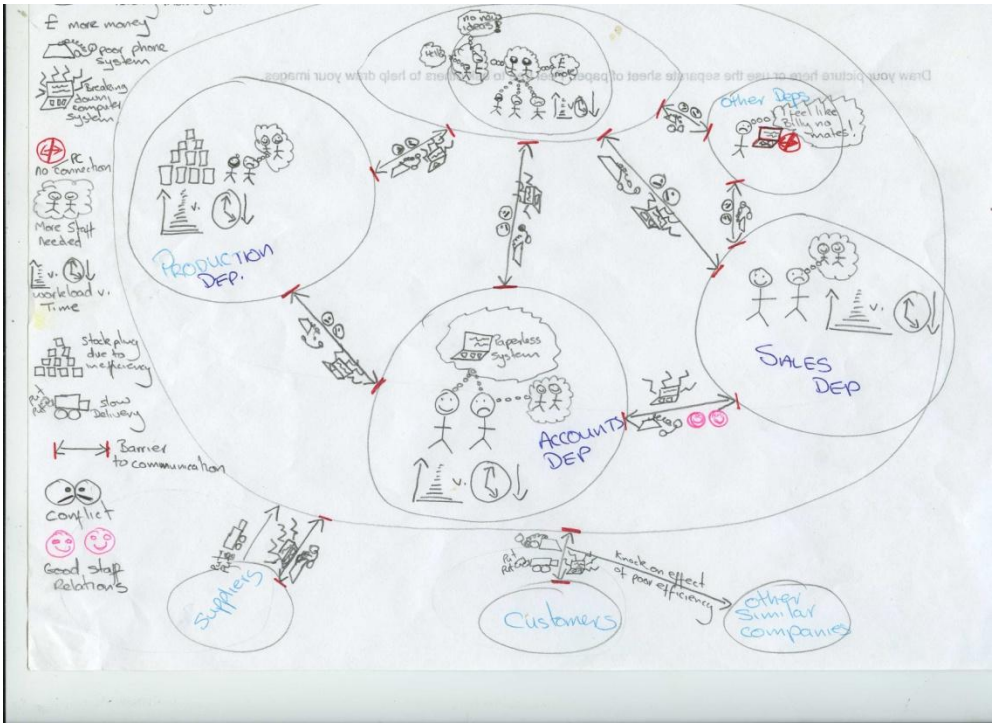


Figure 2.6 Example RP (Berg & Pooley, 2012a)

Checkland encourages the metaphoric colouring of the picture through diagrams that have no formal notation. Darzentas suggests that incorrect terminology and problem avoidance can be corrected through the use of the RP (Darzentas & Spyrou, 1994). The RP lies at the heart of Checkland's 'human activity system' showing how people are involved in the system and to some extent their emotions, such as fear and worry, whilst engaging in or observing a particular event. Unlike other models the RP can show environmental factors and their impact on the system. These environmental factors can be the human activities with their processes and boundaries. SSM attempts to capture the culture and climate of the organisation with the RP as well as finding out if the current system and practises are actually working. Metcalfe studied diagramming techniques and critical thinking. He suggests that when a person is asked to draw a picture from what was originally a particular word, the word will then be taken from the part of the brain that deals with 'language' and put to the part that deals with 'images'. He further proposes that the dissonance that this causes seeks for more understanding and therefore critical thinking is applied (Metcalf, 2006). Some state that the actual size of the images or icons in the picture suggests their importance relative to the overall problem situation (Wood-Harper, Anthill, & Avison, 1985).

RPs are usually hand drawn and do not require artistic talent or they can be drawn with clip-art and other cartoons using simple software. Woof-Harper et al advocate that a computer

generated diagramming tool could be useful to aid the range of viewpoints (Bronte-Stewart, 1999). In 1991 Parker produced a toolkit called 'Get Rich Quick' wherein a toolset of icons and symbols where offered to participants for the construction of a RP. Although over 20 years later this work might be deemed as archaic there are a few interesting features worth noting.

5. Drag and drop
6. Speech/thought bubbles
7. Good selection of shapes, arrows and lines
8. Ability to export text, pictures and images
9. Zooming in facility on the stakeholders offering a drop down menu of names within an organisation
10. Colour and shading
11. Merging facility to allow for one RP to be produced from many different views

(Parker, 1991)

Another SSM computerised support called 'Softcase' contains most of the features of 'Get Rich Quick' but offers other capabilities such as a root definition builder (Zhang, Smith, & Watson, 1997). Zhang et al produced a paper asking whether it is actually feasible and desirable to provide computer support for the RP. They surmised that perhaps 'neat' RPs make the problem situation seem less 'messy' than originally thought.

Bronte-Stewart (1999) abandoned the restrictions that Checkland and his team in Lancaster proposed and started to look into RPs as a standalone tool used by system practitioners. He suggested that all stakeholders can have a common perspective of a situation. Previous studies suggest that the RP is a mental construction of the situation and that there could be problems with misconstrued assumptions. Lewis warns of the dangers of misinterpretation without a source key, "*this has certain dangers, for the use of symbolism and pictorial metaphor may lead to ambiguity, particularly if no key is provided for the diagram*" (Lewis, 1992).

Some believe that the process of the RPs is more relevant to the system than the actual picture. Ragsdell observes, "*Much of the contribution of RPs to organisational change management arose out of the recognition that the process of rich picturing is more important than the actual RP that is produced*" (Ragsdell, 2000). She advises that the final result of the picture is of less importance than the RP process. Darzentas states that the RP could give a

clear understanding to a third party (Darzentas & Spyrou, 1994). Bell and Wood-Harper propose the need for a key of common illustrations, "*it is of value to use a set of symbols that have a clearly defined meaning, in short, to make our final drawings more understandable it is useful to adopt some sort of a grammar of symbols*" (Bell & Wood-Harper, 1992). They are not inferring that it is acceptable to homogenise the process as there is to be no suggestion of lessening the flexibility.

Others in the late 90's state, "*Pictorial representations have been widely considered as lacking in Universal Standards*" (Coyle & Alexander, 1997); (Monk & Howard, 1998). Bronte-Stewart concluded that, "*there does seem to be a need for techniques that assist the analyst during the early stages of an investigation to make sense of the problem situation and in fact decide what the situation is, before moving on to decide what 'the problem' is*" (Bronte-Stewart, 1999).

It is worth noting that the RP can be, and often is, created by a single person. RP's drawn by individuals representing the same problem can be successfully merged but this negates collaborative appreciation which, for some, is the purpose of creating the RP. The recent publication by Rose Armson promotes the use of the RP for understanding personal situations using individual RPs (Armson, 2011). The RP is a representational and creative tool used to see the big picture by zooming away from the immediate problem situation. Looking outwardly at a problem or adopting synthesis allows for more creative human activity problem solving.

The RP tool is primarily used to gain interpretation from multiple perspectives, revealing different perceptions of a problem situation. The RP is an established graphical tool that produces cartoon like representations of problem situations within organisations. Knowledge is gained from multiple stakeholders and differing viewpoints. In complex organisations the RP can reveal both tacit and explicit knowledge whilst offering a rare opportunity to see the whole picture from a system thinking perspective. Barry, discussing 'art as a form of enquiry', notes, "*participants end up conveying their world in ways they may have purposely avoided.....it provides a way of expressing their emotions, of highlighting truths that are more felt than thought*." (Barry, 1996).

The most recent research that has been undertaken using and analysing the RP tool is with Bell and Morse. Their 2012 book 'Resilient Participation' (2012a) looks specifically at group dynamics and how groups can be studied and aided to work efficiently. In their book they make extensive use of RPs in a participatory process under an approach they name as 'Triple

Task' (TT). TT is a process for understanding group dynamics which has three-way tasks for groups to work under. It is suggested that the triangulation of the tasks allows for better group understanding. In task one of TT the RP, under a previously explored 'Imagine' process (Bell & Coudert, 2005), is used to combine different experience of an issue which is under exploration. In TT Bell and Morse introduce the SAGA (Subjective Assessment of Group Analysis) framework to access quality of RPs (Figure 2.9). SAGA consists of 4 indicators that look to access the quality of the RP; use of colour, kinetic elements such as arrows and lines, mood and expression and evidence of focus on the issue being explored. Bell and Morse acknowledge the highly subjective nature of the indicators but argue that they could provide the basis for an analytical framework to "*help guide what to look for in an appreciation or participatory rich pictures*" (Bell & Morse, 2010). They are seen to use the framework to measure outputs or rank picture quality in a substantial body of research spanning 5 participatory workshops, in Malta, Slovakia, Finland, Denmark and the UK during 2009/10.They surmise that, "it *is possible to see that Rich Pictures have a wide and potentially un-explored potential in allowing groups to arrive at a communal mind-set on occluded and difficult issues" (Ibid).*

SAGA indicator	Levels			
	Incoherent rich picture	Semi-incoherent rich picture	Semi coherent rich picture	Coherent rich picture
(1) Colour relevance	*Hardly any or no colour. Not used for any discernable reason*	*Little colour, rarely used to emphasise meaning*	*Colours in some places, sometimes used to emphasise meaning*	*Vibrant colours, attention to additional colouring for meaning*
(2) Kinetic	*Hardly any or no variation in line width and no use of symbol – drawing limited to lines – wide use of words and acronyms*	*Little variation of line width, small use of symbol – substantial use of words or acronyms*	*Some variation of line width and shape, a limited use of symbol – some use of words*	*Vibrant line width and shape, much agitated use of symbol – little or no use of words*
(3)Mood expression	*No evidence of a story, fracture and /or isolated elements.*	*Little evidence of a narrative theme*	*Some evidence of a narrative positive or negative*	*Evidence of a strong 'story' and narrative direction (positive or negative)*
(4) Evidence for information / indicator use incidence	*No explicit reference to indicators in terms of reception, internal use, external use or decision support*	*Little reference to indicators in terms of reception, internal use, probably not external use or decision support*	*Occasional reference to indicators in terms of reception, internal use, maybe external use, probably not decision support*	*Frequent reference to indicators in terms of reception, internal use, external use and decision support*

Figure 2.7 SAGA indicator

The following section looks at issues affecting the use of the RP tool and how multiple perspectives on how the tool is perceived impacts upon its effectiveness and value.

2.7.1 Problems with the Rich Picture Tool

The RP attempts to identify abstract elements such as activities and processes, physical structures such as buildings and locations, organisational culture and finally problems and concerns. It can be difficult to motivate and encourage stakeholders to discuss their personal opinions and beliefs especially if it puts the organisation they work for in a negative light. Checkland (1981) states," *a graphical representation tool creates an uncharacteristic domain that can free up new possibilities of expression thus creating a different relation between graphical modelling and thought with is usually expressed in speech*". Avison and Fitzgerald (2003) propose there is an unwillingness to engage in the rather lengthy requirement gathering process of the RP's and further suggest that management want to avoid political issues that could arise. In certain hierarchal organisations it is suggested that the RP does not appear "*business like*" and there is a lack of credibility with the approach (Daellenbach, 1994). Ragsdell counteracts this by saying that it is exactly the point of the RP to, "*dissipate the hierarchical nature of the organisation during a group session*" (Ragsdell, 2000). She does admit however, there is a general feeling of 'unwillingness' to perform in such a 'mundane' task for the professional worker. Bell agrees with this issue and further suggests the unwillingness of some to be critical of their organisation. Bell et al discuss the need for autonomy when creating the picture to enable the stakeholders to be honest in their thoughts. They believe that in using the RP the '*tricky issues'* can be opened up providing a deeper understanding than a '*face to face'* meeting would have given (Bell & Morse, 1996). Sidhu et al indicate the need for a legend;

"the analyst has no standardized symbols to work with he/she is forced to use any symbols that he/she thinks are appropriate.....in other techniques each symbol has a specified meaning and use." (Sidhu, Jani, & Ramesh, 2001)

However, they further state the advantages of the RP come from the freedom of tools and techniques and the unlimited range of symbols. They claim that the disadvantages of the unstructured RP are:

1. Difficulty in remembering meaning of the symbols.
2. Difficulty in 3rd party understanding.

3. Readers might mistake and misconstrue meaning.

4. Difficulty to produce computerised drawing because non standard symbols are difficult to draw using graphics software.

(Ibid,p140)

Personal discussions with practitioners, via group conversations on a social network forum, who use RPs in common practice, tend to suggest they are not directly opposed to pre-described icons. It was recognised by some of these practitioners that prescribed RP icons are being taught at universities. There was, however, a feeling that instructions can be a barrier, i.e. something to learn which might do more harm than good. Other expert opinions point out the value in offering a more rigorous process and an appreciation for being offered a suitable direction. All of the practitioners that were conversed with during the 3 years of this project concurred that they apply RPs using an ad hoc approach drawing upon their own experience of project facilitation. Many described the RP as one of the tools they use as part of their management/systems toolkit for gaining understanding.

Many academics believe that the RP should not be structured or used as system model (Bronte-Stewart, 1999). Checkland notes this in his 30 year retrospective paper, "*users need to develop skills in making RP's in ways they are comfortable with*" (Checkland, 2000). Alan Waring was acknowledged by Checkland in this paper (Ibid) for his attempt to structure the RP. Waring gives comprehensive instructions (Figure 2.10) on how to draw a RP in his 'practical guide to system methods' (Waring, 1989, pp. 77-81) He offers a selection of visual symbols as a legend as seen in Figure 2.10 stating, "*you can use whatever symbols you find convenient…the table lists some of those that are often used*" (Ibid). Daellenbach (1994, p. 52) is also seen to give a 3 step instruction as a guideline on how to draw a RP. These guidelines suggest there are three major components of the situation represented in a RP; elements of structure, process and the relationship between them.

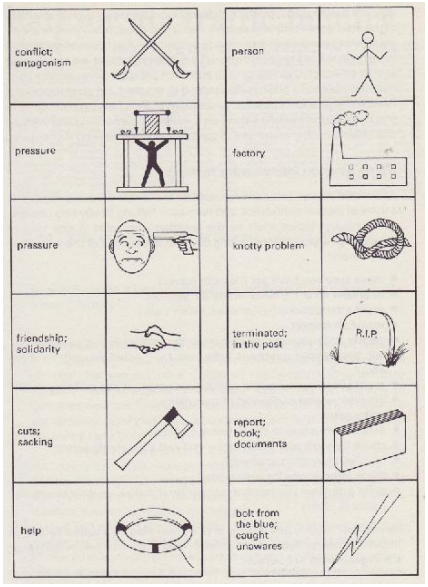


Figure 2.8 (Waring, 1989)

The RP technique gives the lowliest a voice equal to high level professionals and offers a potentially controversial and 'shocking' change to system design and analysis. Hicks agrees with the confidentiality issues surrounding RP's and further suggests the practitioner can change viewpoints to fit into the wider view (Hicks, 2004, p. 266). He, in essence, maintains there could be issues of prejudice and subjectivity on the part of the problem solver. Monk and Howard (1998) and Coyle and Alexander (1997) point out the lack of universal standards used in rich picturing .The RP offers a holistic and macro view of a problem situation but it is universally seen as difficult to create (Bronte-Stewart, 1999). Checkland, although adamantly against prescribed icons, has more recently suggested picturing it is a skill worth cultivating (Checkland, 2000). He states that, "*formalization through the use of readymade fragments is not a good idea*" however, he does concede a little by suggesting that it could be useful as a "*way of making a start*" (Ibid).

The RP as a requirement gathering and problem investigation tool is popular amongst many analysts but has been increasingly criticised over the years for its lack of syntax, structure and rules (Bell & Morse, 1996); (Bronte-Stewart, 1999); (Sidhu, Jani, & Ramesh, 2001); (Wood-Harper, Anthill, & Avison, 1985). The RP, as with many art based methods, tends to be, "*intrusive, time consuming, resistance prone, confusing, frustrating and dependant on the clinical skills of the researcher*" (Barry, 1996, p. 413).

There is, however, a myriad of practitioners who retain such pictures within their own portfolios. Personal conversations with system practitioners, during my research, frequently

resulted in offers of copies from their own collection of RPs. Interestingly, there were some practitioners who acknowledged that they had kept their RPs but did not want to include them in my research. There seemed, for some, to be a reluctance to share their RP personal copies. Often people would say that they would send me copies but never do so. Others said they were either too busy to dig them out whilst some refused, saying, there was nothing I could gain from them. I wonder however, if their pictures had no value then why are they keeping them?

When asked why the practitioners retained their RPs the following replies were received;

1. *"useful to remind and reflect upon a project"*
2. *"I keep the good ones to show others what is expected in a picture"*
3. *"I keep all documentation cause at some point it could become useful"*
4. *"we spent so much time and effort, laughter and arguments on this picture....I just couldn't bring myself to throw it away"*

(Quotes taken from discussion answers during a forum discussion of the SSM group in LinkedIn, September 2011)

It can be seen from these responses that the RP is often an emotional, time-consuming, valuable organisational artwork and not a by-product of a previous soft system phase. One such practitioner of over 25 years experience, in both teaching SSM and industry consulting using RPs, stated that he only used the RP as a conversation starter and the pictures, in themselves, are of no value or indeed cannot they be interpreted to provide any true meaning. He does however have photographic records of all his pictures but was unwilling to donate them to this research.

There has been dwindling research on RP's and their uses within and outwith the SSM field with the notable exceptions of (Bronte-Stewart, 1999); (Campbell Williams, 1998); Campbell Williams (1998); (Monk & Howard, 1998); (Sidhu, Jani, & Ramesh, 2001); (Bell & Morse, 2010) and most recently Bell and Morse (2012) (Bell & Morse, 2012a). Early work by Avison identified the two major risks that arise when trying to formalise the RP; the danger of being reductionist and the risk of over complexity which defies the purpose of the free-form diagramming technique (Avison, Golder, & Shah, 1992, p. 407).

Checkland suggests that SSM models are, "*not models of anything; they are models relevant to debates ….simply devices to stimulate, feed and structure that debate*" (Checkland, 2000). Checkland's insistence of the limitations of the pictures as anything other than a starting point for discussion has possibly been the primary driver to lack of research into the RP. Checkland stated, "*pictures can be taken as a whole and help to encourage holistic rather that reductionist thinking*" (Checkland & Scholes, 1999). The dichotomy of reductionist symbol keys enforcing a move away from the holistic requirement of the RP should be considered. A 2007 paper looking at how the RP can be used to investigate concepts of a construction project found it to be, "*important to standardise the symbols to a certain degree of consistency*" (Sutrisna & Barrett, 2007). They further used solid black lines with arrow heads to represent major flow and different sizing of person figures to represent roles, powers and influence of different stakeholders. Daellenbach (1994, p50) offers a thirty eight icon legend or, as he call it, 'sample symbols for rich pictures'. His sample symbols depict cartoon like representations such as a shark representing competition, skull and crossbones for danger and crossed swords for conflict. He further notes that, "*you will quickly discover that the talent needed is not a good ability to draw, but simply, a good imagination. In fact drawing rich pictures is fun*." (Daellenbach, 1994, p. 51) Avison and Fitzgerald can be seen to create a 'legend key' for the understanding of their RP (Figure 2.11) (Avison & Fitzgerald, 2003).

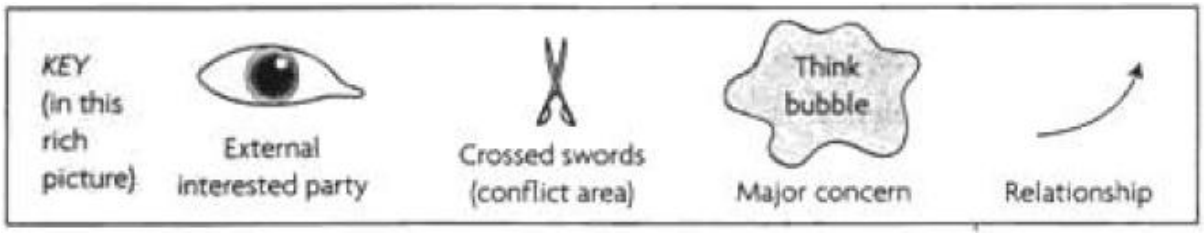


Figure 2.9 Avison and Fitzgerald Legend 2003

Sidhu et al conclude, "*The main factor that could lead to the failure of a RP is the types of symbols used.....if the analyst uses a set of clear familiar symbols to express the relationships this will inevitably assist the analyst." They further state "complicated, elaborate and badly defined symbols will only provide problems*" (Sidhu, Jani, & Ramesh, 2001, p. 141). Bronte-Stewart warns, *"Some propose that a common key of symbols is used in all rich picture diagrams but others regard this as overly prescriptive and are concerned that*

aspects of the situation may be ignored because one does not know a diagrammatic sign for them". (Bronte-Stewart, 1999)

Although the RP has seemingly become more commonly used in industry (Bell & Morse, 2013) there are still staunch advocates discrediting the diagramming technique and its use. Avison and Fitzgerald propose there is an unwillingness to engage in the rather lengthy requirement gathering process of the RPs, "*systems analysts are not prepared to spend enough time on analysis and rush to the design and development phases*" (Avison & Fitzgerald, 2003). They go on further to say that managers try to avoid the political issues that might arise through this process.

Accepting that not all RP's will be artistic or attractive, they are however being kept by many practitioners and not archived as meaningless or destroyed as irrelevant. Although many know why they retain such pictures there are some who keep quiet about such archives. There seems to be almost an embarrassment, by some practitioners, to retaining something that constantly reminds of issues, problems and even flaws. As previously stated the most recent academic studies into how RPs are used for system understanding are with Bell and Morse wherein they talk of the hidden meaning behind the process of picturing.

"*A theme arising from the nature of rich pictures is the 'surfacing' and 'exploratory' element. Rich pictures would appear to be a means to almost 'trick' the individual or the group into an examination of cryptic (hidden meaning), arcane (pertaining it the inward or mystical) or occult (hidden secret) aspects of the individual or the group. In total, the picture is an acroamatic device*." (Bell & Morse, 2012)

Based on an in-depth literature review and on personal communication with those who participate in and facilitate upon RP workshops, the main perceived problem areas with the RP tool are:

Problems associated with the Rich Picture	Authors who claim these Problems
Reluctance to participate	(Avison & Fitzgerald, 2003) (Barry, 1996) (Berg & Pooley, 2012a) (Bell & Morse, 2012a)
Uncertainty at the start	(Barry, 1996) (Bell & Morse, 2012a) (Berg & Pooley, 2012b)
Not Businesslike/unprofessional	(Avison & Fitzgerald, 2003) (Bronte-Stewart, 1999) (Daellenbach, 1994) (Horan, 2002)
Dominant individuals having ownership	(Berg & Pooley, 2012a) (Berg, Pooley, & Queenan, 2011)
Equal participation	(Bell & Morse, 2012a) (Ragsdell, 2000) (Berg, Pooley, & Queenan, 2011)
Unwillingness / perceived inability to draw	(Avison & Fitzgerald, 2003) (Berg & Pooley, 2012c) (Bronte-Stewart, 1999) (Sidhu, Jani, & Ramesh, 2001)
Stakeholder defending status quo	(Avison & Fitzgerald, 2003) (Sidhu, Jani, & Ramesh, 2001) (Bronte-Stewart, 1999) (Berg, Pooley, & Queenan, 2011)
Need for autonomy	(Bell & Morse, 1996) (Bell & Morse, 2012)(Horan, 2002) (Hicks, 2004) (Monk & Howard, 1998)
Interpretation	(Bell & Morse, 2012) (Horan, 2002) (Lewis, 1992) (Bronte-Stewart, 1999)
Time	(Avison & Woodharper, 1990) (Avison & Fitzgerald, 2003) (Barry, 1996) (Berg & Pooley, 2012c)

Table 2.3 Problems associated with the RP

Many of the problems shown in Table 2.3 are associated with confusion over the lack of rules of engagement for the RP process. Not only is there is a problem for facilitators to try to encourage people to begin to draw but also there are issues with group dynamics to consider. The following section looks at the complexity of group working and how a drive for consensus can have negative effects when decision making.

2.7.2 Group Work and the Rich Picture

As previously stated, the RP can be drawn by individuals but traditionally, the RP is drawn in a participative way in small groups. There has been limited research on RP group dynamics with the only notable exception of Bell and Morse (2010) (2012a) (2013). RP group sessions, whether under the remit of SSM or not, are conducted by practitioners who suggest their own individual rules of engagement to their groups. The commonality is that groups are instructed to represent the system they see using pictures. Bell and Morse note that they are only two

'basic rules'. Firstly, the paper has to be visible to all members of the group and secondly stating that text should be avoided (Ibid). It would seem that group dynamics are not governed in the RP process. For Bell and Morse the groups can do what they want in terms of decision making, discussion, leadership, consensus and methodology.

I suggest that the discussion and debate phase of group picturing can however, be problematic. Is the resultant group RP essentially be a compromise by some stakeholders to accept the decisions made by the majority? Checkland, looking at the entirety of the SSM process argues against this, "*it is wrong to see SSM simply as consensus seeking*" (Checkland & Scholes, 1991, p. 30). This accommodation theme was address by Patching wherein he suggests that there are more relevant viewpoints than others. He states, "*giving due consideration to what the client is most likely to accept; it could also affect the chances of the analyst surviving in the long term*" (Patching, 1990, p. 79). Interestingly, Patching suggests that facilitators must be mostly aware of the 'clients needs' and goes on to discuss how manual workers in an organisation could have viewpoints that would be in contrast and confliction with their senior management. It is widely accepted that a facilitator has to acknowledge their own Weltanschauungen and not let it prejudice other perceived views.

Checkland suggests that the more a practitioner applies SSM the better they get at it but he does not acknowledge the practitioner as a moral agent coping with wider moral reasoning's than just that of describing the problem situation. Ackoff states, "*to resolve a conflict is to accept the situation and find a distribution of gains and or losses among opponents for which they are willing to settle"* (Ackoff, 1978, p. 49). He furthers this participatory 'dissolving of conflict' belief by supporting negotiation. He notes, " *the environment may be changed to separate the opponents, eliminate their interaction, remove a scarcity that is the source of their conflict, or change the objective that are being imposed on them from above*"(Ibid). Jackson criticised subjectivist methodologies stating, "*the kind of open, participative debate which is essential for the success of the soft systems approach and is the justification for the results obtained, is impossible to obtain in problem situations where there is fundamental conflict between interest groups which have access to unequal power resources*" (Jackson, 1991).

The very core of system thinking accommodates a holistic and inclusive approach seeking understanding of an adaptive whole which has an ability to survive in a changing environment. Group analysis and decision making is essential to this approach in soft system design. Consensus decision making within organisations, that usually practice 'top down' decision making, can be difficult to achieve. Empowering group members and maximising

chances of accommodating the views of minority groups is complex when members are within a hierarchical structure. Problems surrounding the decision making can produce "action anxiety" and "negative fantasies" (Harvey, 1996). Procrastination and anxiety over proceeding with a certain action can lead to preservation of the status quo. Certain state of affairs can continue for years within an organisation even though the majority of members would prefer change. Harvey recommends a direct confrontational approach to limit 'action anxiety' requiring individuals to take risks in purporting their own viewpoints. The RP tool, using pictures as a narrative to convey meaning, could alleviate much of this anxiety and individual risk.

The popular phrase "tyranny of the majority" is used to emphasise the power of one faction repressing the minority faction. For Checkland, "accommodation" should involve collaboration rather than compromise. One of the major criticisms with SSM is that it offers no standards for human conduct thus having a relativistic stance on interpretation (Brown K. , 1992); (Mingers, 1992a). The research into 'procedural fairness' stems from Thibaut and Walker (1975) who maintain that even if an outcome was unfavourable people would evaluate the outcome more positively if they believed it was achieved with fairness. Although research into procedural fairness belongs mainly within the legal domain it is of interest to acknowledge that "*verbal input to the decision making process increases perceptual fairness*" (Schminke, Ambrose, & Noel, 1997).

The wisdom of crowds by James Surowiecki investigates a simple concept that has profound implications: the many is smarter than the few. He proposes that the very best decisions come from groups that are capable of maintaining their independency and individuality within a group. He furthers this argument stating that individual experts have only limited information at their disposal and it is foolish to rely on one of two expert opinions when altogether all of us know more than anyone of us (Surowiecki, 2004). Mackay, author of 'Extraordinary Popular Delusions and the Madness of Crowds' would disagree with Surowieki stating that crowds make foolish decisions unlike intelligent individual decision making. The discipline of social psychology has long been analysing group work and their interaction behaviour. A successful group is one that has commitment, shared boundaries and equality. It has been found that the harder it is to enter and become a member of a group the more likely the membership is valued (Fortune & Peters, 1995, p. 45).

Surowiecki (2004) suggests there are 4 main qualities that must exist in order for a group to be smart;

1. A diversity of people: gender, age, culture, religion

2. Decentralisation: a spread of power
3. A process of summarising opinions to a collective verdict
4. Independency: not to be worried to voice opinion

Group psychology can also have negative connotations that reduce effectiveness and potentially produce poor decision making. Consensus decision making is susceptible to the Albilene paradox (McAvoy & Butler, 2007). This paradox claims that, a group can agree on a course of action that no one individual member actually wants. "*Organizations frequently take actions in contradiction to what they really want to do and therefore defeat the very purposes they are trying to achieve"* (Harvey, 1996). What is being acknowledged here is that the ability to manage agreement is just as important as the ability to manage conflict.

Janis, renowned author of Groupthink suggests a small group phenomenon can often spell disaster as the drive for consensus, at any cost, can suppress appraisal of alternatives. He states, "*the more amiability and esprit de corps among the members, the greater is the danger that independent critical thinking will be replaced by groupthink, which is likely to result in irrational and de-humanising actions directed against out-groups*" (Janis, 1974, p. 13). Janis identifies the 'Groupthink' syndrome suggesting that in-group pressure can lead to 3 types of problems.

1. **Type 1 Overestimates of the group: its power and mortality**

   The group can have an illusion of invulnerability which creates excessive optimism encouraging extreme risk taking. The group believes in their inherent mortality making them discount the morality and ethical implications of their decisions.

2. **Type 2 Closed Mindedness**

   They start to discount certain information as unimportant to create stereotyped viewpoints to validate their decision making.

3. **Type 3 Pressure towards Uniformity**

   The creation of self censorship of deviation from apparent group consensus thereby minimising self doubt. They have a shared illusion of unanimity resulting in a false

assumption that silence means consent and there is pressure on members to comply with the majority rather than expressing new arguments. Janis suggests the emergence of 'mind-guards' who take it upon themselves to protect the group from adverse information.

The 3 problem types are more likely to occur in situations where

- Groups are highly cohesive.
- Isolation of the group from outside influences.
- Examining of only few alternatives.
- Not being critical of each other's ideas.
- Not examining early alternatives.
- Not seeking expert opinion.
- Being highly selective in gathering information.
- Acknowledging the pressures when decision making.

(Ibid)

Gaining full participant involvement and ensuring no passive spectators is a key role for a facilitator. This participation has to be fair and impartially initiated. In practice, decisions that are taken are rationalised by the facilitators, whose own personal beliefs and norms formulate their opinions. As Harvey (1996) states, "*the inability to manage agreement is a major source of organisation dysfunction*". The facilitators own interpretation of the problem situation provides answers to which aspects of the system are considered relevant and those that will be rejected. Human conduct is governed by societal rules alongside more individual morality norms. The RP process does not resolve problems for individuals but instead assembles stakeholders into groups such as managers, suppliers, customers, investors. Thus accepting that any viewpoint, no matter how detrimental to others, will be included as there are no standards or proposed rules that suggest certain viewpoints are undesirable.

Utilitarianism philosophy (Bentham, 1748-1832); (Mill 1806–1873) accepts that in every situation the choice between actions is always the one that creates the greatest utility. The utility represents the economic value of actions. In utilitarianism the greatest good for the greatest number of people theory results in the interests of the minority being overlooked. The same can often be said for the RP process as the resultant problem solution will undoubtedly incur casualties. Examples of this could be dissatisfaction with a new system or, in an extreme situation, physical job losses. As Checkland neatly stated, "*yesterdays solutions may now be seen as today's problems*" (Checkland & Scholes, 1991, p. 1) or as one of Senge's basic principles suggest, '*well intended actions can lead to unintended consequences*' (Senge P. , 1990). The contemporary philosopher, John Rawls (1921-2002) argues that using a utilitarianism approach to problem solving may result in individuals suffering greater disadvantages or gaining greater advantages thus resulting in an unjust outcome. Rawls Justice Theory, when applied to utilitarianism, would suggest that injustice, as fairness, can be sometimes seen as necessary to prevent an even greater injustice but equal rights must have priority over 'greatest happiness' (Crane & Matton, 2007).

There is no guidance on justice, fairness and human conduct when working in RP groups. It could be said, and is my opinion, that the RP, although an excellent modelling / showing device, is lacking in theoretical foundation, discipline and ethical consideration. Facilitators approach the process with only their own experience to guide them. Although no facilitator wants to create negativity around a discussion topic that he/she feels is off-topic or irrelevant it can also be time wasting and pointless to gild such erroneous world views.

It is undeniable that creating models that encapsulate differing viewpoints encourages self awareness, participation, knowledge sharing and opposing perception awareness. However, there will always be a power struggle for stakeholders to accept 'perceived realities' that might invalidate their own perceptions. Argyris and many others take an anti-positivist approach arguing, against Checkland's advice, that the facilitator must be an actor in this process rather than just an observer (Argyris & Schon, 1978). Whether observing or participating the facilitator has to accommodate the dominant and more confident communicators whilst still providing a platform for all viewpoints to be heard. Consensus seeking implies a pedagogic cycle of learning and a harmonic compromise through cooperation and participation. The development of user involvement and participation, therefore, must become a learning process that is just as important as the decision making process.

2.8 Synopsis of Literature Review

Table 2.6 isolates the main points that arise out of the background literature review showing the gaps that are evidenced whilst conducting this review.

Areas discussed in Literature review	Gaps that Emerge
System Thinking, Purposeful Systems.	ST in a new field of emerging socio-technical way of looking at human activity systems. RPs are one way to look at large systems holistically but there no studies that look at the properties of RPs in terms of what are being produced as RP icons and how they might be interpreted
Soft System Methodology (SSM)	SSM is a popular soft system approach to understanding complex systems with emphasis on human system engagement. The RP is a tool emerging from this methodology. There has been little research on the RP discussing facilitation practices, construction advice and interpreting the icons.
Knowledge Management (KM)	KM is a field of ST which looks at organizational knowledge. KM in organizations uses many styles and techniques to gather information. One such technique is the RP. There has, to date, been no in-depth research looking at the advantages and challenges of using RP visualization to portray human activity systems in organizations.
Symbols, Signs and Icons	Research has been undertaken this section into semiotics and the history of ancient images. Gaps in knowledge and understanding are shown in the interpretation of collaborative drawing especially considering cultural communication differences due to multiple perspective interpretation.
Rich Picture	The RP communicates human system knowledge using pictures and symbols. There has been no research on interpreting RP iconography or research on the ways in which RPs are delivered and constructed. There are questions that emerge from this review that are specific to the RP: Are facilitators conducting their RP sessions in similar ways? If so, what are these

	practices and what is being done in different ways? From this I question what the commonalities in group RP behavior are: is there possibly some 'unconscious rules' or 'self organisation' being applied within participative drawing? And if so, what are they? RPs are being kept by some and shared by others but rarely destroyed. Why is this? What constitutes a poor or rich RP? Are there common icons that represent universal understanding? What can we understand from studying the RP iconography in reference to other forms of art and will such research inform upon RP interpretation?

Table 2.4 Analysis Summery Table

These gaps in knowledge form the basis of my objectives in Chapter 1. RP icon interpretation has received very little research attention from academia mainly due to the sensitive and subjective ambiguity of deriving meaning from pictures. The following Chapter is a second literature review exploring the wide area of icon interpretation which can be directly applied to RP icon interpretation. Thus, the information and understandings learnt in the following Chapter 3 form the interpretative analysis discussions for the guidance framework I propose in Chapter 6. Much of this research has centred on a broad and extensive review of current literature regarding possible levels of RP interpretation from wide, and often, divergent areas of research. Thus the following Chapter will read, to some degree, as instructional as well and informing because the sections will be forming the basis of the framework delivered in Chapter 6.

Chapter 3 Literature Review: Interpreting Icons

It is perhaps useful, at this point, to remind ourselves what the hypothesis asserts;

For some individuals and in certain situations, the rich picture tool is enhanced by adding small elements of structure to both the facilitation and construction stage and a set of distinguishable enablers improves end user interpretation

As a background discussion in Appendix A, I have looked at differing facilitation styles and discussed the possibility of adding structure to the facilitation process. Chapter 5 investigates the iconography and looks at the possibility of using an icon legend in a picturing process. Chapter 5 also explores how different RPs can be rated in terms of richness, coherence and connectors. By cross comparing different variables it has been possible to answer a series of questions relating to RPs. Appendix A and Chapter 5 are enquiring about the benefits and risks of structuring the RP with the notable difference that the facilitation section looks at adding elements of structure to the process i.e. a lead in session. Appendix A seeks to find what structures are already inherent within the process of drawing a RP. Chapter 5, by cross comparing RPs, is essentially looking at whether there are natural elements of structure that occur in RP construction for example, common icons, age and gender distinctions on colour use. Chapter 6 will be enquiring if the answers to the questions in Chapter 5 have any practical or functional use for practitioners and educators who facilitate and interpret RPs. In order to gain a better understanding of the RP I will next be exploring icons looking at universal meanings, cultural distinctions, size, colour, boundaries, form and readability as well as investigating more abstract concepts such as aesthetics, orientation, humour, metaphor and attention. The possibility of a RP icon language is discussed introducing the notion of iconic scripting[8].

The RP is capable of having many layers of interpretation just as many forms of artwork. These interpretations may reveal aspects of its creators of which they themselves were unaware. So far however, there has been little discussion on whether the RP is a form of artwork and, if so, what type of art is it portraying. To this end I shall firstly be investigating

[8] An icon script is a system of writing constituted by iconic symbols (Berniker, 2003)

a series of measures for icon interpretation ranging from formal art interpretation, illustration research and language structure. This will explore areas such as comic book construction, colour theory, desirability studies, symmetry, spatial groupings and icon relationship associations. Using knowledge gained from the previous chapters and adopting, adapting and merging different art-based style approaches used for interpretation I suggest a method or guide showing the distinguishable enablers for RP appraisal. In Chapter 6 I present this guide, as a series of questions, for supporting the process of the RP from facilitation, construction and with emphasis on interpretation assistance. It is fully acknowledged that the framework guide will not be useful for every facilitator but instead it could be taken as a preliminary guide for non-expert facilitators and teachers. The framework guide is essentially an instrument to aid thinking about RPs with the potential advantage to the artists and interpreters being small areas of structure introduced throughout the picturing process.

3.1 Analysing RPs using Art Interpretation Methods.

In Chapter 5 I have ranked and scored RPs on a set of value criteria to look for commonalities. Further to this, I have also counted and categorised RP icons. In this Chapter I will use the information gathered from that empirical study and attempt to understand the RP as a whole picture. I see little value in ranking or scoring RPs on their output values if that is the only measure of appraisal. The RP is so much more than a series of process, structure and relationship outputs and therefore, to interpret both soft and hard facts, the appraisal methods need to be holistic as well as deconstructionist. By this I mean, it is only possible to understand certain formal information when taking the RP apart. Looking at the whole picture gives a more comprehensive view which can highlight the more subtle, soft or tacit messages or nuances. To this end I will explore the concept of the RP being recognised as art. By this I mean art in its complete and whole form such as a painting, tapestry or sculpture. A work of art is an expressive object made by a person or, as is often the case with the RP, a group of people. Unlike static objects such as a mountains or buildings a work of art is always about *something* (Danto, 1981) and thus requires interpretation. Interpretation is a tricky and contested area to consider. One could say why not just ask the artist what is/was intended or designed. This, of course, is not always realistic or achievable let alone artistic or suitable. Arguably, you could ask whether the artwork itself is changed by interpretation. Perhaps artwork is autonomous to interpretation or indeed does it exist independent to any form of interpretation. Thus, we start to enter the complicated world of philosophy. So, to

clarify my position and that of this whole Chapter, I will be taking the Barratt viewpoint that, '*to interpret art is to respond to it'* (Barratt T. , 2000). Such response can be conceptual in thoughts and feelings as well as being explicit by experiencing, communicating, writing and telling. So to interpret is simply to make sense of what you see, or to make what you experience meaningful, and, often but not always, to tell others your version of such understandings. Other people's responses can be confirming or contesting to one's own. Thus, sometimes, personal interpretation can be altered or skewed by contradictory opinion. Vidal concluded in his paper entitled 'The Art and Science of Problem Solving' with "*Everything can be approached scientifically and everything we do is art*" (Vidal, 2005). Vidal argues that the boundaries of art have experienced radical change over the last century and within this argument he includes a section discussing the RP and its uses.

If one could accept that the RP is a form of art then it is of interest to look at how different art interpretation frameworks could be adopted to understand the RP. I propose that the RP is indeed a form of art. The RP that is drawn by groups of people is a form of collaborative art but the RP can also fall into many other categories of art styles. The following (Table 3.1) demonstrates the vast array of art styles that are compatible with the RP. I offer this table as evidence to attest to my claim that the RP is a form of art.

Table 3.1 Art Interpretation methods (Vidal, 2005)

Art Style	**Description**	**Related to the RP**
Abstract Art	Involves drawing the essence of something rather than the detail. Often an expression of feelings	Much of the art in the RP is an expression of feeling as opposed to actual detail. It is often difficult to interpret a highly abstract RP.
Realism	Often regarded as 'real art'. What is being drawn is drawn as how it looks in real life.	Many who draw RPs attempt to represent subject matter truthfully avoiding other artistic emotional approaches.
Impressionism	A style of art that allows the artist to filter what they see. The artist allows natural light to emerge by understanding various colour techniques.	Often the RP is an impression of what is seen to be a problem. This can be captured in metaphor. The RP is a glimpse or visual impression from a particular viewpoint.

Expressionism	The use of colour and other techniques to show emotion and an illusion of reality. In contrast with Impressionism which captures a impression or theme. Expressionism does not attempt realism but rather an extreme way of distorted emotions.	The iconography in a RP is often an emotive display of an artist's interpretation on what they see. The icons can be distorted in size and appearance. Raw Emotion in the RP can be displayed by vibrant colour use and bold line distinction.
Figurative art	Represents people, objects and scenarios. Usually refers to art that has a person(s) or Animal (s) as a central theme seeking to portray any cultural values held at the time of drawing.	The RP is frequently drawn as having a person or a group of people as being central to the picture.
Satirical Art	The use of humour to criticise people or objects with the aim to entertain by making them appear foolish or ridiculous.	The RP commonly uses satire, as a form of humour to mock perceived social conventions. Intelligent use of satirical metaphor is familiar in the RP.
Freehand Art	Freehand art is a style of art that does not use tools to aid design.	Most RPs are freehand and drawn without the use of tools.
Comic art	Story telling through sequential juxtaposed panels which together make comic strip art. Also known as graphic novel art.	RPs are highly related to comic art through the use of graphic visuals that together can be read to tell a story. I will discuss this further in the section 6.4.4 on icon scripting.
Aesthetic Art	A branch of art philosophy that deal with beauty perception.	For a RP aesthetics is wrapped around the shape of the picture in terms of colour, narrative direction, pleasurable icons and good connection. Attractive RP's often contain simple / crude icons
Accessible Art	This style of art is easy to use and understand.	The RP is very accessible in terms of inclusive collaboration in group

		construction .The unstructured RP platform provides opportunity for those who do not consider themselves to be artistic to be included in problem structuring using visuals.
Avant Garde Art	Meaning art that is contemporary, modern and sometimes shocking in form. Often refers to new art-based techniques.	The RP offers a contemporary and modern approach to problem structuring using visuals to show concerns.

So the RP can fall into many categories of art (Table 3.1) but, for the RP that has been drawn by a group of people, it is first and foremost a form of collaborative art. Collaborative art has only recently become accepted, by the art world, as mainstream. The most noteworthy example of collaboration amongst artists being the Fluxus movement by George Maciunas. Previous to the 1960s, collaboration on canvas art was perceived as denying the expression of an individual and as such it was seen as wrong to celebrate unified ideas (Barratt D. , 1996). There are of course exceptions to this generalist viewpoint such as the 1924 Kukryniksy, Kryloy and Sokolov Soviet socialist paintings, the 1933 Black Mountain College for collaboration in art. If we delve back to the Renaissance we know artists worked together based on a hierarchical system of labour division (Ibid). The artist is traditionally seen as a solitary lonesome figure and while that image does seem to still persist the majority of artists do not see themselves in this light (Ibid). So it really has been only in the last 20 years or so that collaborative art practices have become mainstream with artists choosing to work together to produce unified cultural works. The RP is rather different than a standard form of artwork as it is created by participants in a problem structuring process rather than artists performing their skill.

So, in agreement with Vidal (2005), I argue that, although possibly a crude form, the RP is indeed a form of artwork. Therefore my research extended to a review of literature based around the disciplines of art theory, colour theory, art philosophy and graphical art. I sought to find how art is assessed and categorised and what, if any, of these structures of categorisation, might be applied to assess the RP as a form of artwork. It should be noted here that I am not trying to find a way of scoring RPs in terms of value but rather find a way of

making sure that as many as possible of the elements within a RP are being observed whether they be explicit or less noticeable to a casual observer. Thus, accepting there are many forms of art interpretation, I chose the following classifications (Table 3.2) because they are most relevant to RP interpretation but they do not necessarily all follow traditional or formal pragmatist art theory.

Table 3.2 Art Interpretation Forms

FORMS OF ART INTERPRETATION RELEVANT TO THE RP	DESCRIPTION
Goldsmiths 8 factors of syntactic emphasis.	Evelyn Goldsmith (Goldsmith, 1984, pp. 245-270) moves the pioneering work of Brant (Brant, 1945) on to a new level by identifying 8 factors which attract and/ or direct attention within illustrations. The factors are colour, position, size, isolation, complexity, tonal contrast, directionality and implied motion. She is primarily interested in the communication aspects of illustration analysis.
McCloud's Six Steps	McCloud, (McCloud, 1993)a renowned comic artist, identifies 6 categories to enable understanding of comic art. He states, "by using our translation scale as a tool we can begin to unravel some of the mysteries surrounding the invisible art of comic storytelling" (Ibid,p74). As well as his categories McCloud also offers a six part process of artistic creation; Idea or Purpose, Form, Idiom, Structure, Craft, Surface (Ibid,p182).
Thomas Munro and The Scientific Method in Aesthetics (1928)	Munro (1887-1974), a renowned art philosopher, suggested that all artworks come from a specific time and place reflecting values and culture of that time. He argues that the picture is not as important as what human response to the pictures is. He furthers this to suggest that this is why great or renowned works of art (he included literature and music in this too) are often only popular, or regarded as great, at a particular time and place but not as popular to later generations or other cultures. Munro believed that no two persons see the same thing but there are areas that can be agreed upon such as line length, line thickness, light and dark areas and colour presence.
Barrett's principles of interpretation	Barrett (1994) produced an eighteen point list of interpretation principles acknowledging the often differing viewpoints of the artist and the viewer. 1. Artworks have "aboutness" and demand interpretation. 2. Interpretations are persuasive arguments. 3. Some interpretations are better than others.

	4. Good interpretations of art tell more about the artwork than they tell about the critic. 5. Feelings are guides to interpretations. 6. There can be different, competing, and contradictory interpretations of the same artwork. 7. Interpretations are often based on a worldview. 8. Interpretations are not so much absolutely right, but more or less reasonable, convincing, enlightening, and informative. 9. Interpretations can be judged by coherence, correspondence, and inclusiveness. 10. An artwork is not necessarily about what the artist wanted it to be about. 11. A critic ought not to be the spokesperson for the artist. 12. Interpretations ought to present the work in its best rather than its weakest light. 13. The objects of interpretation are artworks, not artists. 14. All art is in part about the world in which it emerged. 15. All art is in part about other art. 16. No single interpretation is exhaustive of the meaning of an artwork. 17. The meanings of an artwork may be different from its significance to the viewer. Interpretation is ultimately a communal endeavour, and the community is ultimately self- corrective. 18. Good interpretations invite us to see for ourselves and to continue on our own.
Tarot classification structure (earliest date being 1392 (McCormack.K, 1998)**)**	The tarot symbol structure might be a surprising addition to this list because it is perhaps not seen as a form of interpretation. The tarot is structurally split into two groups; major and minor. All cards have unique meanings but also have common identity with other cards in their group. The tarot is a form of art that is all about response from interpretation. The tarot artist has purposefully added symbols and icons to each card to represent or signify a particular meaning. The meaning however is interpreted by tarot participants in a unique personal way as with all forms of artwork.

I have purposely picked juxtaposed and diverse forms of artwork interpretation for a deliberate contrasting effect of variance. I wanted to see, by merging various forms of appraisal and critique methods, whether there were any similar behaviours of structure appreciation. From studying these five, very different, ways of understanding forms of art

and symbol classification it became apparent that there were areas of consideration that were unanimously agreed upon to aid comprehension and understanding. Thus, with acknowledgement that there are many such other ways to classify, there are 4 interpretative criteria areas that I decided to investigate which are relevant to RP interpretation; context and artefacts, communication, emotion and colour. In the following sections I will discuss these criteria areas and demonstrate how they relate to RP interpretation. My discussion for this Chapter is primarily qualitative and oriented to explication. However much of the statistically proven data in Chapter 5 has played an important role in shaping my understanding and growing my knowledge. In Chapter 6 I offer, based on the analysis of this Chapter and taking into account Appendix A and results in Chapter 5, a visual guidance framework to give insight on interpreting the RP.

3.2 Context and Artefacts

3.2.1 Icons

Art as a form of graphical organisational enquiry is not unique to the RP. There are many other graphical tools that gather organisational information such as affinity diagrams, cause and effect diagrams and the Unified Modeling Language. For some the art therapy approach of symbolic constructivism using sculpture, pictures, paint and photographs gives a unique opportunity to gain insight into differing perspectives. Barry claims that using these types of art based methods as a form of investigation often leads to interesting results, "*participants end up conveying their world in ways they may have purposefully avoided or never thought to do*" (Barry, 1996). Williams furthers this by suggesting that certain symbols in symbo-constructive pictures are a, "*voice of the unconscious*" or *"shadow areas*" that resemble dream images. (Williams M. C., 1996). Langer is famously known for suggesting that tacit knowledge can be represented through artistic forms and that different ways of knowing require different forms of representation (Langer, 1942). Vision is our dominant sense as we can learn and recollect from a picture more easily than the written or spoken word. We learn on average 83% visually and only 11% audibly (Horton, 1991, p. 6). Flemming and Mills

(1992) offer the VARK questionnaire as a learning guide for students and teachers whilst others such as Kolb, Honey and Mumford and Bloom are renowned authors in this field offering learning models and taxonomies of learning styles.

Horton (1991) states, "*I treat graphics as a language*" whilst Haramundanus (1996) argues that graphics are too limiting and must be accompanied by text, stating, "*every language includes not only words but grammar*". Grammar provides the rules and syntax and order that govern a language. Gelb (1963) suggests that communication using visual objects leads to ambiguity and misunderstanding and is limited by geographical and cultural boundaries (Haramundanis, 1996). I suggest that the RP can provide enough context of domain and boundary to allow certain iconography to be understood with universal acceptance. Context will come from the adjacent icons, boundary and sub-boundaries and other supplementary stimuli such as colour, size, text and even facial expression and body language. Other RP interpretation enablers which are not directly associated with the icon can be background space, lines and arrows demarcating direction, consistent style and size of neighbouring icons. I discuss these areas further in the following sections.

Synecdoche is frequently seen within the RP. The synecdoche is a familiar sign to represent a whole object or a concept, for example knife and fork pictures for the food court or a musical note to represent sound. I found these examples of synecdoche in my data-set;

- Hats and/or Ties on stick figures to represent management
- Flags for countries
- Beds representing accommodation
- Shopping basket for retail outlets
- Mortar board/ gown for academia

Certain RP icon meanings can be difficult to depict and it can be easier to show a litotes which in simple terms is the negation of its opposite to portray meaning (Figure 3.1).

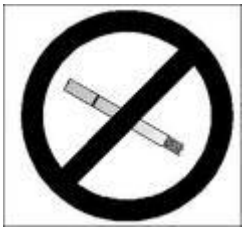


Figure 3.1 Litotes example icon

Figure 3.2 Stick figures

Stick figures (Figure 3.2) are a common icon in the RP. Simple adjustments to legs and arms can show movement and additions, such as pointing or holding objects, give additional information. One word explanation can give clarity of meaning and a sense of purpose to the figure (s).

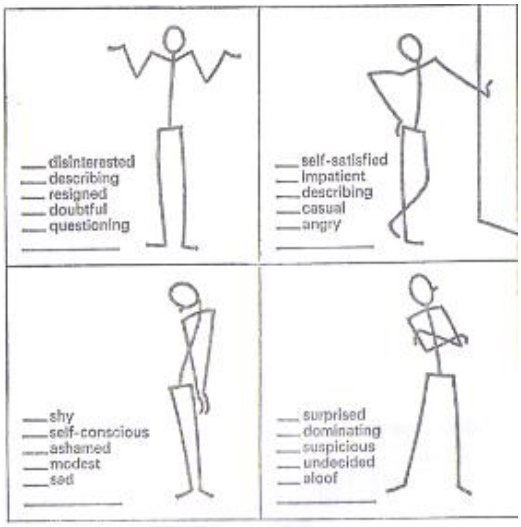


Figure 3.3 Argyle Figures

Figure 3.3 was taken from Argyle (1988) to show the simplicity of stick drawings and the variety of moods and expressions that can be implied. These examples have ambiguous meanings. For example, a disinterested person is not necessarily resigned and a shy person does not have to be sad. Further, a surprised person is not inevitably aloof and undecided. In essence, it can be difficult for the interpreter to ascertain the true meanings of the images and therefore taking note of other closely related icons can offer more clarity. Body language in a RP can however be very obvious and worth taking note of. Often icons showing clear body language are backed up by a speech bubble to clarify exact meaning. Stick figures are fine in a RP but I have found that the better the image the more the understanding and knowledge can be portrayed. For Example, Figure 3.4 shows fuller people images.

Figure 3.4 Full images

Facial expressions depicting emotions such as sadness, happiness and displeasure can give better understanding to an area of the RP. Eyebrows express emotion more clearly than even the eyes do. It is possible to convey anger, joy, and surprise with the position of the eyebrows. Examples of this have been taken from Argyle.

1. Fully raised : disbelief
2. Half raised : surprise
3. Half lowered : puzzled
4. Fully lowered : angry (Argyle, 1988)

The RP is usually used to help understand complex and problematic situations and thus icons can often be quite dark or even morbid. According to Hillman (1972) pathologising is one or the four imaginal activities carried out by the human psyche, the others being personifying, psychologising and de-humanising. Pathologising is the need by the human psyche to express itself through symbols of physical and mental disorder (Giles, 1992). The RP can contain pathologising icons which, being often very metaphorical and even satirical, represent, a situation or emotion as being disease-like or some foreboding of a thing that requires treatment. In the icon dataset I can identify many icons that could fall under the category of a pathological icon, for example, guns firing, sea monsters, the devil, drowning and burning. One example was at a workshop in 2012. I asked groups to draw RPs on ‘Teenagers and Technology’ and one group drew a large syringe to represent how they saw technology being like a drug to teenagers (Figure 3.5).

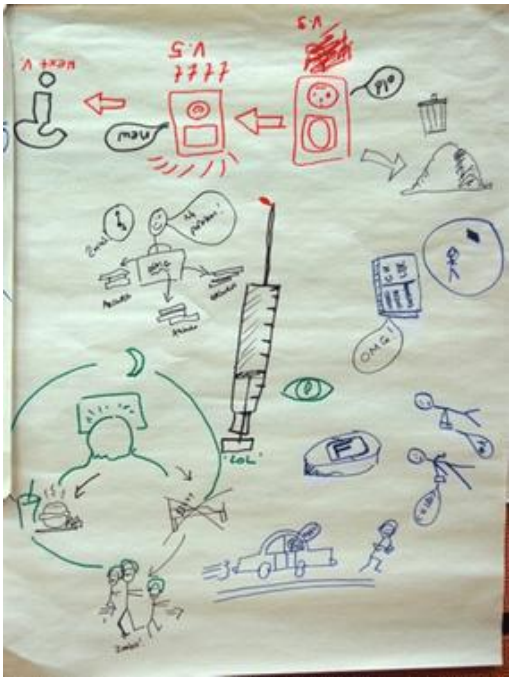


Figure 3.5 RP from (Berg & Pooley, 2012b)

There are many ways to classify the icons in the RP. Using the popular icons in my dataset I suggest one way would be Figures 3.6 to 3.10. The icons I have used in figures 3.6 to 3.10 lean more towards an office based domain and I suspect the essential elements, stakeholders and physical issues would change in icon depending on the context. This is discussed further in Chapter 6.

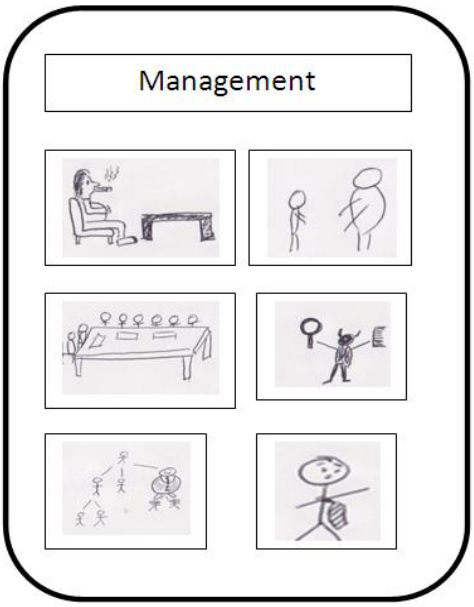


Figure 3.6 Management icons

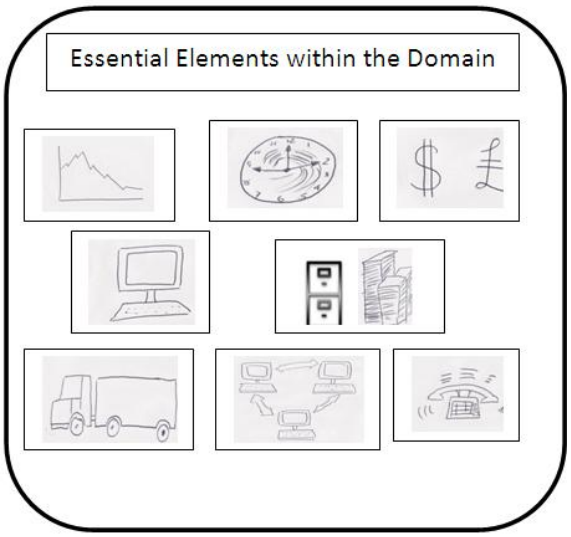


Figure 3.7 Essential icons

Figure 3.8 Stakeholder icons

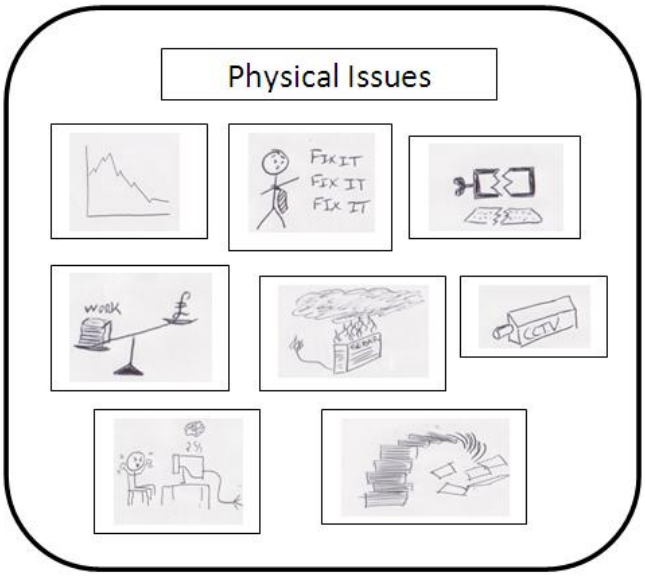


Figure 3.9 Physical icons

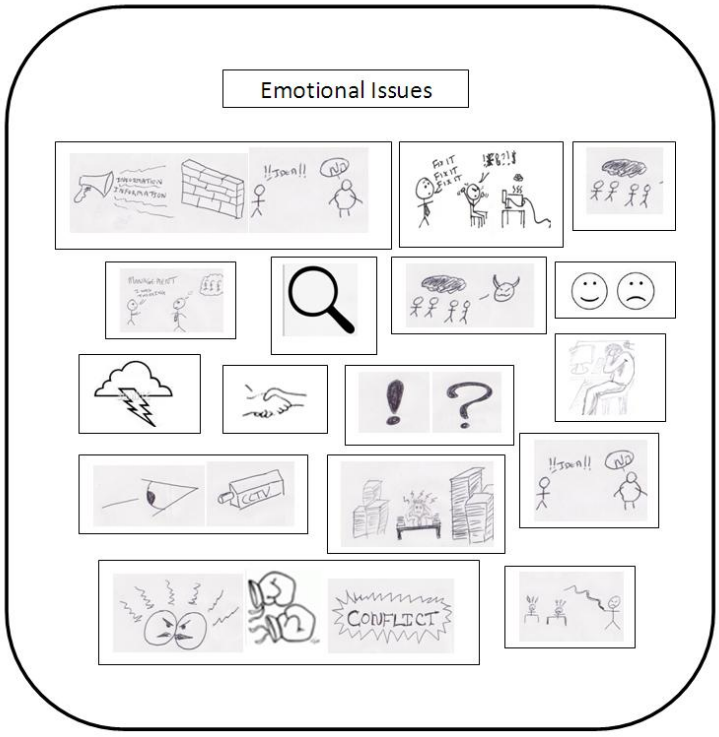


Figure 3.10 Emotional icons

3.2.2 Traditional icons

Previous work (Berg, 2010) identified RP icons that have become obsolete over time and other icons that are becoming more popular. The 'crossed swords' icon, much favoured by Checkland, is being used less and less as the sign for conflict in modern RPs. Polluted factory icons are being replaced by smart office blocks and telephones by computers. The angled 'watching eye' icon that was seemingly synonymous with the RP is being substituted by the CCTV camera icon.

Human icon interpretation is considerably better than it was 30 years ago due to our daily exposure to symbols. McCloud states, "*ours is an increasingly symbol orientated culture*" (McCloud, 1993, p. 58). We are constantly being bombarded with graphical symbols:

- Signs in airports and roads
- Buttons on kitchen appliances
- Icons on computer screens
- Mobile phones
- Television Advertising

Technologies seek to instruct, advertise and provide information using icons and logos that are becoming universally accepted. I can see that many of these images are becoming noticeable within the modern RP and hence construction and interpretation are developing from an understanding of modern iconography. The history of the Highway Code is a good example of common iconography. The Highway Code has recently celebrated its eightieth birthday. Their website suggests it is always on the best seller lists and is one of the few books in print that can lay claim to saving thousands of lives (DSA, 2001).

Interestingly, although the RP icons are often similar to simple clipart and can resemble fairly standard images that are ever present in society, I see a surprising dearth of global brands being depicted. Brands are globally recognised signs such as those depicted in Figure 3.11.

Figure 3.11 Global brands

I rarely see global brands being drawn in RPs with exceptions to this being within the 20-30 age groups who will occasionally draw social networking symbols such as Facebook and Twitter, golden arches for MacDonald's restaurant and an apple for technology devices. One way to explain this absence of brands is that these brand symbols are recognised by all of us but not really known. By this I mean they are hard re-create correctly. Off the top of your head can you remember exactly what the Tesco/Sainsbury or Asda signs are and the colours and font type they use? What are the colours that make up the Google sign? What is the sign for Premier Inn? Try to draw the FedEx or BMW signs and most of us will find they are not easy to recreate. I suggest we recognise these signs and know them inherently but cannot

recreate them because they live in our sub-conscious. As an aside, it is perhaps reassuring if there is a genuine failure by brands to penetrate the full conscious of people. I would suggest that the RP operates at a more tacit level of understanding and therefore these marketing brand signs are either not registering as a meaningful to include in a RP or are indeed too difficult for correct recreation.

There are however many icons that are traditional icons within domain or context of the situation being described. The following table illustrates examples of traditional domain icons.

Table 3.3 Domain Icons

Domain	**Icons**
Environmental	Water, fish, polluted factories, sun, transport (air and road), flags, children
Academic	Mortarboard, scroll, students, lecturers, computers, books, money, food
Hospital	Red cross, beds, needles, stethoscopes, white coats, skull and cross bones
Business/Office	Computers (both broken and working), offices, management, desks, filing cabinets, clocks

I am not suggesting that these icons will not appear in many other domains but they are seen to occur frequently in certain RPs telling stories within a particular theme. For example; food icons of all descriptions will occur in many RPs but they are seen to be commonly repeated in RPs drawn by university students. Some icons in Table 3.3 are not only recurrent in context domain but are also seen to represent whole domains in different RPs. For example the Red-cross icon can be seen to symbolise the health domain in a RP discussing a travel and tourism situation and the mortarboard being used to represent university or education in a RP about sustainability. I have discussed the name for these icons as synecdoche in section 3.2.1.

Unfortunately, as discussed in Appendix A, I do not have enough variety of domain samples in my icon-dataset to establish exact or robust statistics on domain icons. As previously

stated, a better understanding of domain icons might make a proffered legend more beneficial to RP creators.

3.2.3 Cultural icons

Misinterpretation and misrepresentation can occur through cultural differences. As Horton (1991) states, "*every culture has artistic traditions and expectations that embody the basic values of the culture at large*". There can be problems of differing perspective when size indicates distance. The obvious example is taken from Hudson in 1960 whose picture is of a man attacking an animal with a spear (Figure 3.12).

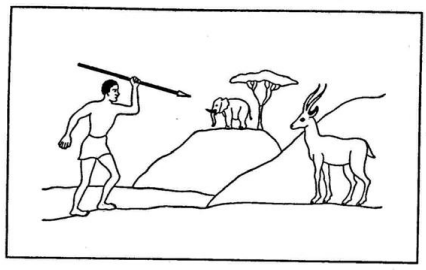


Figure 3.12 Kennedy, 1974, p. 72)

Western ideas of perspective suggest the man is aiming at an antelope in the foreground but others believed that he is aiming at the elephant with the tip of his spear. Hudson, enquiring from South African children, found that few had problems identifying the animals and the human but there were definite distinctions on what was being attacked (Hudson, 1960). Some applied logic to the picture saying that man would never kill an elephant whilst others stated the picture was ambiguous. As Kennedy neatly states, "*asking for interpretation is asking for cultural diversity*" (Kennedy, 1974).

Both Hudson (1960) and Goldsmith (1984) on the subject of visual literacy suggest that humans need to learn to read pictures and issues of context, experience, depth and interpretation can be enhanced with exposure and training. If a culture has little or no access to pictorial materials then their understanding of depth perception is decreased from those who have access at an early age (Goldsmith, 1984, p. 201). Accepting that this is an unlikely occurrence within organisational drawings it is, however, worth addressing cultural

distinctions of perception as they can offer interpretive insight to certain unrecognisable or polysemic iconography. Reading direction can be culturally defined; Europeans read from left to right, Arabian from right to left and Chinese from top to bottom. Figure 3.13, from Dreyfuss's "Symbol Sourcebook" (p79), shows a picture used to give instructions to illiterate miners in the South African Chamber of Mines. The instruction was a complete failure because miners read the instruction from right to left and far from picking up the boulders they blocked the tracks with the rocks. The RP's that are rated in the icon dataset to be of good quality both in richness and coherence have overcome directional problems of interpretation by inserting indicative signals such as arrows, lines, legend key or a colour/ numbering systems. Using such signals to guide the reader in a certain way helps to convey intended meaning to the viewer.

Figure 3.13 Instructions using visuals

Pictorial metaphors are best avoided in a RP if there is to be any cultural confusion or offence, for example, drawing exposed parts of the body can be offensive in different cultures whilst quite acceptable in others. Animals have been used throughout history to represent certain metaphoric attributes; sly fox, strong lion, wise owl, bold eagle. In the west the mouse on a computer usually indicates the control for the screen pointer but some nations only see it as a small rodent. Taking text out of pictures can enhance their universal worth; for example drawing keyboards with blank keys. My research indicates many excellent picture metaphors drawn in RP's with examples being a clock with wings to represent time flying and an owl with a gown and mortar board to represent senior academics.

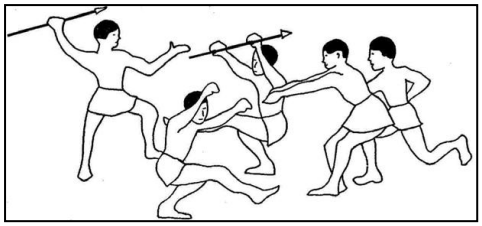


Figure 3.14 Crowd scene (Kennedy, 1974)

In the crowd scene in figure 3.14 the question is; are the people fighting or dancing? Different cultures have rules that forbid men to dance with men. Other cultures do not, and these cultural distinctions change interpretations of the image. Cultural differences within symbol user perception was addressed by Lin in an international study of telecommunication symbols which used a system of rating's to identify symbol preference (Lin, 1999).

It should be noted in this section that unfortunately I do not have enough RPs in my icon dataset to be able to analyse cultural differences within the RP and therefore my discussion can only perforce to be generalist.

3.2.4 Connectors

Connectors, usually being arrows and lines, are important in a RP to show relationships between objects. It can be seen, upon analysis of my icon dataset, that having a variety of connectors showing tone, grades of thickness and of differing sizes enhances the richness of a picture. Visual Stories that are well linked within a RP help to allow the viewer to navigate around the whole picture and thus bring in elements that might be unclear without connector associations. A common way for some people to show discord or fractures in situations is to use a broken link icon. I counted the amount of broken link connectors in my icon dataset and discovered 43 separate instances. For an interpreter these are areas of the RP worth focussing attention on. Broken links can suggest technical problems, human relationship problems and human to machine problems, all of which are of interest.

In Chapter 5 the analysis of the kinetic rating (ie, connectors and lines) showed some interesting results. I would suggest, but this is only opinion based and not proved with statistical analysis, that a picture that has poor, or no, connectors can still be considered coherent or understandable. I suggest there are other ways of relating or indeed understanding connection between icons in a RP. Looking at the 148 RPs that were rated as 'low on connectors' (either poor or no connectors) in my dataset I discovered that 70 of them were

rated as highly coherent (ratings 1 and 2 on the coherence scale in my analysis). Figures 3.15 and 3.16 are two examples from the 70 pictures rated as coherent but having few or no connections. Figure 3.15, a group RP, does have 2 small arrows drawn but it is still considered coherent in content. Figure 3.16 is an individually drawn RP that has no lines or arrows but is highly coherent in terms of icon meaning and emotion. So, from looking at the 70 RPs, there are certain elements that stand out and are noticeable.

The RPs that have been drawn by individuals, as opposed to those drawn in groups, are often very artistic and constructed to be aesthetically pleasing. I suggest that these pictures are drawn with little or no time limits to construction and facilitation is usually self-taught. Thus, the pictures have been structured in creative ways frequently showing high level imaginative and inventive ways to put their point across without the need for arrows and lines. A good example of this is Figure 3.16. Alternatively the RPs drawn in groups are usually facilitated by a person (s) and constructed under time limitations. It is possible that the facilitation prior to drawing did not suggest the need to connect the RPs but it is unlikely that this is the case. What is more likely is that the group did not see the need to connect their picture using the conventional lines and arrows because they felt their drawing was entirely readable. Using colour, closeness of icons to relate themes, boundaries to clarify, occasional words and quality icons these groups have achieved coherent and readable RPs without the need to relate by lines. I have examples in my collection of non-connected (in terms of lines and arrows) RPs using the landscape to clarify meaning i.e. they have been designed by separating the page into three areas; water, land and air to separate the different concerns of the environment.

The backspace or white space can be communicative. Quiet, isolated by distance, iconography can be just as effective as the busy areas of the page. I discuss isolation of icons in Section 3.4.6. Proximity of objects often drawn as small visual narratives communicates a story element of the whole picture and if there are lots of these story elements a full understanding is possible to be shared.

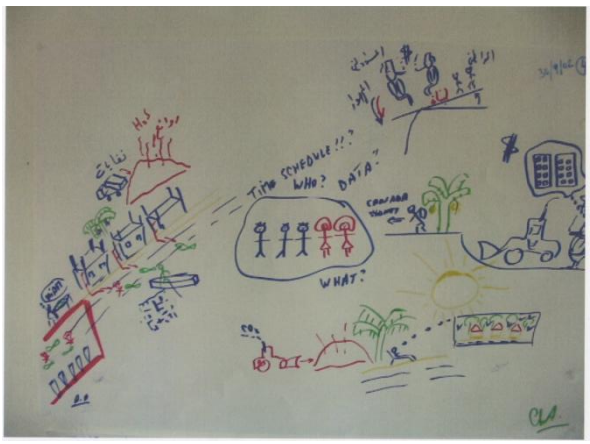


Figure 3.15 RP from Workshop in Lebanon showing heritage and culture issues

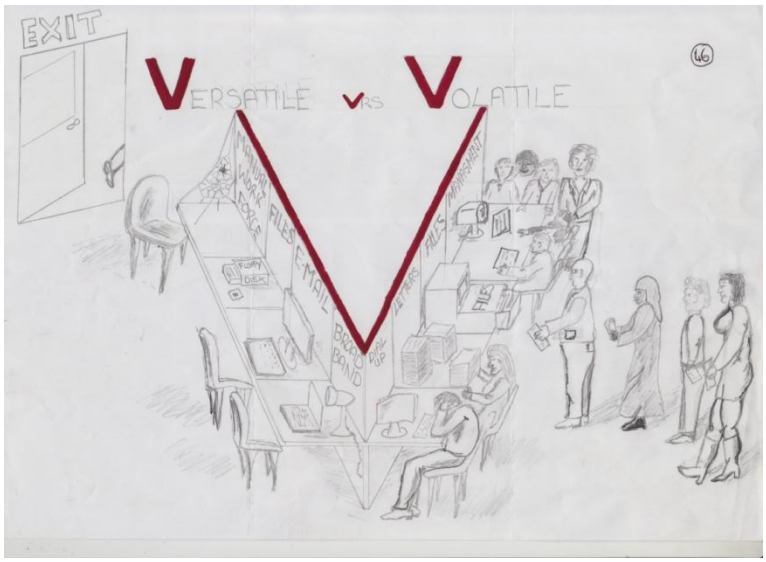


Figure 3.16 RP from UK showing work based technology improvements

3.2.5 Boundary

The RP boundary is a border that bounds, limits, indicates and defines specific areas within the picture. A RP can contain single or multiple boundaries. Such boundaries are usually, but not always, drawn using a single line encompassing related icons to a certain theme or separation from other parts of the RP. A boundary can overlap with other boundaries. The

boundary is often seen in a single context within a RP with icons lying outside and inside the boundary line. A RP is simply an individual or group's conceptual understanding of what they consider to be the 'real' situation. When it comes to boundaries one person's system can be another person's subsystem. The boundary becomes an arbitrary construct or a matter of judgment. Arguably, however, if a boundary is just a mental construct of the observer then it could also be construed as intentional and therefore not an arbitrary unintentional decision. It would perhaps be fair to assume that if everything is connected to everything, even if somewhat remotely in a RP, then boundaries bind the understanding and construction of the truth as far as one is able to grasp at that time. In essence boundaries offer a way of reductionism allowing complexity to be divided up into understandable parts.

As discussed in Chapter 5 all the RPs in the icon dataset were scored using the following criteria.

Table 3.4 Boundary Score results

Boundary criteria score	**Results from 298 RPs**
1- One clear boundary showing both internal and external elements	61 or 20%
2- More than one boundary showing other sub-boundaries	62 or 21%
3- Edge of paper or colour used as the boundary indicator	8 or 3%
4- No boundary	167 or 56%

Upon analysis there was no statistical correlation between boundary and richness or boundary and coherence thus suggesting that having, or not having, single or multiple boundaries in a RP will not enhance the richness or indeed the comprehension or the understanding of a picture. This is perhaps a surprising result as one would imagine that adding structure in the form of a boundary would add to the perceptive appreciation and interpretability of a picture by giving better clarification to the narrative. It would seem that the boundary is synonymous with the RP in so far as whenever a RP is shown in literature it invariably has at least one boundary line drawn. However, when analysing nearly 300 RPs, (Table 3.4) the boundary line(s) are not drawn in the majority of pictures. Interestingly, the individually drawn RPs that I analysed showed that females are more likely to include a boundary than men. Barry

(1996) found, "*people are more willing to be symbolically adventurous if the area being questioned is somehow bounded*". Waring discusses the negativities of boundary drawing, "*by setting down a system boundary you would be rationalising, i.e., trying to make sense of it according to previous knowledge which at such an early stage would be self-defeating*" (Waring, 1989). He concluded on the subject of RP boundaries that, "*if you choose to draw in a boundary make sure it is not a system boundary*" (Ibid). Thus, boundaries in the RP offer insight into system separation or overlapping from different perspectives but are not ultimately required to enhance coherence of a picture.

3.3 Emotion

3.3.1 Aesthetics

The RP can convey information and produce an aesthetic response in a viewer. Despite attempts to turn aesthetics into a science (Munroe, 1928) the meaning, or value, of beauty is still revered as being a branch of speculative psychology. Understanding aesthetic qualities can be highly abstract and conceptual and possibly seen, by some, as being vague or lacking in systematic process. Beauty is seen as one of the key components of art work but it is widely accepted in the art critique world that all art need not be beautiful (Goldsmith, 1984). Aesthetics, or what is seen to be pleasing to the eye, is a subjective concept and hence not susceptible to objective generalisation. Aesthetic personal feelings are too subtle, diverse and unpredictable to be analysed by scientific terminology. For the RP aesthetics is all about the shape or form of the picture in terms of harmonic colours, justifiable order, understandable icons, symmetrical opposing icons, pleasurable icons and, very importantly, clear interconnections between icon elements. A dull and uninteresting RP is less likely to attract attention or be examined in detail whereas a vibrant, colourful and fun RP will appeal aesthetically. Encouraging participants to use colour, be creative in icons and include lots of detail in their drawings will not only be rewarding to the group picturing process but also produce a rich RP that gives lots of information to share with others. An attractive RP often uses icons that have elements that are humorous with satire being a common occurrence. Intelligent use of visual metaphor which describes a situation or offers emotional insight frequently occurs in RPs that are very rich in content. Attractive RP's do not necessarily contain icons of high artistic quality in fact; invariably they are very simple and almost crude in visuals quality. Hand drawn images have an appealing quality because they are

unsophisticated, with the rudimentary and often minimalistic spontaneity of such visuals often giving a direct link to the unconscious mind of the artist. Icons can be worthy of comment, encourage discussion and evoke emotion such as annoyance, happiness, envy and conspiracy. To be able to understand the aesthetic quality or expressive significance of a RP it is important to examine the sensory properties of the picture. Sensory properties of a RP are metaphor, lines, shapes, space, volume, direction, noise and colour. I discuss this further in the next sections.

3.3.2 Metaphor and Humour

"The essence of metaphor is understanding and experiencing one kind of thing in terms of another" (Lackoff & Johnston, 1980, p. 125).

The metaphor in RPs is a common icon that shows imaginative reasoning or rationality, allowing a person, or group of people, to abstract a specific object or actual instance. There have been a number of studies on visual metaphors across a wide range of genres ranging from film, advertising and cartoons (Ibid). The metaphor icon suggests a need to abstract a message, insight or emotion in order to remove from, or heighten with satire, a contentious personal viewpoint. Comedic depiction using metaphor seems to either dampen strong, or what could be controversial messages or, through the use of satire, enhance a problem situation. Refaie states, "*One of the few generalizations that most metaphor theorists would probably agree on is that metaphors tend to represent the unknown, unresolved or problematic in terms of something more familiar and more easily imaginable.* (Rafaie, 2003). The problem with deciphering metaphor in RPs is the plurality of meanings. Meaning is not inherent in the RP, but instead it is jointly derived from the producers and viewers. Metaphorical language is ubiquitous in the RP thus allowing understanding of complex areas in terms of concepts or situations we are more familiar with. Such metaphor icons tend to represent the unresolved or unknown parts of what is often complex and problematic. Visual icons can often inform more easily and effectively than words(Ibid). Text is perhaps more precise in explanation but there are other meanings, such as implied thought, subtle nuance of meaning, personification as well as complexity of relationships that are better presented using visuals;

"the sequential/ temporal characteristics of language-as-speech may lend itself with greater facility to the representation of action and sequences of action; while the spatial display of visual images may, lend itself with greater facility to the representation of elements and their relation to each other". (Kress, 2000)

The icon used as a metaphor can be, on the outset, clearly unambiguous to a viewer in so far as the meaning might seem very clear. This in its self can sometimes be a problem because it can be difficult to distinguish between a literal and a metaphoric icon. Mostly the metaphor in RPs are fairly easy to understand. For example, I have some RPs drawn by workers in a Department in a Council in Scotland and many of the workers depicted their manager with a 'devil' icon with others drawing images of management physically standing over workers with a whip (figure 3.17). They are (hopefully) not saying their manager is a real devil nor are they suggesting they are being actually whipped at work. Instead, through metaphor they are likening the way they see management to negative images in order to explain how they feel. These types of icons might show up areas of weak, dismissive or even bullying management. In section 3.2.1 I discussed the pathologised icon and how some people will draw very negative images to depict an anxious situation. Other RP metaphor examples are often showing objects, such as the computer and server in Figure 3.17, as broken. In the Figure 3.17 the computer objects are clearly being shown as broken but to emphasis the point a wind-up handle is used to show the age of the computer and fire is used to show the imminent danger of the situation.

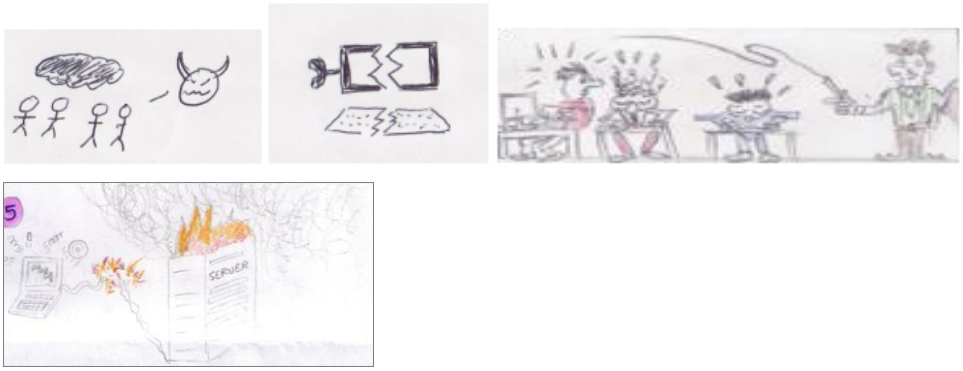


Figure 3.17 Examples of RP metaphor

A common and interesting feature is the injection of humour with metaphors in RPs. Humour in the RPs can be acceptable if it throws light on a problem situation which is potentially hostile and open to dispute. Humour is defined by our societal norms and cultural

perspectives and therefore cannot offer universality. Humour can therefore be dangerous. Sarcasm and cynicism leading to mockery can provoke explosive conflict. I am in agreement with Lewis who suggests that "*trying to make a rich picture diagram humorous for its own sake is a waste of time and rarely successful*" (Lewis, 1992, p. 358).

3.3.3 Shape and form

There are various outlines, orientations and natural relationships to RP iconography that offer intuitive interpretation without the need for expert analysis skills. Objects such as buildings, servers, tables, filing cabinets, computers, transport, CCVT cameras and graphs are mainly drawn with hard straight edges suggesting a mechanistic manmade structure of an object which is fixed and rigid in structure. Hard lined rectangular speech bubbles deliver hard comment, exactness or technical process instruction whereas the softer the shape of the speech bubble the more the message becomes opinion or conceptual in thought. Other rounder shaped icons, such as faces, time, handshakes, clouds, thought bubbles and hand drawn question and exclamation marks are seen to represent abstract concepts such as time, happiness, unhappiness, agreement, concern, anger and query. They are perhaps not as rigid as the hard line drawings but offer understanding on more tacit emotional features of the problem situation. Sharp and jagged shapes are powerful icons in the RP that radiate noise waves or broadcast raw feeling and reaction. Icons such as fire, jagged speech bubbles, crossed swords and crossed out icons all signify sharp shapes. They denote strong emotions or genuine beliefs such as conflict, anger, unhappiness, disagreement, tension, and dispute. Orientation or angling of an icon in the RP offers even more insight. The CCTV camera, the sun or watching eye icons are common features within the RP that are usually angled. The tilt of an object will often point an invisible line towards another entity or series of icon in a picture thus making a connection relationship. For example in a RP a watching eye icon is often tilted or aimed at a group of stick figures and usually represents an overseeing of some sort, perhaps managerial or governmental.

Be aware of orientation in a RP. What is seemingly drawn as upside down is likely to be drawn by group members who accessed the paper at different angles. It is important to investigate a group RP from many angles and I would suggest a 360 degree rotation for full understanding.

3.4 Communication

3.4.1 Group work

The RP has an excellent multifaceted communicative ability. The RP does not tell a single story but instead tells lots of stories going on simultaneously. They can reveal stories people didn't consciously build into them. The RP can show disagreement and conflicting opinion, "*rich pictures are negotiated and hence agreed positions; they are the outcomes of participation. Not all within a group may necessarily agree with what is in the picture or indeed what is missing*" (Bell & Morse, 2013).The communication in a RP can often be confusing to interpret. The icons might be undistinguishable and the relationships unclear. Sometimes objects and processes are not related by either line or proximity. These unrelated areas are worth further investigation. It could be the group or individual has limited knowledge about this area of the picture so thus the communication lines are weak. It could also be the case that there is disagreement within a group on what or how to depict their position. I discuss further on icon isolation in section 3.4.6.

There is much in the literature about group dynamics but little on RP group dynamics. Bell and Morse (2012, 2013) are the most influential authors to date in this area. They acknowledge the lack of facilitator involvement, "*the group dynamics is entirely a matter for the group and the assumption is that separate groups can negotiate a shared understanding of the system but that understanding will at least in part be driven by the composition and dynamics of the group*" I have observed many groups drawing RPs. Lively debate in these groups usually results in a negotiation on what icons are to be drawn. Such icons are often drawn by one or two group members who are quite dominant characters in the group. It is often the case that there is not full group agreement on what should be drawn. I have discussed group work and the possible ethical dimensions for facilitator consideration in a recent paper (Berg, Pooley, & Queenan, 2011). Dominant group members are both useful within groups and yet can also be disruptive, insistent, dismissive and sometimes even intimidating or oppressing (Janis, 1974). Facilitators running a RP session rarely get involved in the group-work discussions and this lack of involvement usually works well with groups being free to discuss and express any way they want. However, I have observed, and been involved in, group picturing sessions where one group member is very opinionated and overbearing. This behaviour can result in other group members not being allowed or even asked to contribute to the picture.

Disagreement with the dominant group member (s) can lead to sub-groups forming and drawing their own inputs on the page. I find the resultant icons from dominant group members to be more central to the page and slightly greater in size to other icons on the same page. Another interesting observation on the icons that are drawn during the most debated times of the picturing session is that the dominant member of the group, or the person who purports a strong position, will often draw thick or colourful relationship lines to other areas of the picture. The dominant person(s) will often make the decision to relate all aspects of the picture back to their own icon (s). I have seen, in many RP group workshops, that likeminded people, perhaps even friends, create sub-groups. Subgroups, when rich picturing, are often the people who draw at the edge or even a corner of the page; their icons are often small and full of details that are not always coherent to a viewer. Subgroups seem to deal with the more difficult, complex and often personal areas of concern and are often seen to teeter on the edge of the group in terms of having more private conversations.

It is often the more dominant group members who link the subgroup picture stories to the larger picture. I find that groups that know each other and are seemingly good friends draw confident, strong and quality RPs in terms of what the major issues of concern are. They can fill the page with ease and often seem to enjoy the whole exercise. However, it is often not these pictures that provide the most information. In my observations and subsequent analysis of the resultant pictures it is the groups who do not know each other and come from diverse backgrounds that draw the most interesting RPs. Their pictures are not necessarily aesthetically pleasing and can sometimes be disjointed, unrelated and confusing but they are often full of emotion, agreement and differing opinion. I find that the RPs that are drawn by people who know each other are usually bold and confident of icon and relationship whereas, it would seem from my research, that the more diverse the group is the more visual information is given. Diverse groups of strangers produce more icons and tell more stories than groups of people who know each other. I suggest that to stimulate good debate and have a rich RP it is best to have a good group variance on gender, age and background. I would further add, although not statistically proven in Chapter 5, that having at least one female in a group would be beneficial in terms of producing an all round richer picture. Janis (1974) writes about having a good gender mix in groups. My results, when comparing low richness scores with gender, did not however suggest that males are more likely to draw weak RPs. Another suggestion for gaining good communication in groups, and also corroborated in the analysis results in Chapter 5 and Janis (Ibid), is to be aware of age of the participants. It can be seen in Chapter 5 that the two age brackets that drew the richest and also the most

coherent pictures were; 30-39 and 40-49 and over 50 in age scored low on richness. These results cannot however be statistically proven by the chi square test because of the low sample I have on ages.

In summary, I have found, through observational data, that the RPs that are produced by groups who have very dominant, self-appointed, leaders are often very coherent but lacking in detail. They are often tidy pictures that reflect a singular story or opinion but lack the disorder and chaos of one that reflects multiple issues. Dominant members in picturing group-work can also be very good for group dynamics (Janis, 1974). Sometimes natural leaders emerge with qualities such as fairness, respect and good communication and listening skills. If a leader brings less confident group members out of their shell and includes them, and their opinions, into the group then this is very useful. Surowiecki (2004), author of the infamous "Wisdom of Crowds" book suggests smart groups who deliver quality have 4 main virtues'

- A diversity of people: gender, age, culture, religion
- Decentralisation: a spread of power
- A process of summarising opinions to a collective verdict
- Independency: not to be worried to voice opinion

3.4.2 Size and placement

The actual size of a RP icon in relation to other iconography on the same page is an important area to explore. We pay more attention to larger elements, attributing then more significance and power (Yarbus, 1967). I suggest the larger the individual iconography then the more this indicates the key issues of concern. The dominant elements are the icons that stand out and demand attention. In many of the RPs in my dataset authors drew their management as physically larger images than the workers recognising their status in the organisation in visual size dimensions. It is useful to note how the elements and images in a RP are organised. The way the RP has been arranged or formed brings about its formal properties. Technical properties are the way the RP has been constructed or its design using elements such as icon, colour boundaries and connectors.

The expressive properties of a RP operate at the tacit or emotional level. What does the picture have to say to us or what appears to be the mood of the RP? For example; light,

sombre, flippant, menacing, happy or troubled. Another area of expressive properties is looking at the dynamic state of the RP for example, tension, conflict, relaxation, confusion.

3.4.3 Visual Complexity

Goldsmith states, "*simplicity in illustration is difficult to define: if simplicity means lacking of information a picture could be far from simple to understand*" (Goldsmith, 1984, p. 2). Vitz (1966) suggests that humans prefer complexity in visuals. What constitutes complexity whilst embracing simplicity in visual illustrations? Goldsmith (1984, p. 270) suggests there are eight factors that attract or direct attention; colour, position, size, isolation, complexity, tonal contrast, directionality and implied motion. I discuss visual attention further in section 3.4.5. The human capacity for processing information is actually quite limited. Millers Law (1956) of seven (plus or minus two) has been long accepted as a common guideline for the number of objects we can hold in our working memory. More recent studies have shown the correct number is probably around 3 or 4 (Farrington, 2011). The Law of Closure is a gestaltian belief that objects that are grouped together are seen as a whole. Often known as the law of simplicity, this theory suggests that our minds self-organize information in a standard way that is arranged, symmetric, and simple to interpret. We organize shapes or lines in our mind to a single form that is more than the sum of its parts (Figure 3.18).

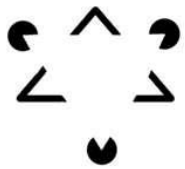


Figure 3.18 Law of closure

The background or blank space in a RP is not a by-product of a picture as it has many communicative qualities. The backdrop sets the scope of the picture and provides a frame of reference that can be used to compare clusters of objects, emergent patterns, isolate key elements and guide the reader's eye in a certain direction around the page. Spatial grouping in the RP can be analysed to interpret interrelationships. The proximity of objects shows their relatedness which can be further enhanced by lines and arrows. Such connectors offer the reader a holistic understanding of several interconnected objects.

When Interpreting a RP try to look for elements that are grouped together depicting a specific event or situation. Don't worry if all icons don't make sense but instead try and get a feel for

what is being said. Look for connections, such as lines arrows and colours used, to other events or situations and read what is being said in speech bubbles. Consider the key elements that seem to be dominant in the story and don't reject analysis because of inability to comprehend all icons. Be aware of over analysis too. Abstract elements such as strange doodling or weird over-penning or scribbling might not be relevant in fact they often are being drawn whilst the creator is trying to think.

3.4.4 Readability through Icon Scripts

It is not my intention to suggest a 'correctness of reading' of the RP as that can only be really achieved by asking the author(s) through focussed dialogue. Instead I am interested in drawing attention to aspects of the RP that might give indicative signs or clarification on areas that may benefit ones understanding by further investigation.

The relationship between the viewer and the RP is shaped by what both bring to the encounter, and the resultant understanding occurs through what Gadamer calls a "*fusion of horizons*" (1986, p. 273). On one side of this relation are the icons themselves showing author intent, through object, structure and process with the other perspective being the reader who comes with purposes, expectations, questions and sundry assumptions drawn from past experiences. Understanding is not simply a matter of grasping an author's intended meaning or of finding the correct message, but also of bringing one's imagination to the reading, recognising that multiple juxtaposed interpretations are entirely possible.

Pictures are truly a language in their own right and are not just, as often perceived (McCloud, 1993), a decorative adjunct to a verbal or written language. Visuals lend themselves to many readings and this is especially true of the RP. The RP is often too chaotic and challenging to be able to read and comprehend all the meanings being drawn. There can be however, areas, or sections of a RP, of well defined unambiguous visuals that are easily recognisable when coupled together. I will, adopting a term from Berniker (2003), call these related icons of the RP 'icon scripts' Berniker states that the "*iconic script is a system of writing constituted by iconic symbols*" (Berniker, 2003). I suggest figure 3.19 and 3.20 are good examples of RP icon script where several icons are used to convey a single or variety of problem situations. The iconic script tells a simple, or at least uncomplicated, story with the use of icons with a clear start and finishing point.

Figure 3.19 Icon script example

Figure 3.20 Icon scrip example

Icon scripts occur frequently in RPs. Often the icon script shows a moment of clarity in a drawing session. If the RP is to be read as a story of scripts then obvious problems occur with where to start the reading; linear, right to left, left to right, columns, single pictographs, stacked, circular. To read and interpret a RP in one way could actually suggest the opposite of the true intended meaning or, at very least, take away from the key elements. As previously stated, for western societies it can be difficult to look beyond our habitual notions of left to right and top to bottom. Other considerations must be factored in such as the size of the actual icons in meaning to other icons, use of space on the paper, boundaries and sub-boundaries, domain specific icons, colour, metaphors and metaphors with humour. To understand a RP one must take all these considerations into account.

3.4.5 Visual Attention

There are a great many elements that attract a reader to view a RP in a certain direction, such as, colour, layout, relationship lines, size of icon and thickness of connector. Providing elements that attract visual attention is, according to my analysis, better with individual RPs than those drawn in groups. This is perhaps not surprising as group RPs have a team of

people who are sketching icons from their physical position around a table using the angle they can access the paper. Thus group RPs are often lacking in start and finish indicators and flow in sporadic directions in terms of readability. I would agree with Daellenbach who suggested that it might be worthy to note the point at which group members entered into the RP and where they started drawing (Daellenbach, 1994, p. 53).

There are however, some things that are intrinsically and universally interesting to people or as Rosbergen et al, in the advertising context, describes as, "*heterogeneity across consumers*" (Rosbergen, Pieters, & Wedel, 1997). A person, as opposed to other objects, in a picture or scene will compel viewer attention especially if there are facial expressions attached (Yarbus, 1967). The pioneering work of the Russian psychologist Alfred Yarbus discovered that target areas for viewer attention centre on eyes nose and mouth and any other features that define facial expression (Figure 3.21).

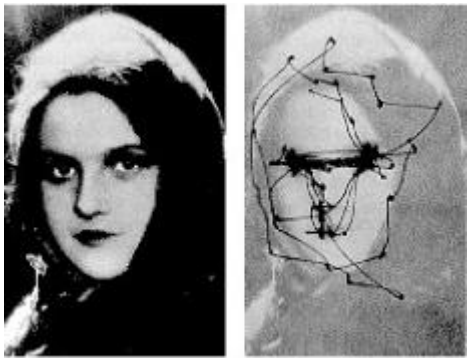


Figure 3.21 Eye tracking experiment by Yarbus 1967

Yarbus using eye-tracking experiments determined; *"Human eyes voluntarily and involuntarily fixate on those elements of a visual scene that carry essential and useful information. The more information is contained in an element, the longer the eyes stay on it. The distribution of fixations on the elements of a scene changes depends on the purpose of the observer, i.e., it is determined by information to be obtained and the thought process accompanying the analysis of this information. Hence people who think differently also, to some extent, see differently."(Ibid)*

An influence of visual attraction is the use of 'goals' or, as Yarbus states, the influence of "*extrapictorial factors*" (Ibid). What is being said here is that a viewer's attention will be better if it is influenced by a goal or asked a specific question relating to a picture. For example Figure 3.22 is an extract taken from (Brown A. , 2006) on a visual eye-tracking test showing how asking questions of a viewer changes the they way and what they view.

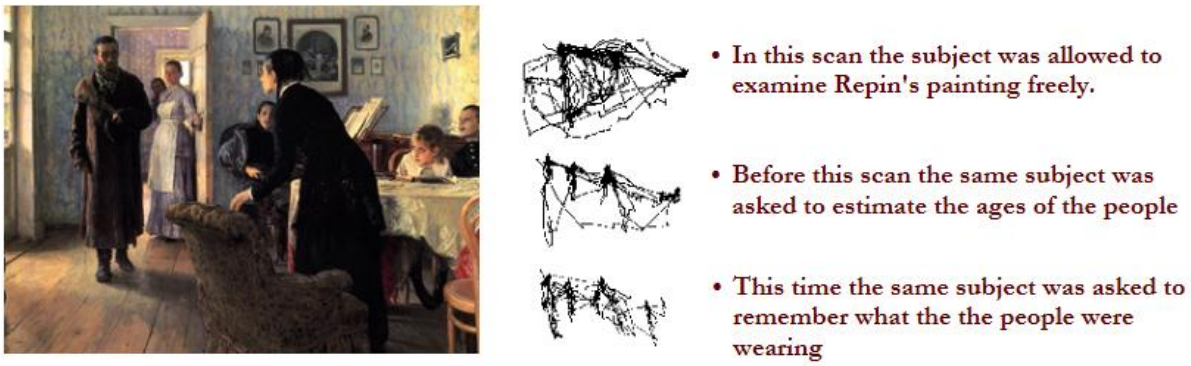


Figure 3.22 Eye tracking experiment

So, according to the above test, it would seem that asking questions concerning a picture directs attention to visual elements. This, I would suggest, lends credence to my guidance framework for the RP. The framework is essentially a visual questionnaire to aid viewing and interpretation of a RP. There is a large amount of literature on visual attention which has mostly been adopted by the semiotic advertising branch of philosophy (Rosbergen, Pieters, & Wedel, 1997) and within IT for computer screen usability testing (Poole & Ball, 2003). The recent development of more sophisticated eye-tracking technology has allowed for some definitive and novel understanding on how our brain directs eye movement and what attracts attention. Discussion about eye-tracking and RPs are included in the 'further work' section of Chapter 6. I suggest that it would be an interesting study to apply eye tracking technology to understand how people read the RP in terms of where they start and finish and what type of RP visuals hold attention more than others.

3.4.6 Isolation

Not all icons in RPs are related by style, lines, arrows or colour. Some icons sit in remote isolation from an often complex, related by line and space, jumble of icons in a picture. Therefore, by sitting apart from other elements in a picture, an isolated icon takes on visual importance. Williams et al discovered, through eye-tracking investigations on visuals, that isolation has a positive effect on attention (Williams, Mulligan, Koprowicz, Miller, Reimann, & Wang, 2004). So from this we can suggest that, whether consciously or unconsciously drawn, the RP icons that sit alone, with blank space around them, assert a visual dominance in a picture. I would suggest, from analysing the RPs in my icon dataset that many of these icons are seemingly unrelated from what is being drawn on the rest of the page. These icons are being drawn as having significance to the whole RP but they are perhaps un-linkable

because they are of private opinion in a group situation or still conceptual in a thought process. They may need further examination or discussion to become relevant to the complex scene being drawn elsewhere on the page. It is difficult to determine, without further study, whether isolation of icon in a RP is a matter of a lack of links or the distance they are removed from other icons. I suggest that it is likely to be some weighted combination of the two but that would have to be tester further to prove as valid.

RPs are mostly drawn on large sheet of paper so the background space, will always be white unless significantly changed by the artist using colour or texture. I find such change very rare and the RP to hardly ever have a background that is not the original white paper. The space between icons is very important as it can take two seemingly separate icons and transform them into an idea or story depending on the proximity. McCloud, studying the art of comic book construction, calls the space between comic panels the "*gutter*" (McCloud, 1993). He states, "*the gutter plays host to much of the magic and mystery that are at the very heart of comics*" (Ibid p66). Figure 3.23, an example taken from McCloud, shows how time and space in visuals allow us to mentally construct or fill in the gaps allowing us to see a continuous unified story.

Figure 3.23 Illustration from McCloud 1993 p67

Sequential panels or icons related by other forms of linkages as likened to comic art can be seen in many of the RP's I have examined. They mostly come from individual RPs by people who have taken time to construct an aesthetically pleasing picture as opposed to group RPs who often have limited time to think about structure or design. It should be noted however, that RPs are not expected to be structured in any specific way (Checkland, 1981) in fact there is often a discouragement to plan, shape or design a pleasing picture. In many of the RPs I have analysed there appears to be no logical relationship between some icons even though they are seen to be together in terms of proximity to each other. I would suggest that these seemingly non-related icons do have meaning resonance but it is either not being made clear by the artist or perhaps such interpretation, without explanation, is mistaken.

3.4.7 Coherence

Coherence is an area of importance in RP interpretation. Forty three percent of the RPs in the icon dataset were rated low (bottom three ratings) on coherence. Thus, many RPs were not particularly coherent however, they do often show areas or segments of coherence within a picture. RPs can be maddeningly vague about what is being shown and often there is a real expectation that the interpreter will be able to understand the story by almost, 'filling in the blanks' in a picture. I have observed, during my research, that people are generally quite proud of their RPs insofar as they managed to produce something that tells a story and highlights areas that are important to them.

I ran a workshop using RPs for a Diagramming Colloquium in March 2012 and had groups drawing RPs on the subject of 'Teenagers and Technology' (Berg & Pooley, 2012b). I did not have time during the workshop to ask people about what they drew and why. It was over a week later that I interviewed individual members from different groups about their pictures. All of the people I interviewed were keen to discuss their RPs and explain the reasoning behind the icons. They could recall all aspects of their group pictures even areas where they were not directly involved in drawing. What was interesting was that they unanimously could not recall the names of the people in their group. They discussed what other group members drew by describing the people, "*the lady in the trouser suit*", and "*the professor in our group*". This complies, to some degree, with the pictorial superiority effect which, in essence, states that we learn better and for longer with visuals rather than words (Nelson, Reed, & Walling, 1976).

People draw RPs based on what they know about a situation. They attempt to show, in icons, their understanding about a situation and thus the resultant RPs are as comprehensive as they are able to be at that time, with the knowledge those people had. It is not always possible to be logical, organised or indeed to relate a clear story because the situation might be complex and difficult to understand let alone show pictorially. Hence coherence in RPs is often difficult to achieve.

3.5 Colour

3.5.1 Discussion on Colour

I shall discuss this important area before I bring in the relation to the RP in following section. The psychological effects of colour have been studied over many years and by many highly regarded experts. Kandinsky, an influential Russian painter and renowned art theorist, claimed that colour has a noticeable influence over our whole physical body. Colour can bring about feelings of pleasure and contentment as well as influence anger envy and upset. Colour has long been seen as having healing powers. Colour is an important factor for communication with international symbols.

An example is the red, amber and green traffic lights and red signs meaning 'no' as opposed to green suggesting 'yes'. Kandinsky believed that colour evokes a '*psychic effect'* such as a warm red causing pain or disgust with the association of running blood (Kandinsky, 1977). Kandinsky researched into geometrical elements such as circles, lines and curves along with colour as a means of visual identification. He says that certain colours combine with certain forms.

For Kandinsky there are 3 main colours; red, yellow and blue. He suggests that a dull shape is a circle and therefore it requires a dull colour such as blue, an interesting and dynamic shape such as a triangle requires the bright colour yellow and an intermediate shape like a square deserves the colour red. He furthered linked these colours into lines, angles and position (centrality). Kandinsky does not suggest rules to art but moreover a way to better understanding abstract expressionist art by way of his colour theory. Faber Birren (1900-1988), from the famous Bauhaus School of Art, the author of numerous books and articles on colour theory, has similar associations regarding form and colour to Kandinky. Others such as Albers and Itten also wrote on colour theory within the Bauhaus School of Art. Birren notes the biological reaction that humans have to colour, *"red tends to raise blood pressure, pulse rate, respiration and skin response (perspiration) and to excite the brain waves. There is a noticeable muscular reaction and greater frequency of eye blinks. Blue tends to have the reverse effects, to lower blood pressure and pulse rate. The green region of the spectrum is more or less neutral. Reactions to orange and yellow are akin to reactions to red but less pronounced. Reaction to purple and violet is similar to reaction to blue*." (Birrin, 1978)

Dreyfuss, author of the 'Symbol Sourcebook' spent years collecting, sorting and analysing hundreds of symbols with a large element of his work focussing on colour. He discovered that there is little cultural universality with colour. There are numerous positive and negative associations of colour that have strong connotations with various different cultures, regions, economies and political persuasions. Table 3.5 is a small summary of colour selection and international distinction taken from the 'Symbol Sourcebook' (Dreyfuss, 1972, p. 234).

Table 3.5 Colour Association

COLOUR	POSITIVE ASSOCIATION	NEGATIVE ASSOCIATION	CULTURAL COMPARISON
Red	blood (life), fire (warmth), passion, patriotism, valour, revolution	blood (spilled), fire (burning), death, war, danger, devil	*England* : Royalty, Labour Party, Sport team, danger *China*: festivity, joyfulness, emperor clothing *Japan*: fighting ,anger, danger *American Indian*: masculine, success, triumph
Yellow	Sun, light, illumination, magnanimity, intuition, supreme, wisdom, divinity, ripening grain	Treachery, Cowardice, debauchery, malevolence, impure love	*China:* Dynasties, honour, imperial dignity *Egypt*: happiness, prosperity *Japan*: childish, gay *Spain*: executioner costume
Green	Vegetation, nature, fertility, sympathy, prosperity, hope, life, immortality, youth, freshness, wisdom	Death, lividness, jealousy, envy, disgrace, sinister, opposition, moral, degradation, madness	*American Indian*: Feminine *Egypt:* fertility, vegetation, rain, strength *Japan*: Energy, future,

Goldsmith (1984, p. 263) notes, "*it appears from literature that it is not colour in itself which is important; it is the contrast which it provides with surrounding areas*". Colour can aid learning by enhancing recall, focus attention on key elements and add visual dimensions that exceed a black and white drawing. More recent studies consider colour within the somewhat rare neurological condition 'grapheme-synaesthesia' where an individual's perception of

numbers and letters is associated certain colours. Kandinsky (1977) argues that colour communicates via sight to the soul affecting all bodily senses;

1. Taste : yellow might be considered sour as in the taste of a lemon
2. Hearing: yellow as a high pitched sound and dark blue with a low bass note, brown as 'F major'
3. Touch: The colour rose appears soft and smooth
4. Smell : Green may be evocative of the smell of grass

He strongly believed that there was a definite link between colour and sound with one of his first publications being titled 'Sounds' (Ibid). The association of one sense with another is known as synaesthesia. Kindinsky suggested the expression '*scented colour'* for associations of smell and colour. The advertising world of fragrance, soap, cleaning products and have long been using such ideas, for example, blue is for aquatic and green for freshness. Colour can be used to represent associations; the tobacco brand 'Silk Cut' has a logo showing purple silk implying its connection with royalty and splendour. There have been many orderings or 'wheels' of colour versus smell and taste with, arguably the first being Rimmel (1865) and his 'floral clock' for botanists with the more recent perfume 'fragrance wheel' by Edwards (2008). *In* The Smell Report, Kate Fox (199*, pp. 6-7) observes:

"*One of the studies showing our tendency to prefer scents that we can identify correctly also showed that the use of an appropriate colour can help us make correct identification, thus increasing our liking for the fragrance. The scent of cherries, for example, was accurately identified more often when presented along with the colour red – and subjects' ability to identify the scent significantly enhanced their rating of its pleasantness*."

Fabar Birren believed there was a science to colour as a human perception sensation that provokes emotional responses. He suggested it is a natural phenomenon for most people to find pleasure in colour harmonies showing extreme contrast (Birren.F, 1961, p. 49). However, he also indicates the human eye will focus more sharply on a warm colour rather than what he sees as a cool one.

"This is due to the makeup of vision itself and accounts for the general blurring of blue, violet and purple at a distance. In an abstract sense, therefore, red, orange and yellow are best associated with sharp angular forms; Blue, violet and purple with softer forms."
(Birren.F, 1961, p. 103)

Birren (Birrin, 1978, pp. 120-126) discusses 11 key responses to colour. For example here are the first five;

1. Red : Red relates to a person's introverted or extroverted tendencies either naturally or by deliberate choice. Red, along with blue is one of the most preferred colours. This suggests a person who is impulsive, possibly athletic, quick to speak their mind and emotional. Life is meant to be exciting and happy but self control is also required. To dislike red suggests a frustrated person who is perhaps bitter and angry or with mental health problems.
2. Pink: Protected and guarded people. Red souls who have not the courage to choose the colour in its full intensity. Often signifies youth, gentility and affection. To dislike pink suggests a person who is pampered, vain, rich and indulged.
3. Orange: This is the social colour, cheerful, warm, good-natured, gregarious and luminous rather than hot like red. Orange is frequently disliked as it is seen to be flippant and flighty.
4. Blue: The colour of conservatism, accomplishment, devotion, deliberation and introspection. A dislike of blue may be a signal revolt, guilt or a sense of failure.
5. Yellow: The colour of innovation, originality, wisdom. In western cultures it is symbolized as cowardliness, prejudice and persecution. To dislike the colour suggests a troubled mind.

3.5.2 The Colours of the Rich Picture

Colour is of particular importance to the RP as it can evoke strong and differing human responses. The choice of colour in an RP is laden with symbolism, cultural connotation and visual reception. Colour is used to accentuate visual perception and evoke or resemble emotion (Birrin, 1978). I argue that colour is a distinguishable element to a RP with results from Chapter 5 suggested that richness is improved when colour is introduced within a RP. The result from the analysis of the RPs showed a clear statistically proven link between colour and 'richness' (PT19 in Appendix). Just over 50% of the RPs in my icon dataset have used colour. Different colours were used to separate and define different areas of the pictures such as boundaries and stakeholders. Observation from analysing the pictures sees certain pictures using colour as an enhancement to the 'overall 'look' of the picture rather than to clarify meaning. Some pictures in my collection used colour to define actors, speech, observations and overlapping boundaries giving a colour key to interpret.

In Chapter 5 I also looked at individually drawn or group work RPs compared with colour. It was only possible to isolate for definite 138 pictures that fall into these two categories as many of my RP's are unknown as to who, or how many, drew them. From the 138 group and individual RP's there is a clear indication that groups prefer to use colour and individuals are considerably less keen. These results show that out of 40 group RP's there were only 2 that used no colour. Out of 98 individual RP's there were only 27 who used 3 or more colours. Perhaps the use of colour is a factor of materials presented to the participants. It is impossible to determine with any clarity from this study whether coloured pens were available to those who drew the individual RPs. It is also not possible to find out what colours are primarily used in RPs from the 298 samples that have been collected. This is due to the fact that many have been taken from books and articles that are published in black and white and do not show what colours the originals possibly had.

So, in order to analyse colour preference in RPs the following case study workshop has been used. The Diagramming Colloquium of 7th March 2012 (Berg & Pooley, 2012b) held a group RP workshop wherein 9 groups of 4 to 7, mixed gender, participants drew pictures relating to a specific problematic situation. Each separate table for each group were given a variety of colours to use; red, blue, black, orange, pink, yellow and green. The groups were encouraged to use colour in their pictures in a short presentation before the workshop started.

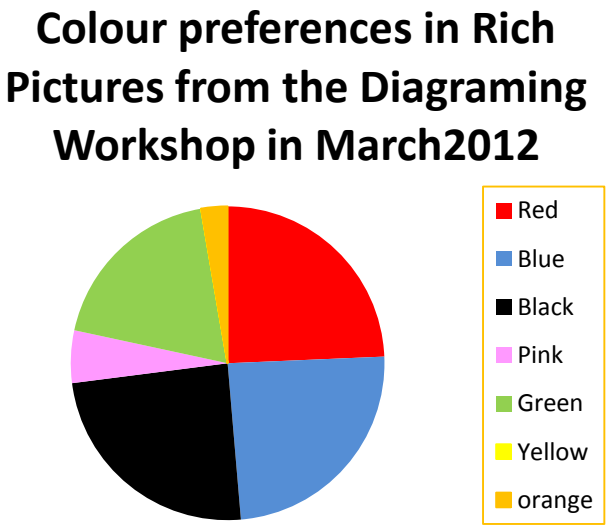


Figure 3.24 Colour preference chart

Upon analysis of the resulting RP's (Figure 3.24) the results show that every group used at least 3 colours. All 9 groups used red, blue and black with 7 of the groups also using green.

The colour pink was used twice and orange was used only once. Yellow was not a colour used by any group. These results concur with Birrens findings wherein he suggests that red and blue are the most preferred colours and yellow is the least favourite colour (Birrin, 1978). The results from this workshop clearly indicate that a rich (in colour) RP requires at least 4 main colours to be offered to participants; red, blue, black and green. However is should be noted that the more colours that are used within the pictures the greater the richness and ascetic look of the RP.

3.6 Summary of Chapter 3

Within this chapter I have determined an in-depth study on icon interpretation across many differing disciplines which have elements that can offer insight into RP icon interpretation. It has been shown that not all icons are universal in meaning and certain icons have differing cultural connotations. I have looked at size, colour, boundary and form in detail and related much of the accepted literature in these domains to RP analysis. I have considered the more abstract issues of aesthetics, orientation, humour and metaphor and how they might be relevant and relate to the RP as well as interpreting RPs through an art based approach. In essence this chapter investigated a diverse series of measures that can be used for RP icon interpretation.

The following Chapter 4 defines the methodologies and processes adopted throughout my research in terms of data type, data collection, storage, dissemination and statistical analysis.

Chapter 4 Methodology

"You see things; and you say 'why?' But I dream things that never were; and I say 'Why not?'"
George Bernard Shaw (1856-1950)

4.1 Introduction

This research seeks to gain better insight on how to understand, read and interpret the RP. One way to do this is to look at or identify emergent patterns, consistent usages and prevalent iconography. Thus, results have been achieved throughout this work by qualitative analysis within an overarching wide theme of Action Research. Elements of the methodological structure relate to the Grounded Theory framework (Glaser & Strauss, 1967). Robustness of data was achieved using intercoder reliability indices (Baer & McKool, 2009) measuring homogeneity (extent of consensus) to strengthen the validity of the findings. I shall be explaining, in detail, these methods and frameworks throughout this chapter. One aim of this research was to collate, analyse and document a substantial collection of RPs that will build up a databank of RP iconography for this and future research projects. Other aims look at how the RP is facilitated and how people think and act during the RP process. Thus, my research is diverse in data collection and analysis methods. This chapter is broken down into 7 main sections which determine motivation, methodology, data collection and analysis.

3.2 The Research Question
3.3 Motivation
3.4 Determining the Methodology and Epistemology
3.5 Data Collection
3.6 Data Analysis
3.7 Limitations of Data Collection and Analysis
3.8 Summery of Methodology Chapter

These sections will demonstrate understanding on methodology (the philosophical approach), methodologies (physical approach) and methods (techniques used). The final section looks at limitations of this research and the possible routes to other areas of consideration and to what extent they might have yielded different results had they been explored further.

4.2 The Research Question

The main research question (taken directly from the hypothesis,) asks:

Will, for some individuals and in certain situations, the rich picture tool be enhanced by adding small elements of structure to both the facilitation and construction stage and can a set of distinguishable enablers improve end user interpretation?

My hypothesis assumes the affirmative position to the above question. To confirm and justify the hypothesis I have divided the research areas into 3 main sections all of which will include individual literature reviews, specific tests and relevant findings. The research area (RA) sections are:

RA1: Facilitation
RA2: Construction
RA3: Interpretation

This research discusses the importance of the RP tool, argues the need for adding small amounts of structure and introduces an icon interpretation framework to aid understanding. The main test findings look at the benefits and implications of providing a pre-drawing lead-in session, a legend of icons and a visual framework for icon understanding. An empirical analysis of iconography within RPs provides the underpinning and support for the contribution to knowledge in this field.

4.3 Motivation

Due to internet technology and rising globalisation there is an increasing need for information systems to be more robust, flexible and able to cope with the multifaceted complexity of human activity (Sherwood, 2002). Senge (1990) suggested back in the 90's it was becoming inadvisable to fix problems or design new system solutions without taking into consideration the whole problem situation rather than the supposed isolated areas of concern. The RP is an established tool for looking holistically or 'zooming out' of a situation. Weick reports that there is not enough consideration being applied to the pre-modelling or knowledge elicitation phase of system building (Weick, 1993). It has been widely acknowledged that gaining multiple perspectives from those involved in a problem situation provides improved

understanding (Ackoff, 1978). The RP, although gaining popularity in industry (Bell & Morse, 2012), is not a common tool (Bronte-Stewart, 1999) for multiple perspective problem understanding. This somewhat moderate use is primarily due to the problems associated with using the tool as stated in Table 2.3. I have, to some small extent, already completed a background study on the iconography in the RP with my BSc undergraduate dissertation: (Berg, 2010). This one year of research work was the main motivation for continued investigation with the RP. I discuss this background work and the motivation for further research in Chapter 5, section5.2.

My current research explores the issues highlighted in table 1.2 and offers, where possible, solutions to overcome such difficulties. The benefit of this research is an interlinked and guided set of objectives.

O1: Determine RP facilitation process styles and the materials offered to participants.

O2: Isolate, through the collation of the iconography, the specific images that occur and indeed re-occur over many rich picture samples

O3: Analyse the above collation looking for similarities, duplications, emergent themes, grammar associations and relationship dependencies.

O4: Isolate the most common non domain specific icons gleaned from the above analysis to be used in a key symbol legend

O5: Use the legend to investigate areas in which structure may increase usability and robustness of the tool.

O6: Determine, using the results of the prior investigation (objectives 1-4), what can provide insight on how best to use RP to explore the group mindset.

4.4 Determining the Methodology and Epistemology stance

It is important to note that the methodology was not determined in advance and then applied. Unlike many traditional thesis styles my research evolved as a bricolage[9] within the wider theme of an Action Research methodological approach. This approach is essentially

[9] Bricolage: the method emerges in response to the task of conducting the study. Rather than imposing a pre-determined method on the topic the researcher is well informed about a range of alternative approaches, and selects from these to 'get the job done' (McLoud, 2001, pp. 119-129)

qualitative as defined by Bannister et al (Bannister, Burman, Parker, Taylor, & Tindall, 1994);

"*Qualitative research is the interpretative study of a specified issue or problem in which the researcher is central to the sense that is made"(Ibid,p2)*

Prediction of outcome is not a meaningful goal in qualitative study. Qualitative research is more concerned with the understanding of process and gaining knowledge of the 'what' and 'how' questions. Action Research (AR henceforth) is purposely designed to help to implement change and provide solutions that affect social systems. According to Cohen and Manion AR is, "*a small scale intervention in the functioning of the real world ....and the close examination of the effects of such interventions*" (Cohen & Manion, 1996, p. 186).

There are however, elements of my research that can be argued to be quantitative in nature; these are discussed in section 3.16. The epistemological stance of this research is taken to be one of both empirical (bottom up thinking as adopted by Francis Bacon 1561-1626) and also constructionist (top down thinking as adopted by Descartes (1596-1690) as reproduced in (Bristow, 2011). This twofold stance is defended by taking the viewpoint that human beings have the capacity to see the world around them both subjectively and objectively. Any attempt to divide the two in an AR environment would, in my opinion, be impossible to sustain, with any true certainty of findings. This is a study of human worldviews, perceptions, emotions and attitudes thus requiring a pragmatic approach or in essence finding a way that works and embracing it.

Considerable time was spent trying to find a methodology that would suit the needs of my research. It was difficult to find a methodology that would allow flexibility of exploration whist giving enough structure to ensure robustness of outcome. McLeods five methods were considered as they are very highly rated in qualitative research journals but it was found they were too heavily focussed on counselling and interview techniques and unrelated to this work of gathering data from visual media (McLoud, 2001).

From further reading Willigs' six methodological approaches seemed a good starting point (Willig, 2008).These are:

1. Grounded Theory GT)
2. Phenomenology (IPA)
3. Case Study
4. Discursive Psychology
5. Foucauldian Discourse Analysis (DA)
6. Narrative Psychology/memory Work

However, most of this six are looking at spoken or written language analysis and do not relate to visual data collection and interpretation. Initially the interpretative phenomenological analysis (IPA) approach was the most closely related of Willigs' six. IPA was developed by Jonathon Smith to allow rigorous exploration of idiographic subjective experiences or social cognitions and has been used extensively in British psychology (Hart, Scoular, & Brigg, 2001); (Thompson, Kent, & Smith, 2002); (Biggerstaff & Thompson, 2008). It became apparent, from further research that the data collection method in IPA is predominantly interviewing and the analysis relies upon clustering of work groups (Biggerstaff & Thompson, 2008). To some degree this clustering into themes might have worked as part of a mixed methodology for this work in visuals as, instead of words, the pictures could be clustered into themes. However, adopting the specific IPA approach was abandoned as a methodology because the techniques used were very prescriptive and the analysis focussed solely on understanding behaviour. Looking further into social science techniques the discourse analysis (DA) was explored as a possible option. DA is a complex analysis technique looking predominantly at language and how social constructions are made and understood. DA, as with IPA, looks to cluster into themes of transcribed text. DA centres upon how people use discourse to maintain or construct their own identity. Once again, although not totally irrelevant as a methodology, DA was rejected due to the style of the data collection and the lack of reliability of interpretation.

An extensive review of relevant system and qualitative literature considered; (Banister, Burman, Parker, Taylor, & Tindall, 1994); (Jayaratna, 1994); (Hildreth & Kimble, 2002); (Hirschheim & Klein, 1995); (Lombard, 2002); (McLoud, 2001); (Mullekom & Vennix, 2008); (Mumford, 1996); (Patching, 1990); (Patton, 1980); (Rosenhead & Mingers, 2001); (Seely, Brown, & Duguid, 1998); (Senge P. , 1990); (Waring, 1989); (Wilson, 1984); (Willig, 2008) (FitzGerald & FitzGerald, 1973); (Wood-Harper, Anthill, & Avison, 1985). It became apparent that there was no 'one size fits all' methodology that would work with this research. There were no obvious methodologies that fitted with understanding pictures and icons. This led to a journey of research into semiotic methods of enquiry (Peirce, 1931-1958); (Saussure, 1916); (Chandler, 2009) but it was found that this discipline was too heavily analysed from a marketing perspective, i.e., symbols and their meaning predominantly relevant to the sales industry. Studying further literature the search naturally emerged into areas of art appreciation and research pertaining to illustration: (Kandinsky, 1977); (Goldsmith, 1984); (Tufte, 1990); (McCloud, 1993); (Birren.F, 1961); (McCormack.K, 1998). These readings

were of great interest and the discipline of art appreciation is discussed in considerably more detail in Chapter 6.

Upon reflection the search returned back to Willigs' 6 approaches and in particular to Grounded Theory (GT henceforth). GT is not, as the name suggests, a theory, but is in fact a method to develop theory, based or grounded, upon qualitative data. Developed by Glassier and Strauss GT does not follow traditional methods; hypothesis, question, method, data collection, analysis and hypothesis contradiction or confirmation. The GT approach involves iterations of interpretation of small amounts of data thus allowing for a continuous refining of the main concept. As with IPA, themes and clusters of data patterns emerge but the GT approach allows considerably more flexibility with data type, storage and collection methods. GT attempts to conceptualise observed data so it is not necessary to have a hard question or hypothesis in advance. GT results are a collective collection of human responses to differing situations. Theoretical memoing is used in GT;

"*Memos are the theorizing write-up of ideas about substantive codes and their theoretically coded relationships as they emerge during coding, collecting and analysing data, and during memoing*" (Glaser, 1992, p. 8)

The GT approach allows a researcher to be guided by the data rather than be limited by it. Myres et al recently noted than GT is becoming a popular approach in information system research (Myres & Klein, 2011) and in previous works Baskerville and Myres state;

"*if the researcher is able to make an original contribution [...] by using the techniques of grounded theory for coding only, then I believe this somewhat limited use of grounded theory can be justified*" (Baskerville & Myres, 2009).GT is used to facilitate a process of discovery by helping to categorise. Categories in GT can be simple, low level abstractions by way of interpretation rather than defined labelling. Coding in GT is often fed by intuition looking for what seems to be common similarities within data. Ultimately GT allows a researcher to move back and forward between data collection and analysis accepting that emerging categories might require different levels of abstraction.

So, after much reading, contemplation and deliberation it was decided the philosophical approach is to be one of AR, with GT, using a plethora of mixed techniques to acquire understanding and knowledge. Such enquiry ranges from maintained reading throughout research, attending workshops to get insider perspective, facilitating group RP work, facilitation of individual RPs, collecting sorting and analysing pictures, statistical analysis of data, social networking, interviewing, training volunteers in RP assessment and maintaining a

marketing campaign to encourage people to donate their RPs. Data collection techniques are discussed in more detail in the following section 3.14.

4.5 Data Collection

Data collection completed here began in 2009 for a BSc dissertation project (Berg, 2010). The pictures collected in 2009 were sourced from a variety of places and people. As well as amassing a substantial collection of RPs from books and academic papers there were also requests made for individuals and groups to draw RPs. Many of the individual pictures are based on a single scenario. I have included a condensed walkthrough of the major findings in Chapter 5 of this document. After dissertation, and upon the award of a 3 year PhD funding scholarship (2010-2013), the project expanded into a much larger development. Further RPs were requested, and donated. Group workshops were both participated in and facilitated. RPs were sourced from current literature, website and practitioner personal collections. Requests were made within networking groups, via seminars and conference talks resulting in an extensive and prolonged gathering of data. Data collection was stopped in January 2012 in order to analyse and test the samples. There are 298 RPs in the databank system which I am calling the icon dataset. There have however, been many more RPs donated by colleagues and generated in personal workshops since this cut off date and they have been stored for future addition to the collection. For the sake of analysis and project time constraints it was decided to add these further pictures to the icon dataset after the PhD research has been completed subject to further post doc funding.

The pictures have been collected from a variety of sources (Figure 4.1). The RPs have been sourced from books, academic papers, the internet, workshops, and scenario tests. Both the Falkirk and Fife Council samples came from specific UK office based scenario tests. The ‘other’ in Figure 4.1 represents pictures that have been donated by academics and industry practitioners or acquired during workshops.

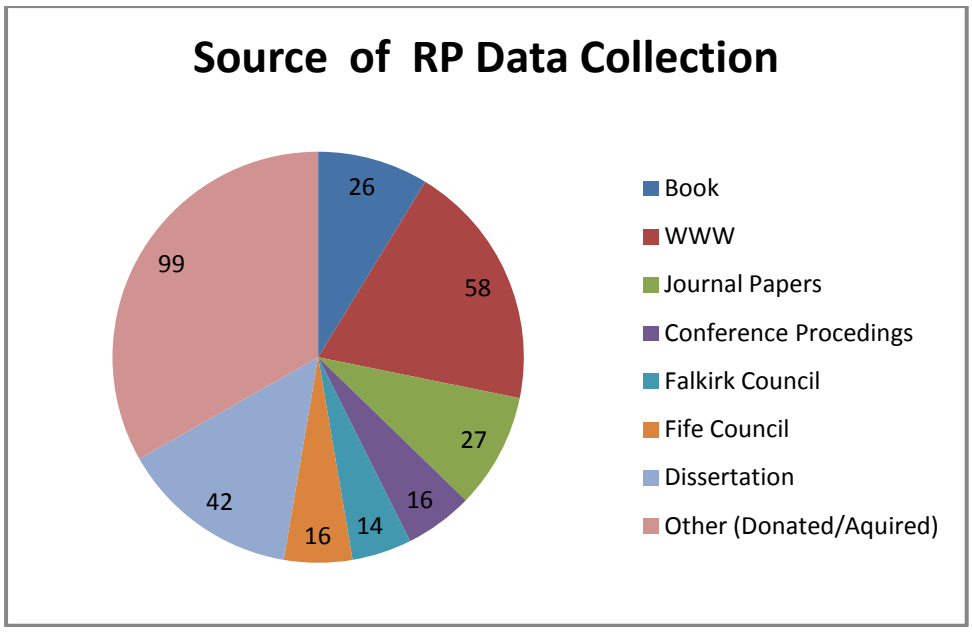


Figure 4.1 Data Collection Distribution

NB) It should be noted that the 42 samples that are called 'Dissertation' have been gathered prior to this PhD work and were part of my initial BSc study. All 256 remaining samples have been gathered as part of the PhD work.

Every picture has been stored as a hard copy in folders and given a unique identifier code. This code or RP number has been entered into an Excel spreadsheet along with all relevant data pertaining to each picture. The fields included in the spreadsheets are;

RP number
Source of RP
Domain of picture (sustainability, government, environmental, construction, university, school, charity, NHS, business/commercial, Travel and tourism, other and unknown)
Gender of artist (s) if known
Drawn as a group or by an individual
Colour (yes/no, one or two colours more than black/grey)
Date of picture if known
Count of icons in picture
Age of artist if known
Legend drawn or given to participant
Source Country
Computer generated (yes, no, partly)
Richness rating
Kinetic rating
Coherence rating
Boundary score
Humour score

All icons, in every picture, were recorded in a separate spreadsheet if they were duplicated more than 4 times throughout the 298 RPs. A total of 72 icons were found to be replicated in this way across the entire icon dataset regardless of domain. The results and a full discussion of this can be seen in Chapter 5.

The spreadsheets containing the data were not designed to have a polished front end. It was decided that spending time on a usable GUI and implementing a neat HCI front end would be time wasting for this project. The data is all accessible and workable for the researcher but probably difficult for a non expert user to understand or indeed manipulate according to their own need. It would be a simple, but time-costly, job to create a database with preset SQL commands in order to allow others to access question and compare the data. It is envisioned that the data should become open source after this project. My research work is becoming more widely known due to journal papers, seminars, colloquiums, media interviews and conference talks (OR54, 2012) & (Berg 2012a, b,and c). To this end there are still emails and letters from academics and practitioners, who are not known to the researcher, offering their RPs to add to the collection. A recent example (Nov,2012) of this was an email from the H.E. Ambassador of South Korea and Libya offering a RP from the first SSM workshop ever held in Libya investigating the 2012 National Congress elections (Figure 4.2).

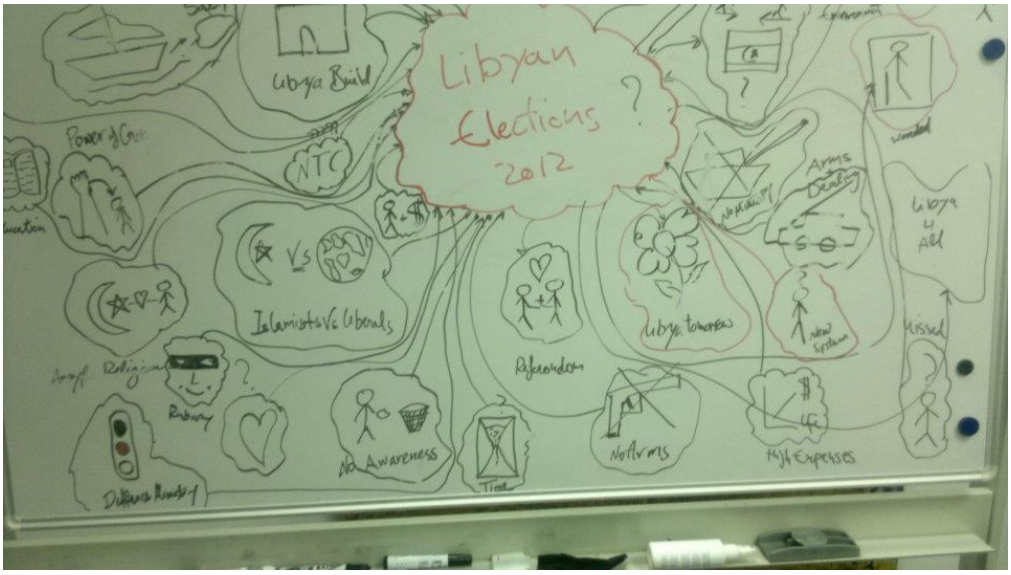


Figure 4.2 RP of 2012 National Congress elections in Libya

Some areas of my research were approached using an ethnographic study as this method offered the optimum understanding of group and individual practices in the context of drawing a RP. Ethnography is a descriptive account of cultural practices and qualitative observations made within ethnographic fieldwork. Ethnography has its roots most formally in

cultural anthropology (Geertz, 1973); (Malinowski, 1922); (Mead, 1928) although nowadays academics, from a variety of disciplines, have begun adapting the method to engage with other theoretical frameworks. Ethnography essentially relies on participant observation, qualitative interviews, and analysis of cultural artefacts with interpretation relying on qualitative statistical approaches. The first part of my research was interested in mapping out facilitator workshop practices for both group and individual picturing. Thus, adopting an ethnographic approach in Chapter 4 was seen as the best way to gain better understanding

4.6 Data Analysis

"*Data analysis is the process of bringing order, structure and meaning to the mass of collected data. It is a messy, ambiguous, time-consuming, creative, and fascinating process. It does not proceed in a linear fashion; it is not neat. Qualitative data analysis is a search for general statements about relationships among categories of data.*"

(Marshall & Rossman, 1990, p. 111)

Analysis was aided by Excel spreadsheets which allow for the counting and recording of duplicated icons and relationship associations on the separate pictures. Excel, along with being very transportable and robust, has excellent advanced tools that are more than sufficient to analyse my data. Excel however, is not particularly efficient at analysing qualitative data. Extensive research was undertaken to find a relevant qualitative analysis tool for studying the RP iconography. There are a small number of accessible software tools such as Atlas and NVivo but they are primarily focussed on text and speech analysis and not pictures. To this end I decided to create a program of spreadsheets to store the iconography data using the pivot table functions for in-depth and comparative analysis. Such is the unusual nature of this human perception/reception research a considerable amount of the analysis was achieved by physically comparing RPs without the use of technology. Figure 4.3 is a picture of one of the many colour coding systems used throughout the research as a means of identifying areas of interest. Physically coding pictures has been a good analysis tool as often clusters or themes emerge from the process that would not have been apparent in any other form of investigation.

Figure 4.3 Photograph of Hand Coding Analysis using Coloured Tags

The RPs have been rated/scored on richness, coherence, kinetics, boundary and humour. These ratings have been verified by external judges. The following describes the criteria for each rating with an explanation on how the judging was accomplished.

Richness rating looks at the all-round richness of the picture. Score was based on elements such as storytelling, colour, kinetics, boundaries, expression, relevance of visuals and coherence.

1: Very rich picture, high on expression, visual elements, colour, kinetics and coherence
2: Good picture with reasonable amount of expression, visual elements, colour kinetics and coherence
3: Acceptable as a rich picture showing some visual elements with limited coherence
4: Poor picture with few visual elements
5: Very poor picture with no visuals elements

Kinetic rating looks at how the connectors in the picture enhance a story in terms of motion, direction and association.

1: Good variety of connectors showing direction, tone, grades of thickness and size
2: Reasonable use of connecters but little use of thickness, size and tone.
3: Poor use of connectors showing no variance in size tone and thickness
4: No connectors

Coherence / narrative rating: to what extent is there a story in the picture? Are the elements clearly related to each other or simply struck on the page with little thought to their coherence?

1: Clear story told using relevant and visual elements
2: At times there is a story being told but often can be ambiguous in meaning
3: Unclear story using unclear visual elements
4: Little or no visual elements with no obvious story
5: Text only

Boundary score:

1: One clear boundary showing both internal and external elements
2: More than one boundary showing other sub-boundaries
3: Edge of paper or colour used as the boundary indicator
4: No boundary

Humour score:

1: No obvious humour
2: Possible interpretation on a few elements
3: Possible interpretation on many elements
4: Humour clearly attempted by the artist(s)

I personally rated all 298 pictures. To offer some degree of validity to these ratings Content Analysis (CA) was used[10]. CA is a qualitative way of determining the presence of certain words or concepts within texts or sets of texts. For the purpose of my data and due to the lack of tools available for visual determining, or understanding pictures, it was decided to use the fundamentals of CA. So, instead of looking for the presence of words in text CA was used to looks for icons and elements in pictures. It is widely believed that CA is, "*fundamental to communication research*" (Lombard, 2002). To make sure the content analysis coding is reliable and the analysis can be trusted Intercoded Reliability tests were conducted. Intercoded reliability is a term used for the extent to which independent coders evaluate a characteristic, message or, for the purpose of my research, a picture to the same conclusion as originally rated by the researcher. In essence it offers an indication of measurement consistency.

[10] Humour and Boundary have been scored by myself and have not been rated by the judges. Boundary lines were either clearly identifiable or not and therefore not requiring a second opinion. It was felt that humour was too subjective and aligned to personal preference thus, accepting criticism; I have rated humour from my own personal standpoint. Humour is discussed in more detail in Chapters 5 & 6.

I used one of the rating tools used in CA called the Consensual Assessment Technique (CAT).

"The Consensual Assessment Technique is a powerful tool used by creativity researchers in which panels of expert judges are asked to rate the creativity of creative products such as stories, collages, poems, and other artefacts." (Baer & McKool, 2009)

A sample test was trial run on 12 students before 'going live' to iron out any issues of incorrect wording or errors in the rating questions. I then advertised for volunteers. An advertisement was posted within the internal department 'participate' website (http://www.drpawel.co.uk/participate). This website exists to allow researchers to advertise their projects and volunteer requirements. I shared this site on my Facebook and Twitter accounts and offered £10 Amazon vouchers to all volunteers. Nine raters were chosen to be the expert judges of the RPs. They were chosen to get a good mix of age, gender and occupation. They were encouraged to use their own subjective definition of creativity as they rated the pictures. The chosen judgers were not trained or given an opportunity to confer with one another. The judges were, however, given exposure to many RPs and encouraged to ask questions and understand the wider research area of my work before applying their specific ratings to the pictures. Individual time was spent with each of the raters showing them samples of RPs. The judges were not asked to defend their ratings in any way. The nine judges were not aware of RPs before the task. There was a good variety of age, gender and occupation amongst the judges (table 4.1).

Judge Number	Age Range	Gender	Occupation
1	**40-49**	**M**	**Support worker**
2	**18-29**	**F**	**Student**
3	**30-39**	**F**	**Housewife**
4	**18-29**	**M**	**Student**
5	**40-49**	**F**	**Physiotherapist**
6	**50-59**	**F**	**Research Associate**
7	**40-49**	**M**	**Charity fund manager**
8	**18-29**	**M**	**Computer Technician**
9	**60+**	**F**	**Retired Banker**

Table 4.1 Information on judges

Kaufman et al state;
"*The average number of expert judges reported by Amabile (1996) is just over 10, with a low of 2 (in which case only a simple r correlation coefficient could be reported) and a high of*

40. For most purposes, five to ten experts represent a sufficiently large group. Using fewer than five experts runs a serious risk of having an unacceptably low level of inter- rater reliability, and using more than 10, although desirable (after all, the more experts, the higher the inter- rater reliability is likely to be), is rarely necessary and can become expensive and burdensome." (Kaufman, J Plucker, & Baer, 2008, p. 58)

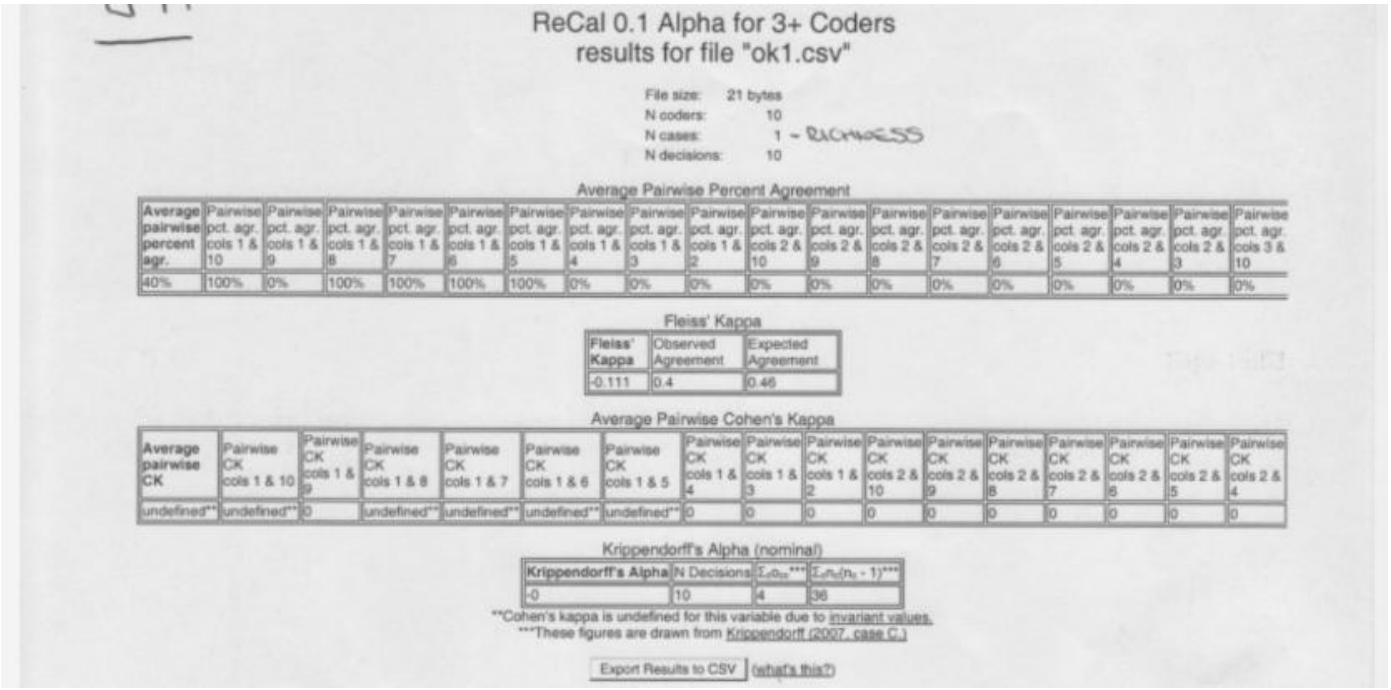
Thirty, picked by a random number generator, pictures (around 10% of the whole icon dataset) were assessed and rated by the 9 judges. Creativity or scoring of RPs is difficult to determine but it was hoped that the levels of Inter-Rater Reliability (agreement) would consistently emerge as high (over 70%).

Upon analysis, a mean and mode score for all 30 expert rated pictures was produced. Figure 4.2 is an extract of the RP17, which was one of the 30 pictures randomly selected and shows the calculation of mean and mode scores.

RP Number	Volunteer Ref	Richness Rating	Connector Rating	Coherence Rating			
RP17	Researcher	1	2	1	RP17 Richness	RP17 Connector	RP17 Coherence
RP17	V1	3	3	2			
RP17	V2	2	4	2	Reasearcher score: 1	Researcher score: 2	Researcher score: 1
RP17	V3	2	2	2	Raters mean: 1.6	Raters mean: 2.4	Raters mean:1.4
RP17	V4	1	2	1	Raters mode: 1	Raters Mode: 2	Raters mode:1
RP17	V5	1	2	1			
RP17	V6	1	3	1	(note: analysis in red shows the scores that have significant difference)		
RP17	V7	1	2	1			
RP17	V8	2	3	2			
RP17	V9	1	1	1			

Figure 4-2 Extract of Analysis table

This was compared with the results to the original rating given by the researcher at the beginning of the test. In figure 4.2 the researcher rating is shown on the first line of data and the V1-V9 shows the volunteer ratings. Out of the 90 (3 variables x 30 pictures) separate rating results there were 20 that showed a significant difference of agreement (> or <0.5%). In figure 4.2 one such significance is shown in red. These 20 significant differences were then processed through the ReCal3 reliability calculator (Freelon, 2010) to compute the Inter-Rater reliability coefficient of the data. Figure 4.3 shows a copy of the findings for the significance indicated in RP17 as seen in figure 4.2. The data was assessed using the four common intercoder investigative analysis techniques; Average pair wise percent agreement, Fleiss' Kappa, average pair wise, Cohen's Kappa, and Krippendorff's Alpha. All remaining 20 pictures passed the inter-coder reliability tests.



ReCal 0.1 Alpha for 3+ Coders
results for file "ok1.csv"

File size: 21 bytes
N coders: 10
N cases: 1 - RACHAEL55
N decisions: 10

Average Pairwise Percent Agreement

Average pairwise percent agr.	Pairwise pct. agr. cols 1 & 10	Pairwise pct. agr. cols 1 & 9	Pairwise pct. agr. cols 1 & 8	Pairwise pct. agr. cols 1 & 7	Pairwise pct. agr. cols 1 & 6	Pairwise pct. agr. cols 1 & 5	Pairwise pct. agr. cols 1 & 4	Pairwise pct. agr. cols 1 & 3	Pairwise pct. agr. cols 1 & 2	Pairwise pct. agr. cols 2 & 10	Pairwise pct. agr. cols 2 & 9	Pairwise pct. agr. cols 2 & 8	Pairwise pct. agr. cols 2 & 7	Pairwise pct. agr. cols 2 & 6	Pairwise pct. agr. cols 2 & 5	Pairwise pct. agr. cols 2 & 4	Pairwise pct. agr. cols 2 & 3	Pairwise pct. agr. cols 3 & 10
40%	100%	0%	100%	100%	100%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Fleiss' Kappa

Fleiss' Kappa	Observed Agreement	Expected Agreement
-0.111	0.4	0.46

Average Pairwise Cohen's Kappa

Average pairwise CK	Pairwise CK cols 1 & 10	Pairwise CK cols 1 & 9	Pairwise CK cols 1 & 8	Pairwise CK cols 1 & 7	Pairwise CK cols 1 & 6	Pairwise CK cols 1 & 5	Pairwise CK cols 1 & 4	Pairwise CK cols 1 & 3	Pairwise CK cols 1 & 2	Pairwise CK cols 2 & 10	Pairwise CK cols 2 & 9	Pairwise CK cols 2 & 8	Pairwise CK cols 2 & 7	Pairwise CK cols 2 & 6	Pairwise CK cols 2 & 5	Pairwise CK cols 2 & 4
undefined**	undefined**	0	undefined**	undefined**	undefined**	undefined**	0	0	0	0	0	0	0	0	0	0

Krippendorff's Alpha (nominal)

Krippendorff's Alpha	N Decisions	$\Sigma_c o_{cc}$***	$\Sigma_c n_c(n_c - 1)$***
-0	10	4	36

**Cohen's kappa is undefined for this variable due to invariant values.
***These figures are drawn from Krippendorff (2007, case C.)

Export Results to CSV (what's this?)

Figure 4-3 Relcal results for RP17

The Relcal interrelated reliability tests measure homogeneity or the extent to which consensus can be accepted. I ran a Relcal test for every indication where the mean and mode scores differenced significantly and looked to see if I could have acceptable agreement across the board of all pictures. The Relcal results agreed that my rating results for the volunteers and researcher are acceptable in terms of reasonable consensus. Therefore, to surmise, it is considered reasonable that the ratings I have given to all pictures in the icon dataset are realistically reflective of common opinion. According to Lombard et al (2002) and Tinsley et (1975) al this type of assessment and recording for qualitative content analysis is a reliable and acceptable to proceed for calculating coding scores of independent judges. As previously stated Kaufman et al (2008) suggest that, "*five to ten experts represent a sufficiently large group"* to allow an interrelated reliability test to be conducted. I had 9 judges in my test. Thus the results of this type of qualitative testing ensure, with what is described as a 'reasonable' amount of surety (Ibid), that it is accurate to carry on and rate all samples as a fair and agreed upon judge.

4.7 Limitations of Data Collection and Analysis

A large part of this research was classically scientific or reductionist in nature; thus to acquire understanding, the RPs needed to be broken down into smaller pieces. The icon dataset is a

catalogue of every data sample RP with elements (icons) being extracted from the whole (picture). Thus, although the icon dataset is empirically bounded it is still open to the researchers' subjective interpretation as to what constitutes an icon, connector, humour and boundary. Care and attention was taken to dismiss any ambiguous elements (icons that might have multiple interpretations) only recording clear and evident iconography. The icon dataset itself could be open to criticism; attempting to divorce the icons from the whole picture is potentially meaningless just as it would be to extract words out of a sentence and attempt to find meaning. In Chapter 6 this possible criticism is heavily reported upon and defended using a variety of examples. It should be noted that many of the major findings of this research would not have been possible without the cataloguing and icon deconstruction of the pictures.

Other areas of this research are also subjective. Individually scoring boundary and humour in pictures is highly debatable to report as robust data. Rating on richness, kinetics and coherence, even with running inter-rated reliability tests, can still be open to criticism. The judges were chosen to get a good variety of age and gender but it was not possible to get a good spread of different nationalities and culture. All the judges were white British with the exception of one white American who had been in Britain for over 40 years. Humour was only rated by the researcher and not judges as it was felt that humour was far too lacking in objectivity and is aligned to personal preference. Thus, research findings on humour can only perforce to be anecdotal hence requiring further research to be able to report as robust. I suggest that since there has to date been such limited research into RPs it is still useful to provide anecdotal evidence to become the basis of further research.

Running workshops to test new facilitation exercises and offering icon legends are highly questionable in evaluation due to style and personality of the researcher viewpoint on the day of the tests. Each facilitation test was evaluated in Appendix A by using a comparison workshop and this too is never going to be truly objective. Issues of participant types (culture, nationality, age, gender) and workshop facilitation are always open to interpretation. All of these issues and potential inadequacies have been addressed within this thesis in Chapters 3 and 5 and many have been reflected upon in refereed journal and conference papers during my research journey (Berg, Pooley, & Queenan, 2011); (Berg & Pooley, 2012a); (Berg & Pooley, 2012b); (Berg & Pooley, 2012c).

Another problem that became all too apparent throughout the data collection phase of the research was the issue with colour copies. Many pictures, taken from books and journals were not in colour even though the original was drawn in colour. Considerable time and

investigation was spent trying to source the original colour copies but this was often unsuccessful. Colour copies were also an issue with some of the donated pictures. Often the originals were destroyed or lost and the only copy was a black and white scanned image. The problem here is that RPs are often drawn on flipchart size paper and it is rare, due to the expense, for an organisation or university to have access to a large colour scanner/photocopier. So often the images are only kept in black and white format. This too, has been a problem in my own research. Flipchart paper is very flimsy and light and is difficult to store neatly. Photographing pictures with a high quality camera is one way to capture all visual elements but pictures are often unclear and external light/condition dependant. Many of the donated pictures in the icon dataset are colour Jpeg pictures but these are not always of particularly high quality and often clarity is lost due to photographic quality.

One mistake during data collection ended up having a serendipitous outcome. Thirty of the pictures were rated by judges on richness, kinetics, comprehension. There was, however, originally an emotion rating question asked at the beginning of the exercise. The emotion rating question can be seen in the Appendix It was felt that an interesting question would be to see what mood, expression or emotion could be agreed upon when looking at the pictures. The Plutchik model of the nature of emotions was chosen because it was a strong visual model wherein the emotion concepts are analogous to the colours on a colour wheel. The vertical dimension represents intensity of emotion with the circles showing the similarity and overlap of emotions (Figure 4.4)

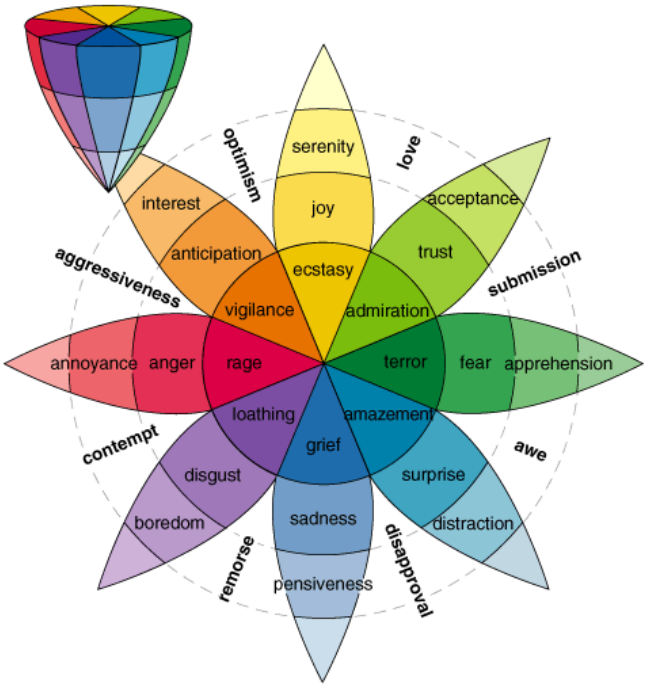


Figure 4-4 Plutchik emotion model (Fractal.org)

After due consideration the emotion rating, although results have been kept for possible future projects, was dropped from the test analysis. The reason for this exclusion came from 3 key deciding factors.

1. The response from the judges suggested that the question was confusing and difficult to interpret.
2. Judges could not find the appropriate words in the list offered. Plutchik's model was too restrictive.
3. Too many of the raters (although not asked to) added their own words to the list

These cumulating factors resulted in the test being too weak for any meaningful results to be analysed to any degree of accuracy. However, the emotion question, although not useful in itself, had an accidental benefit that was unforeseen prior to running the test. The judges, at the very beginning, had to spend a considerable amount of time studying each and every picture to look for any of the 33 emotions listed. This forced the judges to really analyse and concentrate on the pictures. After-test comments confirmed this to be the case with judges saying it took over 90minutes to analyse the 30 pictures mainly because of the time taken to look for emotions.

Quotations in after test discussions and written done on the forms were:

"It took me ages and I had to stare at the pictures for ages"
"The emotions question at the beginning was quite hard"
"I didn't like your answers for the emotion question so I added a few of my own"
"I reckon you just put in the 1st question to make me really look at each picture"

The serendipitous affect was that they were all in an excellent position as judges to move on and rate with expertise and full understanding the following questions in the test. The emotion question forced a deep level of picture study therefore leaving it difficult to be flippant or lackadaisical in attitude for the following questions on richness, kinetics and coherence. It should be noted that although I suggest this was indeed a successful venture it could also be interpreted as a negative outcome. It is quite possible that if I had asked more than 9 volunteers to decided upon picture emotions the process might annoy and grate on people with the possibility of the volunteer refusing to finish the task.

4.7.1 Sampling Process

A major limitation to this research was not being able to cross compare different cultural iconography. It was disappointing to see how few international RPs I managed to collect. The vast majority are from the UK. Another difficulty in data collection was that many RPs could not be sourced as per the country they came from because they were extracted from books, papers and websites. I suggest many are likely to be from the USA but I cannot confirm this with and surety. Although a great deal of time was taken to find RP sources it was frustrating to not be able to gain sufficient data. Even some of the donated pictures that were given could not be sourced on country of origin. The majority of the international pictures (not UK) came from one person who kindly made accessible on drop box a large selection of RPs.
The following is a list of the sampling processes I undertook to collect RPs

- Continuous review of academic literature looking for RPs
- Extended reviews of literature by using references lists of reference lists
- Personal letters and emails to the authors identified in the Literature review who have written books/ papers about the RP.
- Postings on various LinkedIn groups asking for RP donations.
- Telephone and Skype conversations asking for RP donations or links to other people who might also be willing to donate.

- Regular Google scholar and web search using Boolean operators and search criteria with words such as SSM, rich pictures, Checkland, Rich picture +country, Rich picture +author, rich picture icons.
- Running workshops with University students and University staff.
- Running workshops at colloquiums and seminars
- Local business requests asking staff to draw RPs.

Table 4.2 shows the source country distribution for the RPs in the icon dataset..

Rich Picture Source Countries	
UK	117
Unknown	126
Maldives	1
Australia	5
USA	1
Lebanon	5
Kuwait	1
Bangladesh	7
China	2
Spain	6
Saudi Arabia	1
Italy	1
Malta	4
Turkey	6
United Arab Emirates	8
Slovenia	5
Israel	1
Sweden	1

Table 4.2 RP Source Countries

To this end it is not been possible to run comparative data analysis on RP source countries due to the lack of samples and any discussions within this research can only be observational/anecdotal and not defended by any vigorous testing. This is an area of personal interest and, in my opinion, would be highly justifiable of further research should more culturally diverse samples be added to the icon dataset. Gaining better understanding on universal RP iconography would enhance RP interpretation on a global scale.

4.8 Core Analysis of Dataset

One of the primary goals of GT is to formulate the hypotheses based on conceptual ideas. GT does not aim for an absolute certainty or truth but rather to conceptualize what's going on by using empirical data. This style of enquiry is emphasised by Michael Crotty in his book 'The Foundations of Social Research', "*are we guilty of merely plucking a research approach off the shelf ?No we are not. Rather than selecting established paradigms to follow we are using established paradigms to delineate and illustrate our own*" (Crotty, 1998, p. 216) To this end the typology of questions were devised to consider elements and areas of specific interest related to the core objectives of this research. As seen in the previous section (4.7 Limitations) it is not possible to run comparative analysis on several elements of the RP due to the quantity and quality of pictures in the icon dataset. Therefore, it is fully accepted that there are many other questions one could ask of the dataset but it was considered that those given in Chapter 1 relate most directly to the research question. The Typology of Questions have been split into 3 core themes; core structure, artistry and visual coherence and can be seen in detail in Chapter 1. The answer to these and discussion of the results is reported in Chapter 5. In many cases the data has been analysed using observational qualitative analysis but wherever possible a chi square test was run on the actual data and expected data and the probability value is given in the Chapter 5 results.

4.9 Summary of Methodology Chapter

In this chapter I have discussed my methodological structure which, under the wide overarching theme of AR, relates most closely with GT. I have explained how I managed to measure homogeneity amongst the expert raters and gain reasonable surety that the ratings I have given to the RPs are realistically reflective of common opinion. The icon dataset has been analysed and evaluated upon and limitations of the dataset has been considered. Although much of my research has been Qualitative research there has been a statistical quantitative approach taken in Chapter 5 wherein chi square tests are ruin to show probability levels.

Chapter 5 Rich Picture Construction

5.1 Introduction

This Chapter is core to my research as it offers, not only, qualitative data but also, where possible, empirical evidence to support my findings. In the 'Background to facilitation' report, as found in the Appendix, I have discussed the stereotypical process of a facilitator led group RP. In the Appendix we see that there were many different styles of facilitation. I tentatively concluded, through analysing observational data, that better facilitation seems to equate to a better RP. This led me to question is a good or poor RP. It should be noted however that the discursive results in Appendix A can only perforce to be observational and needing further testing to be conclusive.

In this Chapter I seek to understand a RP in terms of its component parts whereas, in Chapter 3, I looked at the wider issues of art interpretation and aesthetics. In this Chapter I firstly offer a detailed description on my previous dissertation results as this new PhD research work is building directly from earlier findings. Secondly I discuss my icon dataset which stores data on a large collection of RPs. In this icon dataset the RPs are recorded across 17 separate variables. I list these variables in section 4.5 in the methodology Chapter. On a separate spreadsheet in the dataset I document every icon that has been repeated 5 or more times across all RPs. By cross comparing the data in the dataset I am able to isolate both strong and weak correlation relationships between icon elements. This then allows me to answer the questions set out in Chapter 1: The Typology of Questions.

Within this Chapter I present a legend of icons that represent the most common elements within the dataset. I test to see if this legend aids the RP process by presenting it firstly to individual (non-group) participant RP creators and secondly to workshop groups. I compare the resultant group RPs with those drawn with no legend.

The following list identifies the following main sections within this Chapter:

5.2 Background Work

This research study would not have been possible without the knowledge gained from my previous BSc dissertation study. The dissertation can be found in the Heriot-Watt Library, Edinburgh (Berg, 2010). This Chapter of my thesis, looking at RP iconography, relates directly to the dissertation. Within this section I will highlight the main points that came from the previous research and explain the motivation behind my continued study in this field.

In the dissertation I claim there has been a change to icons that are renowned as being synonymous within previous RP construction. This work investigated the modern iconography that could be incorporated within a symbol legend for future RP construction.

The dissertation study set out to determine if there are common pictorial icons and symbols that are accepted to have similar meanings within RP construction. Data was retrieved from by people to draw on a scenario based situation a RP. The evidence from this study suggests that there are certain icons that are commonly used in RPs. The second major finding was that icons in the RP shift over time. Some icons that could be suggested as synonymous with the RP in the 80s are not in use thirty years later whilst other icons do not seem to change independent of the domain they are being created within. Males and females take to a RP in different ways and it is tentatively suggested in these findings that females of a certain age draw richer pictures. Another area of interest was that less than half of those who agreed to be participants in the test actually drew RPs. From personal observations and conversations with those who refused to partake it was noted that many did not like, or want, to draw. For some there seemed to be a real irritation and annoyance that they were being asked to do a task which, seemed to them, to be pointless.

The dissertation results offered some interesting findings on the iconography of the RP and these were recently published in 2012 (Berg & Pooley, 2012a). The dissertation results opened up more questions suggesting the need for further work. Thus, it is at this point I took up the PhD study to find answers to the questions that came from the dissertation study.

5.3 Creation and testing of a RP icon legend

Within my previous year's BSc dissertation I had highlighted common duplicated icons that are used in RPs. In my conclusion I suggested these icons to be the most suitable icons to be

put in a key symbol legend for RP construction. I did not however, devise or test to see if such a legend would aid or inhibit RP design. It is at this point I left the dissertation behind and started the new PhD work.

I put together a RP icon legend. The type of elements and icons included in this legend came directly from the current icon dataset results. Figures 5.1 and 5.2 show the most replicated icons across all domains from the 298 RPs in the icon dataset. The following two figures (5.1-5.2) showing chart data should be viewed as one long chart and not two separate. I had to split the chart into two to show all the results.

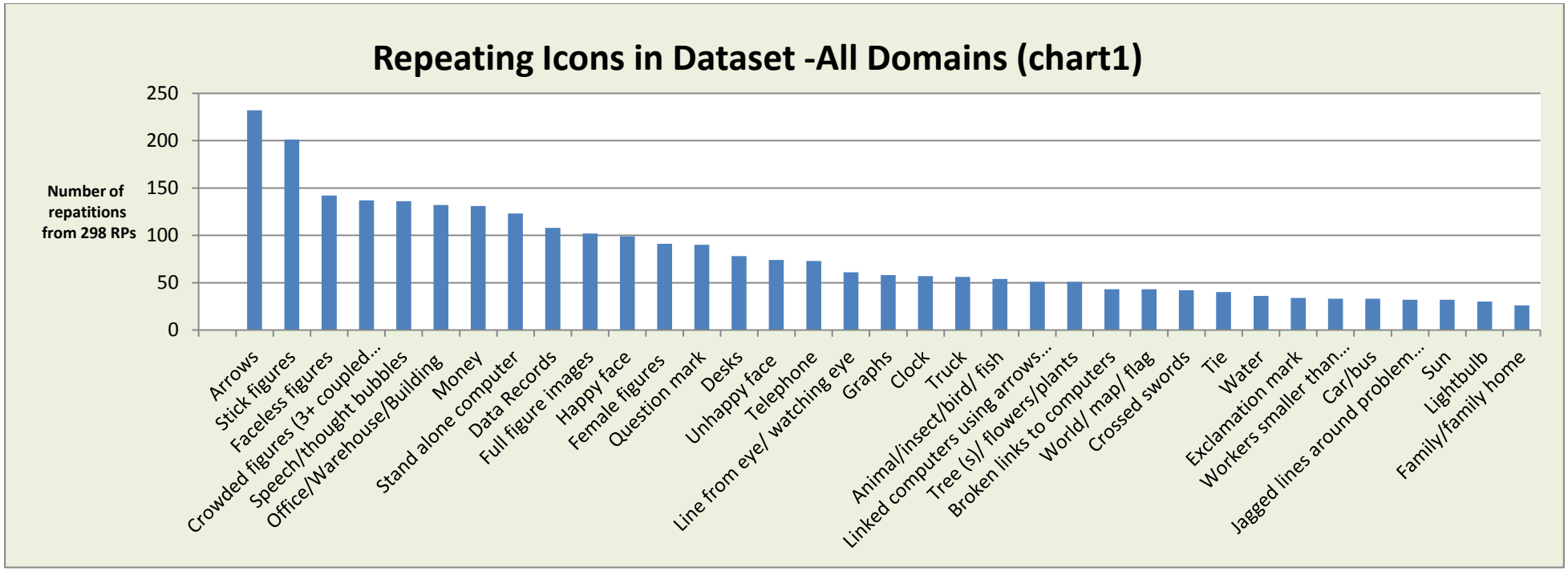


Figure 5.1 Repeating Icons in Icon Dataset

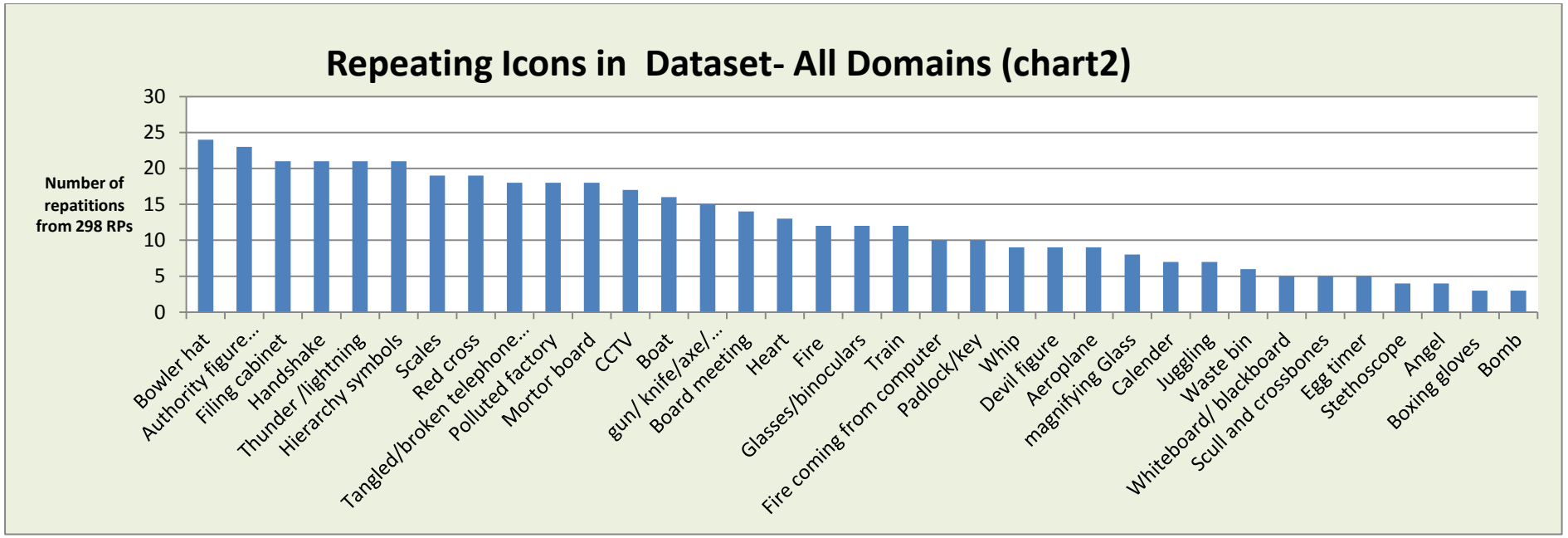


Figure 5.2 Repeating Icons in Icon Dataset

These icons have then been depicted in the legend in a visual format (Figure 5.3). I did not offer every repeated icon in the legend because I felt it would be too confusing and crowded to represent all replications. I showed the top 50 of the repeated icons.[11].The legend was made up of actual (real) icons that have been included in previously drawn RP's. It is readily accepted that there are other options for the style of the legend icons but I felt that using digital icons, although perhaps offering a more professional representation, would detract from the freeform and spontaneous nature of the RP.I wanted to create a legend that looked almost messy and unordered just as RPs often are. I wanted the legend to potentially aid design rather than be too leading. It was hoped that using this type of artistic style for the legend would provide a way of merging with the author's free-hand style RP. The legend was designed to be copied by RP creators and therefore the icons were simple in structure.

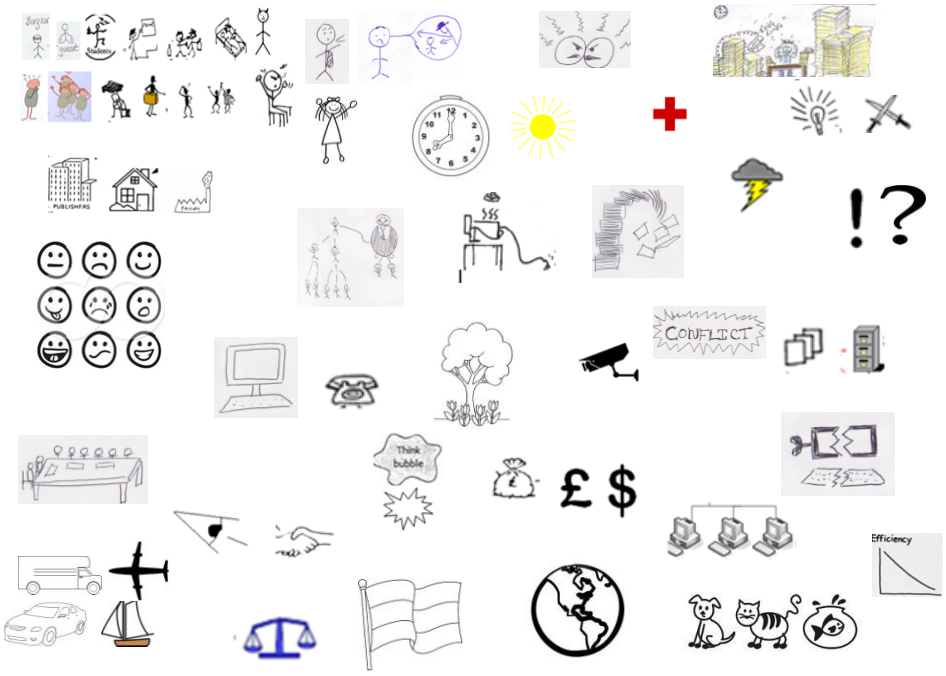


Figure 5.3 RP legend showing most common icons from the RP Icon Dataset

I then ran a test to see how the legend, using the same RP scenario used in the dissertation, would be received by those drawing a RP. The legend was given, with permissions granted, to 15 local civil servants' working in differing departments across a Scottish Fife based

[11] It should be noted that the top 50 icons changed during the research due to more RPs being added to the icon dataset. Figure 50 is what the legend looked like once all 298 RPs were added to the icon dataset.

Council. It should be noted that individual RPs were being created in this test and not group pictures. The participants were asked to not only draw a RP but also comment about the legend in a questionnaire. The following positive comments were received about the legend:

The legend was helpful to give me a starting point but I didn't use any of the symbols

Legend helped me to check out what types of symbols to use

Found the legend helpful for ideas

I used a few icons as a basis for the type of icons I went onto create

Legend helpful. Gave ideas and indication of symbols to use

Legend was useful but I felt they were already well known and a bit obvious

Useful to start thinking

Legend was good. I needed the ideas

Good reference for information required

Some of the symbols explained certain parts of my picture perfectly

Legend helpful, I am not a good drawer and needed some help

Used some of the icons

The negative comments about the legend were:

Dislike the icons presented

Did not use the legend. I had clear ideas about how I wanted to draw and felt that looking at the legend would change what I would draw.

I think I would have used the same symbols without the legend

5.3.1 Summary of results from testing the legend on individuals

It can be seen that the legend was accepted as useful for those drawing an individual RP by 80% of the people asked in the Scottish council. RP construction, it would seem from the received responses, is made less complicated by the use of established RP icons. For some, the legend was useful as a starting point for understanding. Three out of the fifteen people did not use the legend and one person suggested that the icons were leading and would stilt creativity. Thus, the legend does seem to offer an aid to RP design but for some it was not needed or required. I then wondered if the RP legend would be useful to those who draw RPs in groups. I use the term 'useful' in a mechanistic way meaning an 'easing into the getting of people to draw'. I am not suggesting that a legend will be uniformly 'useful'. Some will not want, nor indeed need, clues to help them uniquely express themselves. Section 5.4 discusses a test implemented on university students who drew RPs in two groups. One group were given the legend and the other group were not. I compare the pictures and the questionnaire responses.

5.4 Testing of legend on group RPs

Two groups made up of four male students each were given a 'University problem situation' scenario and asked to draw a RP diagram. They had never drawn a RP. Information on what to include and how to complete the exercise was given to all students via a PowerPoint presentation. Groups were split into 'Group A' and 'Group B'. The only difference between the two groups was that Group B was given a legend of commonly used RP icons and pictures[12]. Group B were told, on the instruction sheet, that they were welcome to copy any icons that might be relevant within their own diagram. The subjects were given 30 minutes to complete the task.

Once the task was completed the students were asked to complete individual questionnaires. The questionnaires were different depending on what group the students were in. Group A were shown the legend for the first time and asked if they would have found it useful. Group B were asked questions specific to the legend they had been given.

[12] It should be noted that the legend the students received was less comprehensive than figure 50 as I was still adding RPs to my dataset at this point in my studies.

Purpose of test:

- Is a legend considered to be useful in Group RP construction?
- What, if any, icons are copied from the legend onto the new RP diagram?
- Identify new icons relevant to an academic domain.
- Does a legend speed up the process?
- Does a legend produce a 'richer' RP with more icons
- Would a legend of individual movable/detachable pictures be useful?

5.4.1 Results of test

Group A (no legend)

Group A produced a diagram that used 8 commonly associated icons within a RP.

- Graph
- Money
- Crossed swords
- Standalone computer
- Buildings
- Question mark
- Top down hierarchy
- Fire from technology

Their RP was in colour, and had a clearly defined boundary showing elements both inside and out with the boundary. This group used a few lines to show connections but did not draw all of the relationships between icons. The resultant feedback forms from this group stated the need for more time to complete the exercise. One stated, "*due to time constraints we felt rushed…..we maybe could have explained on some aspects/icons a little better*". This group decided to purposely leave out certain elements of the scenario however they did not state 'why'. The group collaborated well. One person took on the position of drawer and the others came up with ideas for icons. After the RP the group was shown the legend that the other group had access to and were asked to fill in a questionnaire.

Upon analysis of the individual questionnaires it was interesting to see that all group members stated that a legend would have been helpful. They suggested that it would speed up the process but also voiced concern that it would be difficult to re-create (copy) the icons in the legend. One person did however state that the legend could "*stifle creativity*".

Group B (with legend)

Group B produced a diagram which had 6 commonly associated icons within a RP.

- Exclamation mark
- Building
- Top down hierarchy
- Scales
- Standalone computer
- Money sign

It is instantly notable that this group produced a RP that had 2 less commonly associated icons than group A despite having a legend to copy from. Their RP was also in colour with a single boundary surrounding the picture. This group drew very clear lines representing relationship flows between the icons as well as conveying movement within the diagram. The feedback forms for Group B suggest they found the exercise relatively easy. They isolated the main problem was a lack of time. The group were seen to decide on the most relevant information to portray in the diagram and purposely decide to omit irrelevant data. They state that they had good collaborative communication and, as with Group A, nominated a single drawer. All four participants in group B suggested that the legend was helpful. They state that the reasons were:

- *Gives ideas on symbol types*
- *Helpful to get started*
- *Deepens understanding of task*

However, as a group they suggest that they did not use/copy many of the symbols but instead used the legend as an 'understanding task' tool. Answers on the feedback forms indicate that they purposefully decided to reject direct copying with quotes such as;

- *easier to construct our own*
- *symbols were irrelevant*
- *more creativity in drawing our own*

Three out or the four group members did not think that an ordered legend with more options would be any more useful. One member in the group suggested that the situation was unique and therefore the symbols must reflect the subject to be of any use. The final question asked Group B if they would find a legend that was deconstructed into individual pictures to attach straight onto the diagram, helpful. Three of the four said yes and commented that this would help make the process faster and '*better looking'*. One voiced a concern that they might be only limited to certain symbols and this would restrict creativity.

Observations by the Facilitator

Both groups were unsure and unwilling to start the task. Group B (with legend) started the task 5 minutes earlier than group A. Group A spent a long time discussing how to draw and what icons to use before committing ideas to paper. The room got considerably nosier as time progressed. All groups complained that they were not given enough time to complete the exercise. It appeared that once drawing commenced and ideas started to flow, the exercise was enjoyable. There was no obvious sense of competition between the groups but rather a group determination to produce a quality diagram.

Findings

Is a legend is considered to be useful in RP construction?

Yes, but seemingly only as a guide for RP construction. It was suggested that the icons offered to the group were leaning to a corporation/office domain and many were not relevant within the academic domain.

What, if any, icons are copied from the legend onto the new RP diagram?

- Exclamation mark
- Building
- Top down hierarchy
- Scales

- Standalone computer
- Money sign

It is difficult to be sure whether these icons were taken directly from the legend. Subjects who had access to the legend suggested that they designed the icons themselves and therefore copied very few. There was almost a reluctance to use the legend

Identify new icons relevant to an academic domain.

Flags were used by both groups to distinguish between International and British students

Graduation cap picture or mortar board

Blackboard icon

Does a legend speed up the process?

It seems to clarify the understanding of the exercise which in turn speeds up the ability to start drawing.

Would a legend of individual pictures attachable to the diagram be useful?

75% stated yes. The following reasons were suggested;

- *Would have made the task faster and better looking*
- *Would have made it easier*
- *Detachable stickers might have been good*

It was suggested that the legend would need to be more generic and there would have to be an opportunity to draw your own icons.

Does a legend produce a 'richer' RP with more icons?

No. In this small study, the richer picture, in my opinion, came from the group with no legend. Both pictures had linked icons and showed a strong narrative but group A showed more complexity although was messier and at times incomprehensible. Group B did not represent a complex problem but instead decided to represent only the parts that they could re-create in a picture with relative ease thus their picture was quite neat in comparison to the other group.

Discussion on findings

Both groups produced colourful, imaginative, connected and fairy coherent RPs. Group A, without legend, managed to portray, all bar 3, elements of the scenario whereas Group B missed out 10. Group B purposely decided to remove the non-essential elements. For example, they decided to define a single stakeholder as a 'student' and not state whether the student was part/full time or undergraduate/postgraduate. They did however differentiate between British and International students outside a University boundary. Group B's picture was clear and understandable but very simple whereas Group A attempted to draw everything onto their diagram thus making it more confusing to analyse and interpret. Certain symbols in Group A's diagram were illegible. Group A did not draw all the relationships between icons whereas Group B connected all symbols. Even though, Group A produced more symbols than Group B, the lack of interconnectivity made it difficult for the interpreter to comprehend full understanding of the situation.

From the feedback it was clear that those with a legend found the exercise easier than those without. The findings suggest that the icons offered where not specific enough to be of use. The group that had the legend required more academic domain iconography to be able to utilise symbols more effectively. The legend does; however, seem to prompt a willingness to apply abstraction and model, the perceived, essential components. This can reduce complexity and increase efficiency of the working group. The group that had access to the legend used relationship arrows and speech bubbles more effectively and therefore produced a clearer and more comprehensible diagram.

It was observed that there was almost a reluctance to use the legend in Group B. It was as if it would be cheating or plagiarising to use the prescribed icons. There was a group determination to 'manage without' and be creative. Perhaps this was due to there being another group, in the same room, doing, what they thought was, the exact the same exercise. As previously stated there did not seem to be competitiveness between the groups but rather a desire to produce quality.

What is perhaps the most interesting result from this test is that there were more commonly associated icons drawn by the group that had no legend than by the group that had visual examples of 50 of the most commonly associated. I had presumed, at start of test, that many of the icons in the legend would be copied but the group used and drew only a few of the icons. There does seem to be a paradox in these findings. Both groups after the test had been completed said they would prefer to have a legend than not but when asked if they would

copy the icons they claimed that they would probably not. Group B, who had the legend in the test, were seen to use very few icons. It is as if the legend was seen as a safety blanket or perhaps a task-understanding tool rather than a direct aid to RP design.

These results echo another legend test I ran during the Open University eSTEeM Diagramming Colloquium workshop in March 2011. My results for the colloquium have been published in the SPAR journal (Berg & Pooley, 2012b). The following is an excerpt from the paper which concurs with the findings of this section.

"As previously stated 7 of the 8 colloquium groups accepted the icon legend (Figure1). Each group were offered the legend individually around 5 minutes into the picturing exercise. Previous research in this area indicates that giving the legend at the very start of a workshop limits the width and scope of creativity (Berg, 2012). *It was explained to all groups that the legend represented the most common RP icons from a research experiment within Heriot-Watt University and are not specific to any domain or theme. One person stated, "So, you are adding structure" and was immediately informed that the legend can be refused. The legend was then accepted without further comment.*

Another group member from a different group said, "perfect timing, we were just wondering what sort of pictures we should use". One person commented that they felt it was a bit like using a 'cheat sheet' and it would be wrong to copy or use however, that person did say that the icons were useful for getting ideas. The legend was seen as a 'conversation stopper' by one group who all studied the legend but decided to not use/copy any of the icons. One person revealed that she found the icons very useful for getting creative ideas but she had to steal a surreptitious look at the legend whist no one was looking. The person felt there was some embarrassment to needing to see the icons and did not want to be seen as uncreative by her group.

In reflection, overall, whilst most groups studied the legend the icons were rarely copied directly. This concurs with the background research being undertaken at Heriot-Watt. This research suggests icons need to be more specific to the domain to be relevant or usable (Berg, 2012). *For some, a legend seems to clarify the understanding of the picturing exercise which in turn speeds up the ability to start drawing. For those who have never drawn collaboratively or those who have had little instruction on RPs the legend does, however, seem to prompt a willingness to apply abstraction and model, the perceived, essential components. This can reduce complexity and increase efficiency of the working group. This theory would need to be tested on a wider sample to confirm implicitly."*

(Berg & Pooley, Rich Pictures: Collaborative Communication through Icons, 2012b)

5.5 Further work: Domain specific legend

In the previous two sections it has been argued that the support for the usefulness of an icon legend seems to be of mixed opinion. Individual RP creators seemed to be more positive on its usefulness to aid RP design whereas group RP creators liked the idea of having something

to ‘start them off’ but were less keen on copying icons directly. This opinion was echoed during another workshop I attended in December 2011 (Walker, 2011) wherein a group, who had just drawn a RP, were asked what they thought of a RP legend. The workshop group were not particularly keen on the idea of using pre-set icons. They did however suggest that having some context specific icons might be useful. This suggestion for a context or domain specific legend has been brought up frequently by the previous legend test participants. I use the word ‘domain’ to describe the context area upon which the RP drawing is describing, for example a RP drawn to describe an academic, environmental or office based situation. My terminology of ‘domain’ can be contested. I acknowledge that not all RPs fit into neatly associated domains and can, and often do, describe many context areas. My use of ‘domain’ is therefore used within this project to categorise RPs that are principally describing a specific singular context area. In many RPs the domain or context area is defined in the title of the RP. My results indicate that a domain specific legend of icons might be of more use to an RP creator than a non-domain specific legend. Unfortunately, due to the time constraints of my PhD and poor domain sample size, I have not been able to test this theory and thus further work needs to be done to confirm if this is correct. However, what I have been able to do is to isolate the most significant repeated icons from 4 domains with the RPs in my icon dataset (Figures 5.4-5.5). The reason there are only four domains being shown is because these are the four domains that I had enough RPs in my dataset to be able to show significant results. For example I have 61 RPs in the sustainability domain but only 2 in the construction domain thus the construction domain does not have enough data samples to be able to test.

It can be argued that the icon dataset needs to have considerably more RPs added, across all domains, to be able to isolate the specific domain icons. Comparing the charts it can be seen that many of the icons are repeated across all the domains and it is only when you get down to the lower end of the chart that icons that are more domain relevant can be seen to emerge. For example, the sustainability domain shows icons such as water, world/flag, red cross, gun/ knife/axe, family home, train, aeroplane and these might be suitable icons to be added to a Sustainability RP legend.

One hundred and sixteen RPs in the icon-dataset are describing a business situation. There are however problems with this domain. I would have preferred to be able to divide this up into more relevant sections such as public, private and third sector but I was unable to get the information I needed to be able to do this. The context of ‘business domain’ is too generalist and has ended up being a place to put all RPs that depict an office or commercial based environment. I have tried many times, over the thesis time period, to come up with a better

name classification than this but I have not been able to gather enough information on some of the RPs to be able to do this. For example, many of my RPs are found on websites or sent to me with no information about what was the situation that is being depicted. Unless blatantly obvious I refrain from speculation and thus many of my RPs in the icon-dataset have not been assigned a domain for this reason.

Interestingly, the university domain shows the crossed swords icon as a relevant situation specific icon. This was proved to be not the case in my background BSc dissertation results. It is only when I analysed further it became apparent that the university domain samples are mostly taken from books and journals in the 80-90s and therefore do not represent a true reflection of modern university icons. Therefore we can see that icons decay over time thus a legend will need to be constantly refreshed to reflect modern iconography. Thus I need more 21st century RPs across all domains to be able to isolate the context specific RP icons. This appears to be the case in the hospital domain (Fig 5.5) as the relevant icons such as the red-cross and stethoscope icons are showing but are not repeated as often as I would expect. The hospital domain only has 16 RPs within it so, it too, requires more samples to be considered good usable data.

I do have, and still receive, RPs to be added to the icon dataset but, as stated previously in the methodology Chapter, I had to stop adding to the collection to be able to have time to analyse the results. This test data has indicated an interesting need for further experimental investigation regarding the use of detachable icons. RP detachable stickers to aid RP design is an area of work not covered by this research but perhaps could be explored in future studies. A question in this area would be, "if you provide stickers that contain difficult images to replicate or draw would participants use them?"

The first two questions in the typology of questions found in Chapter 1 relates to repeated icons in both domain and non domain RPs. In response to these questions I can offer Figures 5.1 & 5.2 and Figures 5.4 to 5.7 as evidence.

The next section of this Chapter will provide answers to the subsequent questions and determine what results provide interesting outcomes whether that is positive or null hypothesis answers.

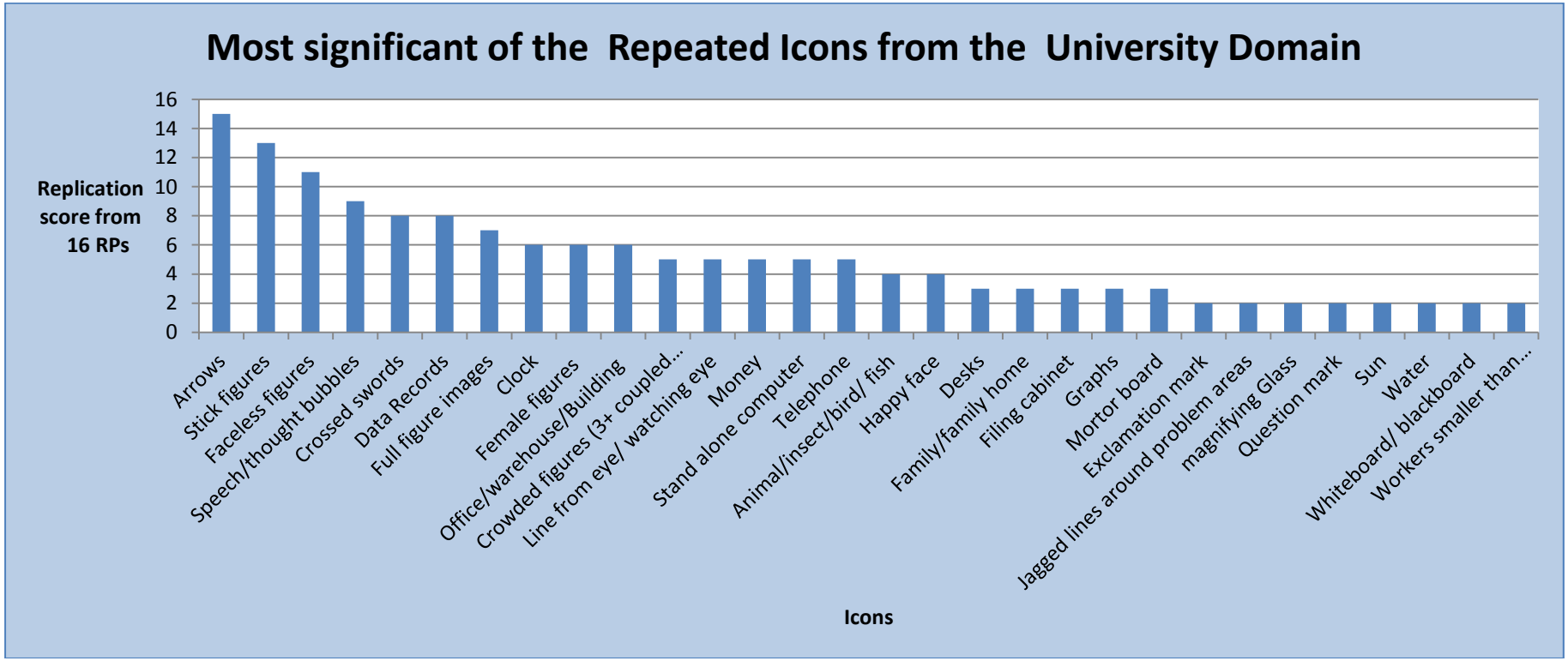


Figure 5.4 Repeated Icons from the University Domain

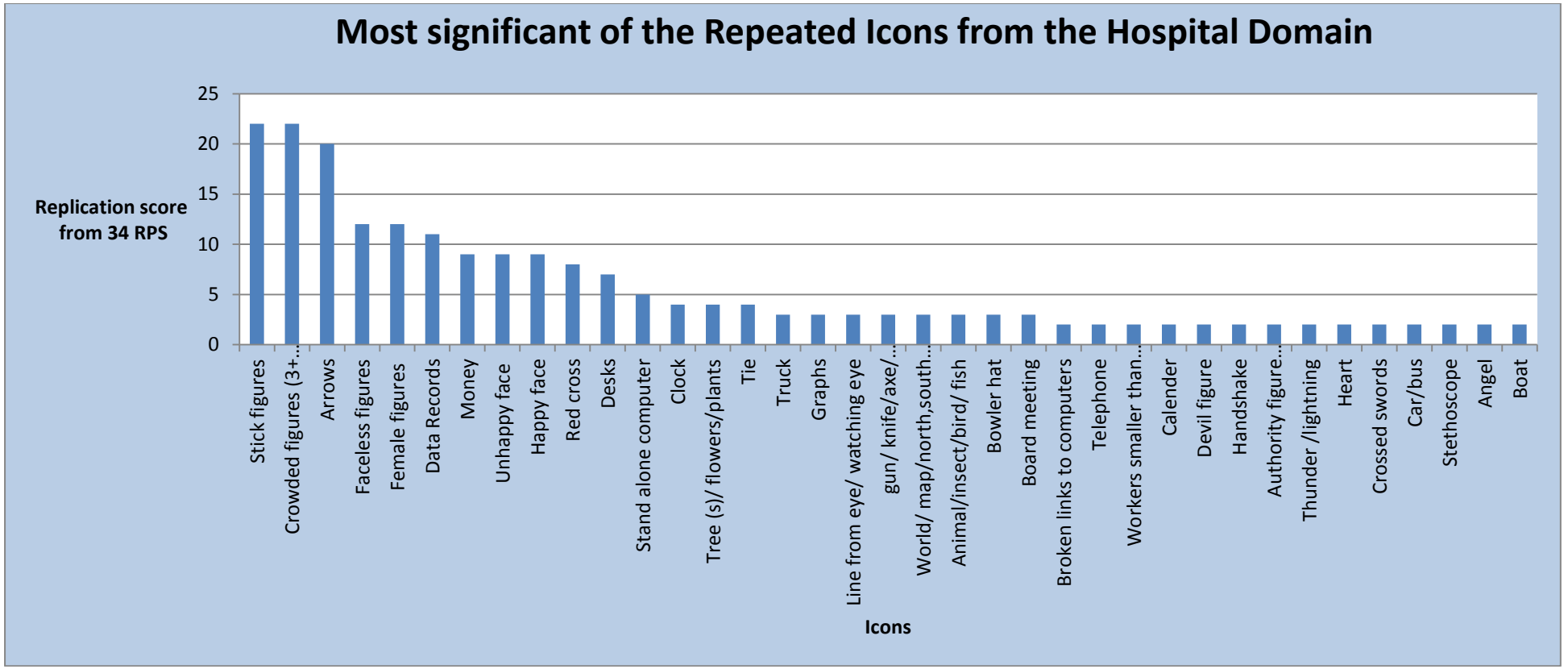


Figure 5.5 Repeated Icons from the Hospital Domain

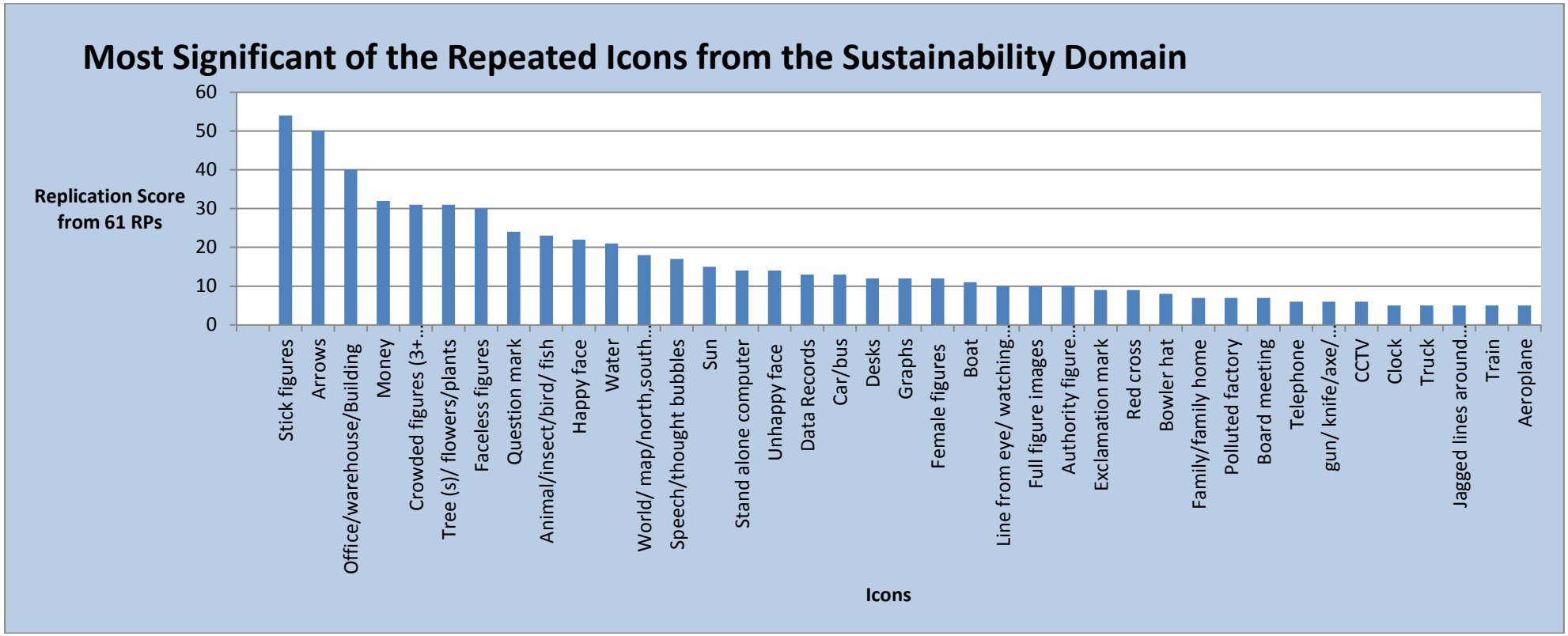


Figure 5.6 Repeated Icons from the Sustainability Domain

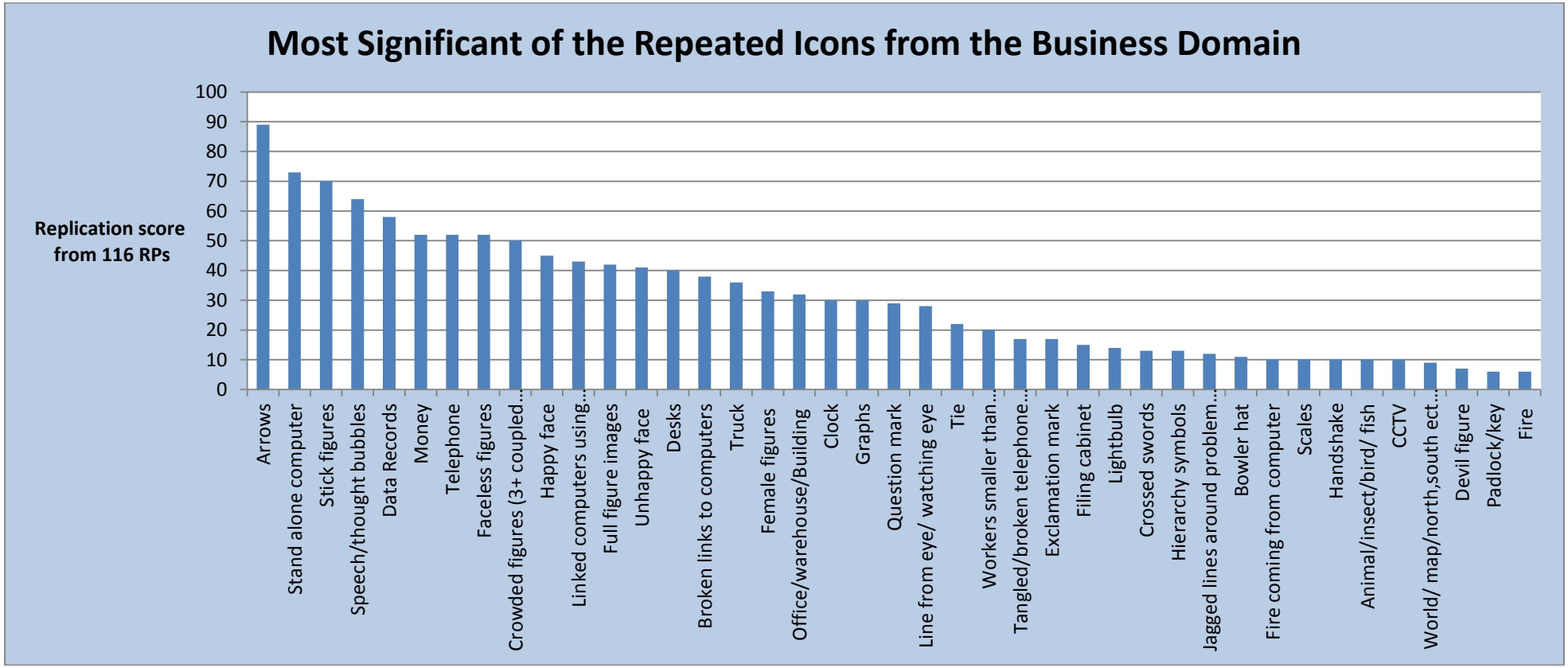


Figure 5.7 Repeated Icons from the Business Domain

5.6 Response answers to Research Questions.

This section uses the icon dataset to answer a series of research questions relating to RPs as given in Chapter 1.The icon dataset was analysed in Microsoft Excel using pivot tables to be able to compare different sets of criteria looking for any significant fluctuations in the results. The following tables present the questions asked of the dataset along with the answers. I discuss the significant results in more detail in the following section.

In tables I will compare the ranked data with other ranked data. I suggest there are 'known' variables" in the dataset that provide information that is definite, or undisputable, such as whether a RP has been drawn by a group / individual or if a RP has colour or not. There are other data in the icon dataset that are subjective and open to interpretation and therefore have been ranked by myself, and other external judges, on a Likert type scale. Chapter 3 section 6 has already discussed the way I have scored and ranked on 5 areas: richness, kinetic, coherence, boundary and humour.

Within these tables I will be using terminology such as 'richest' RPs, 'least comprehensive' RPs and 'highly connected' RPs etc. I believe I am in a good position to apply such terms because of the way the data has been scored and then analysed. For example, in the pivot table below (table 5.1) I look at my first question; comparing richness with gender. I conclude, based upon this analysis of the icon dataset, that there is no difference in richness between males and females. So how did I come to this answer?

Richness versus Gender	**Column Labels**					
Gender	**1**	**2**	**3**	**4**	**5**	**Grand Total**
Female	25	4	5	3	5	42
Male	18	13	8	11	7	57
Grand Total	**43**	**17**	**13**	**14**	**12**	**99**

Table 5.1 Pivot table showing richness compared with gender

By looking at the pivot table it can be seen that there are 99 RPs in my dataset that are known to be either drawn by females or by men. From these, RPs 42 are female and 57 are male. Every RP has been ranked on a 1 to 5 scale of richness. The ratings have been scored as below:

1: Very rich picture, high on expression, visual elements, colour, kinetics and coherence
2: Good picture with reasonable amount of expression, visual elements, colour kinetics and coherence
3: Acceptable as a rich picture showing some visual elements with limited coherence
4: Poor picture with few visual elements
5: Very poor picture with no visuals elements

I have drawn influence from the SAGA indicator (Bell & Morse, 2012a) in naming these ratings. From analysing Table 5.1 it can be seen that out of the 43 RPs rated as 1 (highly rich) 25 of them were drawn by females and out of the 57 drawn by men only 18 were highly rich. Therefore females produced 60% of the very richest pictures whilst men are seen to produce less rich RPs with only 32% of males drawing RPs rated as '1'.Similarly out of the 12 RPs rated as 5 (very poor) seven (58%) of them were drawn by males. It can be seen that out of the 14 pictures that were rated as poor on richness (rank 4) eleven of them (78%) were drawn by men and only 3 drawn by females. However, when a chi square test (significance level set at 0.05) is conducted the results show the probability level is be 0.051 (Table 5.2). Thus there is no evidence to suggest that females draw richer pictures than males.

Actual values						
Richness versus Gender	Column Labels					
Gender	1	2	3	4	5	Grand Total
Female	25	4	5	3	5	42
Male	18	13	8	11	7	57
Grand Total	43	17	13	14	12	99
Expected values						
Gender	1	2	3	4	5	Grand Total
Female	18.24	7.21	5.52	5.94	5.09	42
Male	24.76	9.79	7.48	8.06	6.91	57
Grand Total	43	17	13	14	12	99
Probability level =0.051		(accept the null hypothosis)				
Chi square = 9.45						
Degrees of freedom= 4						

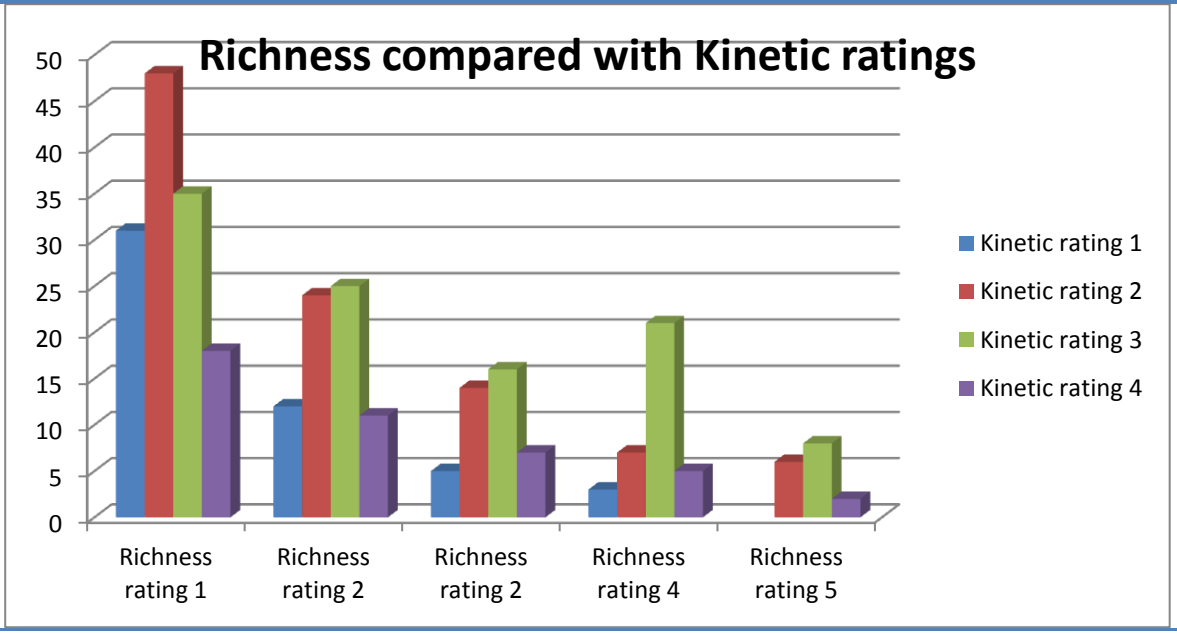
Table 5.2 Chi square analysis on Pivot 1

The following tables 5.3-5.5 show questions relating to the 3 core themes in Chapter 1 in the Typology of questions; core structure, artistry and visual coherence. I have colour coded these questions within each theme in the following tables. The abbreviation PT in the following tables represents 'Pivot table'. These pivot tables and their associated numbers can be found in Appendix C. In each table there are the results of pivot analysis, Chi Square probability results (P value) and a discussion, if required, supporting the findings in more detail. The significance level for the Chi Square is set at 0.05. If $p<0.05$ then I can reject the

null hypothesis and accept the alternative i.e. there is a difference and if p.>0.05 then I can accept the null hypothesis i.e. there is no difference. Each table will also provide the 'supporting analysis reference number' for each question. These references, mostly in the form of pivot tables, can be sourced in the Appendix. Finally, where necessary, some of the tables will include some figures, charts and pivot tables to add clarification to the findings.

Table 5.3 Core structure Questions and Results

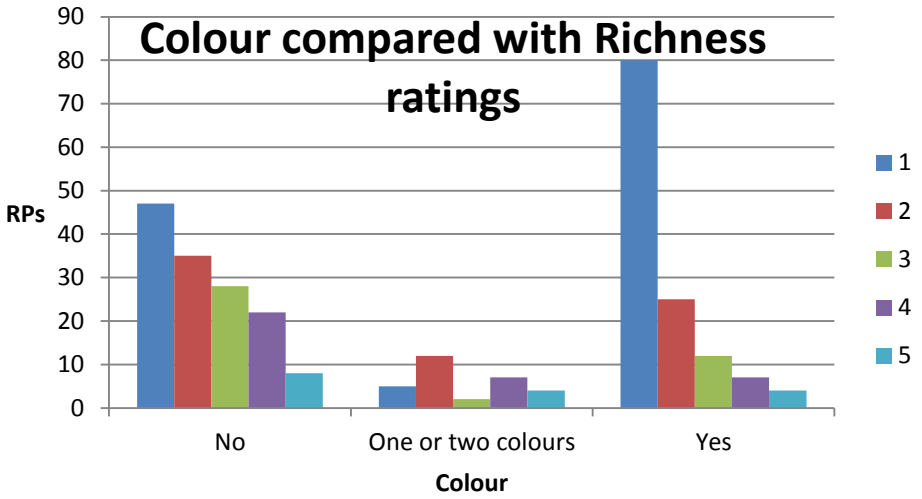
Question	Answer	Supporting Analysis Reference	Discussion
What are the repeating icons in RPs independent of domain?	See figures	Figures 5.13 & 5.14	The previous section discusses these results in detail. These results are used to form the icon legend as offered in section 5.4.
Are there any domains that show repeating icons and if so what are they?	See figures	Figures 5.15 to 5.18	The previous section 5.5 discusses these results in detail. In summary, yes, there are clearly icons that are dominant in certain domains. Sadly, because of poor sample size within domains ,I am unable to offer a definitive list of these context specific icons but rather an early result glimpse at what might be the type of icons in certain domains. Figures 5.15-5.18.
If a legend is provided does it produce a richer picture?	No P=0.99	PT 2	A legend makes no noticeable difference to the richness of a RP. This result echoes the results from the previous section 5.4.1.
Is there any difference in richness in RPs drawn in groups or by individuals?	No P=0.07	PT3	There is no indication that groups are more or less likely to draw a poor or indeed a rich RP than individuals.
Does a RP showing good connections between icon elements equate to being a richer picture?	No P=0.06	PT5	High kinetic rating does not correlate with high richness rating. Out of 132 highly rich RP's 61% scored high on kinetics (31 out of 51 rated as a 1 on both variables) whilst 42% (18 out of 43 rated as a 4 on kinetics and a 1 on richness) scored low. The lowest richness rating was not applied to any RP's that rated high on the Kinetics. The following chart shows the downward trajectory matching to the two rating scales. However the Chi square results show no significant difference overall with a 0.06 probability value.(see chart below) **(PT=pivot table. All supporting PTs can be found in Appendix C)**

Question	Answer	Supporting Analysis Reference	Discussion
			
Does a rich RP have clear boundaries drawn within it?	No P=0.93	PT6	No clear correlation between boundary and richness. 51% scored high on richness for the boundary score 1 (one clear boundary).However 167 RP's had no clear boundaries and of those 42% scored high on richness. Thus a RP is not made any richer by having boundaries.
Do groups draw more boundaries (including sub-boundaries) than individuals?	No P=0.22	PT15	There is no correlation between groups or individuals and the boundaries that they draw.

Question	Answer	Supporting Analysis Reference	Discussion
Is there any correlation between gender, age and boundary drawing?	No P=0.26	PT16	There is no correlation between gender, age and the drawing of boundary lines.
Does a highly coherent RP have boundaries?	No P=0.09	PT17	There is no correlation between coherence and the drawing of boundary lines. A highly coherent picture can have boundaries drawn and can be one that has no boundary and a picture that scores low on coherence can have boundaries or no boundaries.
Are there certain age brackets that draw rich RPs?	No P=0.10	PT18	No link between age and richness. This is a weak result because I can only isolate 74 RPs that I have known ages assigned to them.
Do the RPs rated high on both richness and coherence suggest an optimal amount of individual icons?	Yes	N/A- Data was filtered to provide result	Yes, the pictures rated high on coherence and richness suggested that the optimal amount of icons used were between 6 and 19. Results suggest this is 84% accurate based on the 62 RPs that fall into this criteria (rating both high on coherence and richness)
Do the RPs that have no boundary have a low score on kinetics?	No P=0.40	PT26	No obvious link between kinetics scores and boundary scores. Boundary should be viewed as taking scores 1-3 as 'yes, there is a boundary' and score 4 saying 'no, there is no boundary'. In doing this it is clear that there is very little difference in the amounts that correlate with the kinetic scores either low or high.

Table 5.4 Artistry Questions and Results

<table>
<tr><th>Question</th><th>Answer</th><th>Supporting Analysis Reference</th><th>Discussion</th></tr>
<tr><td>In individually drawn RPs are males or females drawing the richest pictures?</td><td>Neither
P=0.051</td><td>Pivot Table PT1</td><td>Females produced 60% (25/42) of the richest pictures whilst males produce considerable less with only 32% (18/57). However, when the Chi square test was run across the whole sample the results show no difference in gender across all the rating scales.</td></tr>
<tr><td>Are computer generated RPs as rich as hand drawn RPs?</td><td>No
P=0.02</td><td>PT4</td><td>Results show computer generated RP's are not as rich as hand drawn ones. The highest rating of richness was 19% higher for hand drawn pictures. (Hand drawn being 49% and computerised were 30%).</td></tr>
<tr><td>Is a rich RP a highly colourful RP?</td><td>Yes
P=zero
(7.3313E-07)</td><td>PT19</td><td>Colour and richness are closely related. As seen from the following PT the dataset shows an even distribution of colour. From this data the chart below shows that RPs that are rated as highly rich (dark blue) and not rich (purple and light blue) are related strongly to colour.
<table>
<tr><th>Colour</th><th>Count of RP Number</th></tr>
<tr><td>No</td><td>140</td></tr>
<tr><td>One or two colours</td><td>30</td></tr>
<tr><td>Yes (three or more colours)</td><td>128</td></tr>
<tr><td>Grand Total</td><td>298</td></tr>
</table>
</td></tr>
</table>

Question	Answer	Supporting Analysis Reference	Discussion
			
Is a RP which is scored high on kinetics a more colourful RP?	No P=0.66	PT20	There is no indication that strong or weak kinetics (connector showing movement) in a RP has any correlation with colour.
Is a humorous RP usually a colourful RP?	Inconclusive and not proven statistically	PT21	As stated in my methodology I did not ask others to rate on humour. It was seen as too subjective and personal as to what is humorous and what is not. I have however, rated the pictures myself on humour under a wide criteria. I acknowledge this is open to criticism. From my own ratings it is not clear that colour and humour are related. I had very few highly humorous (my opinion) RPs to be able to report any clear findings.
Do groups use more colour than individuals?	Yes P=zero (1.3035E-09)	PT22	Groups are clearly using more colour than individuals when drawing a RP. Out of 298 RP's I was able to isolate 138 group and individually drawn pictures. Of that sample results show that out of 40 group RP's there were only 2 that used no colour. Out of 98 individual RPs there were only 27 who used 3 or more colours. To add to this, 85% of my group RP's added colour whereas only 28% of the individually drawn RPs used colour.

Question	Answer	Supporting Analysis Reference	Discussion
Are there certain age brackets that prefer to use colour?	No P=0.90	PT23	No noticeable correlation between colour and age but perhaps sample too small. Out of 298 RP's I could only identify 74 pictures with the artist's exact age at time of drawing. I do not believe there are enough data samples on 'age' to be able to be significant data.
Do female or males prefer using colour in RPs?	No P=0.07	PT24	There is no indication that males prefer the use of colour than females do when drawing a RP. This result can only be taken from RPs that were drawn individually and not in groups. I am unable to answer if there are any gender differences for colour usage in groups.
Do humorous pictures correspond to certain domains?	Inconclusive	N/A	There is no indication that certain domains have more or less humorous pictures. This is an inconclusive result because the actual ratings on humour were only given by the researcher (myself) and there were not enough pictures that rated as humorous to be counted as a meaningful result.
Do RPs rated as 'not acceptable as RPs (highly texted with few or no icons) correlate to and age or gender group?	No	PT25/PT1	As stated previously, I am unable to comment on age related questions because I do not have enough data. Pivot table (PT) 25 does however show a cross comparison on age, gender and richness but is not robust enough to warrant using to answer to the full question. I can observe that males are more likely to draw a poor RP than females are (PT1). Rating 4 and 5 on the richness scales have been added together to suggest that 32% of males, as opposed to 19% of females, produced RPs that rated as poor RPs. However the statistical analysis on PT1 shows no difference on these results overall and thus the result in not statistical.
How are females represented in RPs? Where are they placed and what are they seen to represent?	N/A	Icon Dataset	These results are observational and not statistical. Females were drawn in 91 of the 298 RPs. The highest proportions (36%) of the females were drawn in the business domain. I have physically coded all RPs and viewed how females are being represented. Firstly, there is little difference between how females view females and how males view females in my RP samples. Secondly, there is also little difference in age ranking between how females view females and how males view females in the RPs. Females are rarely drawn as management or as holding high level positions. Females are predominately being drawn as customers or as workers but in low level working positions such as a receptionist or a secretary. In most RPs, drawn by both males and females, where a female has been drawn there is a male also drawn who is either larger in size or shown as a management icon (see the question below for what these icons are). Females are being represented as having either skirts on, carrying handbags, having long hair or often two or more together. However, although these results are interesting, it should also be noted that I accept that stick figures can be representative of both genders and can indeed be androgynous so isolating 'female' icons could be deemed as being overtly prejudiced

Question	Answer	Supporting Analysis Reference	Discussion
What icons are seen to represent management?	N/A	Icon Dataset	These results are observational and not statistical. Popular management icons in the RPs are 'ties', 'bowler hats' and an interesting emergence in the contemporary pictures is the 'devil' icon being drawn to represent management. I discuss more about this in Chapter 3 wherein I discuss pathological icons. Often management is depicted by showing hierarchy, for example: 
What are the common metaphors seen in the RP?	N/A	Icon Dataset	These results are observational and not statistical. Metaphors are popular in RPs. Thunder and lightning, handshakes, snails, stick figure juggling, scales, and the CCTV camera are all popular in the RPs. Here are some metaphors for example,  Some metaphors are representative of certain domains such as the earth icon is used in the sustainability context and the stethoscope or red cross icon being used in the health domains:  . Metaphors are often drawn in humorous ways and I have many examples of these. Synecdoche metaphor is a familiar sign used to represent a whole object and these can be seen in the RPs, for example; flags representing countries, beds representing accommodation and mortar board for academia and shopping baskets for retail outlets. Certain RP icons can be difficult to depict and it is easier to show as a litotes. A litotes is the negation of its opposite to portray meaning for example:  . In Chapter 3 I discuss RP icon metaphor in more detail.

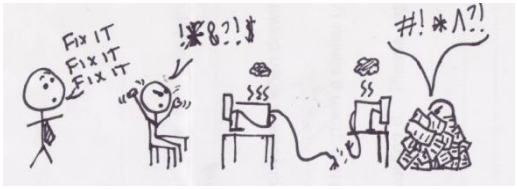
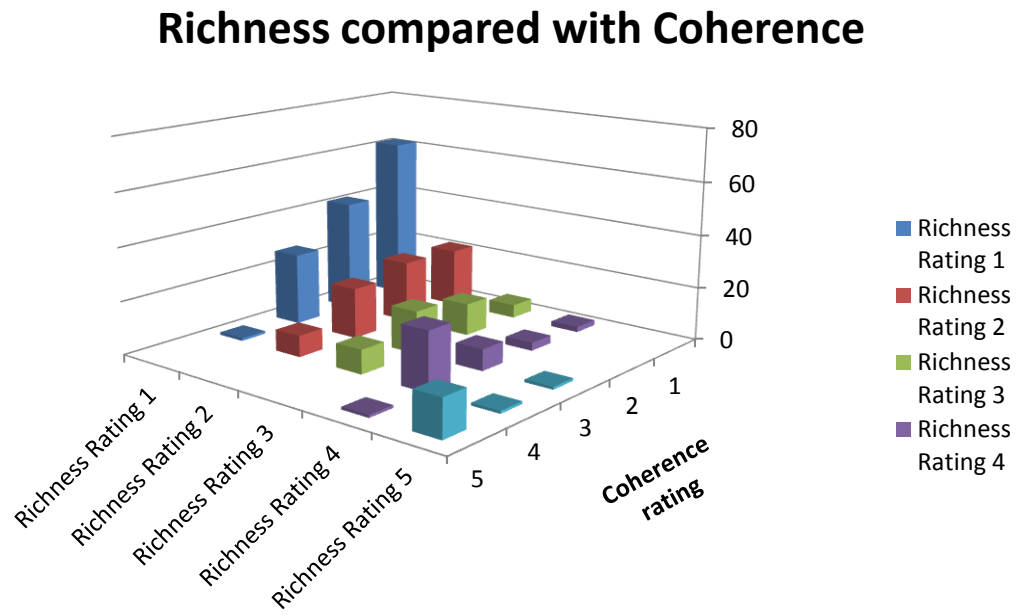
Question	Answer	Supporting Analysis Reference	Discussion
Do different types of speech bubbles represent different thoughts?	Possible yes but not statistical proof	Icon Dataset	These results are observational and not statistical. Hard lined rectangular speech bubbles do seem to deliver important comment, exactness or technical process instruction whereas the softer the shape of the speech bubble the more the message becomes opinion or conceptual in thought.
What are the types of icons that provide soft or conceptual emotional content?		Icon Dataset	These results are observational and not statistical. Rounder shaped icons, such as faces, time, handshakes, clouds, thought bubbles and hand drawn question and exclamation marks are seen to represent abstract concepts such as time, happiness, unhappiness, agreement, concern, anger and query. They are perhaps not as rigid as the hard line drawings but offer understanding on more tacit emotional features of the problem situation.
What are the types of icons that provide strong emotional content?			These results are observational and not statistical. Sharp and jagged shapes are powerful icons in the RP that radiate noise waves or broadcast raw feeling and reaction. I suggest RP icons such as fire, jagged speech bubbles, crossed swords and thunder all signify sharp shapes. They denote strong emotions or genuine beliefs such as conflict, anger, broken technology, disagreement, tension, and dispute.
Are the RPs that show interaction between people and objects high on coherence?	Possible yes but not statistical proof	Icon Dataset	These results are observational and not statistical. The RPs that are highly coherent show frequent reference to stick figure interaction with objects and the showing of emotion. My research takes the viewpoint that the RP icons are graphics that represent an entity, object, process, or concept. Such iconography is considered useful if it offers transparent meaning and valuable content to the whole RP. I am in agreement with Berniker, that the "*iconic script is a system of writing constituted by iconic symbols*" (Berniker, 2003).The following example is a RP icon script where several icons are used to convey a variety of problem issues. The iconic script tells a simple story with the use of icons with a clear start and finishing point.  The RPs high on the coherence rating show clear examples of icon scripting.

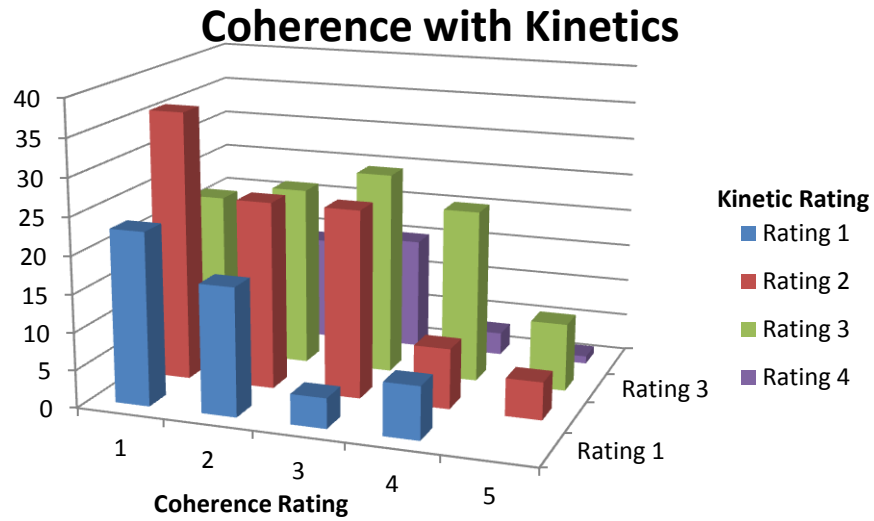
Table 5.5 Visual coherence questions and results

Question	Answer	Supporting Analysis Reference	Discussion
Is a highly coherent RP a rich RP? ***(Coherent =a clear and understandable narrative)***	Yes P=2.83	PT7	A RP that is coherent, or understandable, is viewed as a richer RP and a picture that is not seen as very coherent is seen to be less rich. Richness and coherence are highly connected. Pictures that score very low or very high correlate on both the coherence and richness rating scores. The following chart shows in more detail the rating spread. 

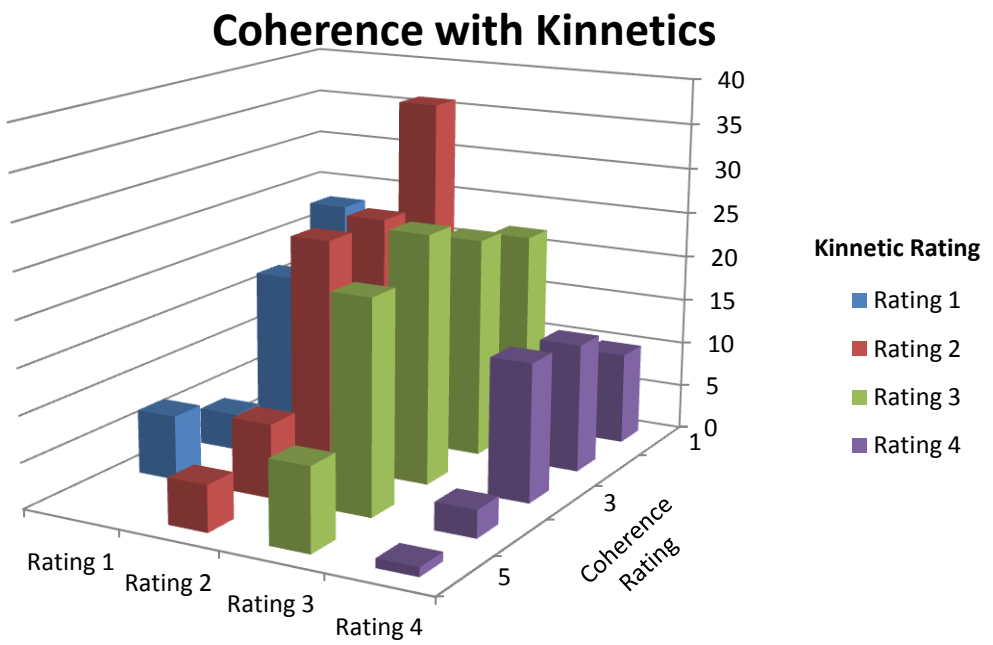
Question	Answer	Supporting Analysis Reference	Discussion
Based on the different rating scales of coherence. Are groups or individuals drawing the most coherent RPs?	N/A	PT8	**Coherence rating Scale:** 1= Clear story told using relevant visual elements ***Answer: Groups =10%*** ***Individuals =41.9%*** 2= At times there is a coherent story but often ambiguous in meaning ***Answer: Groups =47.5%*** ***Individuals =21.4%*** 3= Unclear story using ambiguous visual elements ***Answer: Groups =37.5%*** ***Individuals =12.2%*** 4= Little or no visual elements with no obvious story ***Answer: Groups =5%*** ***Individuals =13.3%*** 5= Text only ***Answer: Groups =0%*** ***Individuals =11.2%*** These results are observational and not statistical proof . What these results suggest is that although individuals draw the most highly coherent pictures (rating 1) the groups do however draw good coherent segments within their pictures (rating 2). On the lower end of the ratings it is clear that individuals are more likely to draw the least visual elements and, for some, text is preferable than visuals. Groups, on the other hand, are less likely to draw RPs that are highly text based or weak on visual elements.

<table>
<tr><th>Question</th><th>Answer</th><th>Supporting Analysis Reference</th><th>Discussion</th></tr>
<tr><td>Is a very coherent RP a highly colourful RP?</td><td>Yes
P=2.12</td><td>PT9</td><td>There is a significant correlation between colour and coherence. Thus a single pen picture is not as understandable as a colourful one. This is not a surprising as there is a clear correlation between colour and richness.</td></tr>
<tr><td>Do males or females draw the most coherent RPs?</td><td>Neither
P=0.50</td><td>PT10</td><td>There is no correlation between gender and coherence ratings</td></tr>
<tr><td>Are there age groups that draw more coherent pictures?</td><td>Yes (weak result)
P=0.01</td><td>PT11</td><td>Coherence is high in age range 30-49 and low in both the 50+ and 18-29 range. I only know the ages of 74 individually drawn pictures and I was not able to get age stats for group RP's. This is therefore a weak result due to sample size and would need to be tested further to confirm.</td></tr>
<tr><td>Does a legend drawn by the RP designer (s) increase coherence?</td><td>No
P=0.16</td><td>PT12</td><td>The Chi Square test says there is no statistical difference. Looking at the top 2 coherence ratings of the PT12 it can be seen that a legend drawn by the author increases comprehensibility by 5% versus having no legend (8+6/23x100/1 and 78+65/257x100/1). However, giving the subjects a specific legend increases by 22% comprehensibility from having no legend (5+9/18x100/1 and 78+65/257x100/1)
Looking at the bottom rating's it can be seen that either giving a participant a legend or the participant drawing their own legend does seem to produce a more comprehensive RP hence there were no instances where these variables produced a score on the lowest comprehensibility rating. Sample numbers are small. Further testing is required.
<table>
<tr><th>Coherence versus Legend</th><th>legend</th><th></th><th></th><th></th></tr>
<tr><th>Coherence rating</th><th>Legend drawn by Author</th><th>No Legend</th><th>Test legend given</th><th>Grand Total</th></tr>
<tr><td>1</td><td>8</td><td>78</td><td>5</td><td>91</td></tr>
<tr><td>2</td><td>6</td><td>65</td><td>9</td><td>80</td></tr>
<tr><td>3</td><td>3</td><td>65</td><td>3</td><td>71</td></tr>
<tr><td>4</td><td>6</td><td>34</td><td>1</td><td>41</td></tr>
<tr><td>5</td><td></td><td>15</td><td></td><td>15</td></tr>
<tr><td>Grand Total</td><td>23</td><td>257</td><td>18</td><td>298</td></tr>
</table></td></tr>
</table>

Question	Answer	Supporting Analysis Reference	Discussion
Is a computer generated RP more coherent?	No P=0.00	PT13	A Computed generated RP is not any more coherent than a hand drawn RP. Out of 298 RPs 77 of them are computer generated. What can be seen however, is that early results suggest that, a RP that is drawn using a mix of computer generated and hand-drawn icons gives a coherent RP. This is based on a very small sample and cannot be used in these results.
Do RPs displaying 'full figure images' (more than just stick figures) provide more richness and comprehension?	No	Icon Dataset	These results are observational and not statistical proof. The stick figures used in the RPs are perfectly adequate, in my opinion, to depict situations,objects and show emotions. Although the pictures that have full figure icons are pleasant to look at they are often unnecessary and time consuming to draw. Most, but certainly not all, people who draw RPs will add features to a face such as a happy smile or a frown whist others might draw cross/angry eyes or add speech bubbles. I have isolated 142 RPs that have stick figures with blanked out faces (no facial features). These faceless figures are usually in RP's that have other stick figures that have got facial characteristics. I find that these faceless figures often are depicted in crowds and seem to suggest information lacking situation or unknown stakeholders.
Does the white or background space communicate in a RP?	Yes	Icon Dataset	These results are observational and not statistical proof. The background or blank space in a RP is not a by-product of the graphical object as it has many communicative qualities. The backdrop sets the scope of the picture and provides a frame of reference that can be used to compare clusters of objects, emergent patterns, isolate key elements and guide the reader's eye in a certain direction around the page. Spatial grouping in the RP can be analysed to interpret interrelationships. The proximity of objects shows their relatedness which can be further enhanced by lines and arrows. Such connectors offer the reader a holistic understanding of several interconnected objects. Symmetry and alignment of RP icons show pattern relations with boundary enclosures signifying similarity within the domain or sub-domain.

Question	Answer	Supporting Analysis Reference	Discussion
Is a highly coherent RP highly connected with variation of lines and arrows?	Yes (weak result) P=0.00	PT14	There is some indication that a highly coherent RP will have a good variety of connectors. Coherence and kinetics seems to be linked but results are weak. I have included two charts showing the same results from different angles to add clarity to my argument. Rating 2 on the kinetic scale represents a 'reasonable use of connectors'. This kinetic rating 2 is highly connected to Coherence rating 1 which represents a clear story is being told. So from this we can say a clear story has a reasonable use of connectors. Similarly rating 3 of the kinetic rating scale represents 'poor use of connectors' and it seems to correlate strongly with ratings 1,2, 3 and 4 of the coherence ratings. Thus, a poorly connected picture can still be highly coherent and or low in coherence. So the results are not only confusing but also questionable. Further testing is required to answer to this question. 

Question	Answer	Supporting Analysis Reference	Discussion



5.6.1 Discussion on significant findings

Using both the icon dataset and personal observations I have answered, accepting the limitations of the icon dataset, the questions set out in Chapter 1. The results have been interesting. I would have expected to discover that a good RP is one that is understandable, rich in colour, clear on boundary, having variance in connectors and containing relevant understandable icons. This is not necessarily the case. Richness ratings can be viewed as the aesthetic response to a RP which can combine numerous elements; engagement, understanding, colour, connectivity, structure, iconography, expression, emotion and narrative. In the icon dataset richness, coherence and colour are seen to be highly related but boundaries are not. Thus a rich RP is one that is understandable, well connected, and colourful but is not made any richer by having boundaries or even sub boundaries. Groups draw no less poor or richer RPs compared to individuals. Hand drawn pictures however are richer than computer generated ones.

The results on boundary scores have been unexpected. The following reminds us how boundaries were scored:

1= One clear boundary showing both internal and external elements
2= More than one boundary showing other sub-boundaries
3= Edge of paper or colour used as the boundary indicator
4= No boundary

Every RP in the dataset was scored on boundary. Upon analysis there was no correlation between boundary and richness or boundary and coherence thus suggesting that having, or not having, a single or multiple boundaries in a RP will not enhance the richness or indeed the comprehension or understanding of a picture. This is a surprising result as one might imagine that adding structure in the form of a boundary would add to the perceived appreciation and interpretability of a picture by giving better clarification to the narrative. Another area of interest is that boundaries feature quite heavily in facilitation i.e. those who are being taught how to draw a RP are being exposed, either by picture example or by spoken dialogue, to boundaries and, through my observations, being encouraged to use them. It is

therefore surprising that there were only 71 RPs in the icon dataset that showed boundaries (scores 1 to 3 on the boundary rating scale) and 167 showed no boundaries. I have found no evidence in literature to support the need for a RP requiring boundaries except to say that literature examples of RPs usually *show* a RP with at least one boundary. So, it would seem, although unsaid, the boundary in a RP is often seen by facilitators and the academic community as synonymous with the RP but there is in fact no evidence to support this. For those who draw RPs, whether in a group or individually there is less than a quarter who will draw boundaries and, for those that do, the boundary or sub boundary s will not make the picture any richer or more coherent.

Within the icon dataset the kinetics ratings, when compared against other criteria produced some interesting results. The kinetic rating looks at how the connectors in the picture enhance a story in terms of motion, direction and association. The following reminds us on how the RPs have been scored on kinetics.

1: Good variety of connectors showing direction, tone, grades of thickness and size
2: Reasonable use of connecters but little use of thickness, size and tone.
3: Poor use of connectors showing no variance in size tone and thickness
4: No connectors

There was no strong correlation between richness and kinetics thus suggesting that a highly connected picture, showing variance in line, is not seen as a richer RP. There is some, but weak, evidence that kinetics and coherence are related. My results suggest there is some evidence that a highly coherent RP will have a good variety of connectors. Results are weak however and it is entirely possible that a poorly connected RP can still be highly coherent and/or low in coherence. The coherence and kinetic findings were weak and inconclusive and will require further testing. I have also looked at whether colour in RPs is related to kinetics but I have found this not to be the case. What I have discovered, although this is observational and not statistically proven, is that the background or blank space in an RP is a good communicative source of information. The background sets the frame of the picture thus allowing the eye to travel in certain directions or to draw attention to certain icons. A clear and unmarked backdrop can show icon relationships and guide the readers' eye to other related areas or singular themes. I discuss interrelationships between icon elements further in Chapter 3 wherein I suggest that the backdrop or amount of white space can aid the

understanding of a RP and encourage a sense interpretive direction between the major elements.

One area that was analysed in detail in the icon dataset was whether coherence correlates with any other criteria. Coherence is the extent to which the RP is being clear with an understandable narrative. We know that richness has a strong connection with coherence and that boundary lines do not correlate but what else can we know about coherence? Out of the ten questions relating to coherence it was discovered that there is a strong correlation between colour and coherence but none with gender and coherence. There was a small indication that a RP that is a combination of computer generated and hand drawn icons, might be quite high on coherence but these results are based on a small sample size and are therefore not robust. What was determined was that a computer generated RP is not more coherent than a hand drawn one. Coherence was scored to be high on age ranges 30-49 and scored low in ages 18-29 and 50+ but this is a weak result and requires further testing. One question asked whether groups or individuals are drawing the most coherent pictures and the results suggest that neither groups nor individual RPs have the most coherence. Groups however, do draw coherence within certain sections in their pictures and are less likely than individuals to draw RPs that are highly text based or weak on visual elements but I accept that this is an observational result and not statistically proven. These observational results also indicate that having 6-19 icon elements is the optimum for a highly rich and highly coherent RP.

Another area that was looked at within the icon dataset was whether a legend being offered to participants would increase richness or coherence. The results indicate, and are in agreement with the findings of Appendix A, that a legend will not increase richness or coherence within RPs.

Some of the questions relate to icons and metaphors and gender associations within RPs. I have given some visual examples within the answers but I accept that these are not statistically proven and are only observational upon data analysis.

It was discovered, upon dataset statistical analysis, that a rich RP is a highly colourful one as well as there being significant correlation between colour and coherence. So what is being suggested here is that a rich RP containing colour enhances comprehension. Groups are seen to add colour more so than individuals but I tentatively suggest that is because they are being offered colour pens during facilitation. Colour theory has been discussed in detail in Chapter 3.

5.7 Summary of Chapter 5

This Chapter has been split into two main areas firstly, I have investigated the possibility of offering a RP legend to aid design and secondly, I have answered specific questions about RPs as set out in Chapter 1. The icon legend was tested on two groups of students, both being asked to draw a RP, wherein one was given a legend and another was not. The findings echo, a previous legend test at a Diagramming Colloquium with the Open University which was subsequently published in the SPAR Journal in 2012 (Berg & Pooley, 2012b). Results show that the legend is useful as a guide for RP construction however the icons in a legend would need to be context specific. Giving a legend of icons to a group does not produce a richer RP. Early results indicate that those groups who have a legend draw rich RPs but rarely copy the visual images. It would seem, for groups, that a legend is valuable to clarify the understanding of the picturing exercise and does prompt a willingness to apply abstraction and model their own situations. This in turn does manage to reduce task complexity whilst increasing efficiency and task-time of the working group. An interesting result, which was echoed throughout all the workshops, was that the legend is often seen as a 'cheat sheet' or 'conversation stopper' (Ibid) whereas for others it was seen to aid creativity and promote ideas on what to draw.

Other results, from legend testing, indicate there are icons that are used in RPs that are often replicated whether it is in non-domain or domain specific contexts. It is perhaps not surprising that there are icons that are used in certain domains and not in others and it would be useful, with more samples, to gain a better understanding on what there are. Although offering the early results of domain specific iconography (figures 5.4-5.7) I did however, acknowledge the small sample size in my icon dataset. I concluded, in section 5.5, suggesting further work is required to gain more context specific and culturally diverse icons for future experimental investigation. Another possible area for future testing is the possibility of providing detachable stickers for RP design as 75% of the test participants stated they would be in favour of this.

The second part of this Chapter used the icon dataset for analysis. I started section 5.6 looking at construction, with preconceived ideas on what would be the ideal criteria for a rich RP. I had previously made assumptions and asked subsequent questions from my icon dataset expecting the results to back up my hypothesis. This has not always been the case. Most notably I have discovered that although richness is highly linked to coherence it is not always

a direct hand in hand correlation. A rich RP does not have to be totally coherent i.e. a rich RP can, and often does, only have segments of understandable areas within it and they are often areas that are unclear or low on comprehension. A rich RP seems to be more about plentiful icons, colour, connections, icons and metaphor but does not have to tell a full narrative story in a linear way. Besides objects the RP will contain icons that represent processes. These processes express action or emotion within a diversity of past present and future events. In essence a rich RP is often considered to be one that 'looks good' and has an aesthetic quality that is vibrant and full of interesting icons whereas a poor RP seems to be one that does not show such vibrancy and is often more text based.

In conclusion to this chapter I suggest, based upon analysis of 298 RP's and the responses of 9 expert RP analysts, that a good or rich RP is one that is clearly understandable, vibrant in colour and contains relevant understandable icons. There was no statistical proof however that a good variety of connectors makes for a richer picture. These basic points are, of course, arguable. What is rich to one person is poor to another, what is beautiful in colour is ugly to another, what is considered a relevant and understandable icon is open to wide interpretation. Perhaps it is worth considering Plato (Cooper, 1997), he would argue that richness is an abstract sense and not actually visible. For example, we see a rich element in a picture but we never actually see the *form* of 'richness' Richness is a property that more than one picture or thing can have and therefore many things can be rich. Richness is but a universal independent property, as with the form of beauty, that more than one thing can have. In essence, RPs can be destroyed but 'richness will still exist. For Plato,the term 'richness' would be the ultimate universal perfection to all that could be considered to be rich.

It should also be noted that perhaps a poor RP is actually rich in information insofar as it reflects the situation i.e., 'poor'. A poor RP might be reflecting an 'information poor' situation which has a low set emotional chord or mood. Perhaps the situation is deficient and lacking with inadequate material or data to be reflected upon thus the constitution of a poor RP. A RP has a singular purpose which is to reflect a situation. The RP, for some, is never actually finished there will always be more to add and take away. It should be noted that no person or persons set out to draw a poor RP they are, however consciously or unconsciously obeying, Socrates advice , 'to know thyself'. To examine a situation one must a weigh up of the best material to be investigated or to be shown in a RP, and this might be so lacking in depth and clarity that a 'rich' RP would be out of the question.

So, in this Chapter, I have isolated lots of new facts and information about RPs but what do they really mean? Are they of any use to those who facilitate or construct such pictures? Can these results be used to aid picturing facilitation or interpretation? Is the RP a form of artwork and, if this is the case, then can it be assessed using predefined art interpretation frameworks? Can we identify the prime characteristics of the RP and classify them into RP element taxonomy?

In Chapter 6 I attempt to answer these questions. I will, based upon all information gathered throughout Appendix A and in Chapters 5 and 6, provide a guidance framework. The framework aims at supporting the whole process of the RP taking into account facilitation and construction guidance with emphasis on interpretation assistance. To end Chapter 6 I will evaluate a newly acquired RP, one that have not yet added to my icon dataset, under the new interpretation framework to test framework validity and value.

In the following, the final chapter in this project, I shall revisit the Aims and Objectives set out in Chapter 1 and provide an answer to the hypothesis assertion. Consideration will be given to the downsides of adding structure to the RP process. Research outcomes and proof of this work being a novel contribution will also be given along with a discussion on what future areas of research might be of interest to explore.

Chapter 6 Discussion and Conclusions

"I may not have gone where I intended to go, but I think I have ended up where I intended to be"
Douglas Adams

6.1 Contribution to knowledge

This study set out to determine if there is value in adding small levels of structure to a RP. The hypothesis is;

For some individuals and in certain situations, the rich picture tool is enhanced by adding small elements of structure to both the facilitation and construction stage and a set of distinguishable enablers improves end user interpretation.

Considering the dearth of relevant literature, there is still much discord and contradiction in academia amongst those who use, facilitate and teach the RP. Much of the argument is based upon syntax and structure. For some the RP is rule-less expression whilst for others there are certain elements that should be incorporated in the RP picture. This thesis argues that there is, for some, a real value in applying a small degree of structure added to the RP process. I suggest that having best practice guidelines, using an icon legend and interpreting RP meaning through a framework are all ways that might improve tool worth and encourage tool confidence. To prove the affirmative of the hypothesis I have answered the six objectives as set out in Chapter 1.

O1: Determine RP facilitation process styles and the materials offered to participants.
(This objective is essentially looking at how differing styles of facilitation and materials offered can affect the RP outcome.)

> *Appendix A discusses facilitation in detail. Three differing facilitation styles have been analysed with suggestions being made in regard to the usefulness of a lead-in pre-drawing session. The session shows some interesting results in terms of quality of resultant RPs and the pen to pick-up rates. I have recommended and discussed the value of expert RP practitioners sharing knowledge to provide best-practice guidelines for those less-experienced practitioners. Materials such as paper size,*

table arrangement and pen colours have been tested and evaluated upon in Chapter 5. It should be noted however that the facilitation analysis purports a weak claim due to such a small scale study and thus results can only claim to be observational. Considerable further research is required in both data gathering and analysis to claim empirical results.

O2: Isolate, through the collation of the iconography, the specific images that occur and indeed re-occur over many rich picture samples (This objective looks at the creation and input into the icon dataset and the subsequent analysis of icon repetition.)

Chapter 5, using the icon dataset, presents and discusses the icons that are most prevalent in RPs and further offers early indication results for icons that are used predominantly in certain specific domains. Chapter 3 furthers the discussion on prevalent icon elements that occur and offers interpretative meaning on what has been drawn.

O3: Analyse the above collation looking for similarities, duplications, emergent themes, grammar associations and relationship dependencies. (This output investigates the icon dataset by the counting and recording of duplicated icons and relationship associations using pivot tables and inter-rated reliability testing where necessary.)

Chapter 3 and 5 provide a deep investigation into the areas of RP construction and interpretation. Chapter 5, using the icon dataset, provides statistical evidence by cross comparing RP elements looking for areas of contrast and correlation. This chapter further answers a typology of research questions that has been set out in Chapter 1.The results of these questions offers new and unprecedented evidence pertaining to the icon elements of the RP. Chapter 3 investigates, using an extensive literature review, how icons and other distinguishable enablers enhance interpretation of RPs.

O4: Isolate the most common non domain specific icons gleaned from the above analysis to be used in a key symbol legend. (This objective required analysis of multiple charts of icons and production of a icon legend)

The first section of Chapter 5 investigates the icons that could be included in a RP legend from the results of the icon dataset. A non-domain specific legend is presented, tested and evaluated.

O5: Use the legend to investigate areas in which structure may increase usability and robustness of the tool. (The purpose was to test the icon legend across a variety of individuals RP creators and group workshops**)**

Chapter 5 tests the usefulness of providing a RP legend of icons to aid construction. There are two tests offered; one based upon two groups of students and another based upon a colloquium workshop. The latter results have been published in a journal and offered as further evidence on the benefits and issues of an icon legend. Results suggest that for some individuals, a legend of icons is useful to aid the drawing of a

RP but for others it is of little practical value. Thus an icon legend should not be universally used by facilitators but could perhaps be offered during the RP process to those who require such assistance.

O6: Determine, using the results of the prior investigation (objectives 1-4), what can provide insight on how best to use RP to explore the group mindset. (The framework provided within this objective is a key research output to this research)

The following sections provide a framework which aims to support the process of the RP taking into account facilitation and construction guidance with emphasis on interpretation assistance. The framework is essentially a set of questions that can be applied to any RP with a link to a discursive topic that offers explanation and meaning to the RP elements.

My hypothesis asserted that a small degree of structure might aid the RP in terms of creating and understanding. My findings present positive results in three main areas of structure;

1. A pre-drawing session was delivered, tested and evaluated to see if a lead-in session might impact favourably upon construction. Results in Appendix A, although weak in data resources, suggest that a pre-drawing session encourages better task engagement, produces more comprehensible icons and speeds up the pen to pick up rate. It was, however, noted that resultant RPs, after a pre-drawing session, are not necessarily richer in colour or connections. There is also a possibility of the relaxed style of the pre-drawing session promoting a careless and laid back attitude to the picturing task. Although further testing on a larger scale is recommended, the effectiveness of a lead-in session was nevertheless encouraging. There was a good indication that task orientation, engagement and functionality can be improved by using this facilitation method. It has however been noted that experienced practitioners are unlikely to use or require such an approach as their experience and knowledge is reflected in their personal facilitation practise. I recommend, in Appendix A, that a set of 'best practise guidelines' would be of use for inexperienced RP users to encourage and accelerate confidence in RP tool practice. It is hoped that this subject area of my research will act as a catalyst for debate concerning the role of the facilitator and further research might involve a colloquium of RP experts coming together to impart and share knowledge.

2. In Chapter 5 I produced, tested and evaluated an icon legend. The legend, which was based upon the results of the most repeated icons in the icon dataset, was a one page, unordered, key of icons. The legend was used in a variety of RP workshops and also by those who drew individual RPs. Results were unexpected, diverse, revealing and warrant further investigation.

   The legend was popular with individual RP creators but had mixed response amongst group RP creators. On the whole the legend was seen as useful as a guide to construction and to clarify instruction but the concurrent theme from group feedback indicated the legend was seen as a 'cheat sheet' and they were reluctant to use it. Many suggested that the legend needed to have icons that were specific to the domain under investigation and others proposed the idea of having detachable icons such as stickers might be more useful. The legend does however; seem to prompt a willingness to apply abstraction and model, the perceived, essential components by reducing task complexity. Feedback resulted in groups saying they would prefer to have a legend than not but when asked if they would copy the icons they claimed that they would probably not. There is a paradox in these findings; it is as if the legend was seen as a safety blanket or perhaps a task-understanding tool rather than a direct aid to RP design.

3. By cross comparing the empirical data in the icon dataset and analysing my observational data I have created a discursive understanding on what many of the RP objects and processes might indicate or represent. In this chapter I provide a framework that can be applied to any RP, independent of domain. The framework has evolved from an amalgamation of my empirical data-set results and the knowledge gained from a large and diverse literature review. I have, in the making of the framework, utilised my RP knowledge on richness, kinetics and comprehensibility and compared it with my qualitative observational data. The observational data, mostly involving interpretation of iconography, is contrasted with empirical knowledge gained from my literature review involving many diverse, but related fields of discovery. In essence the framework provides a sensible balance of new RP empirical knowledge (Chapter 5) whilst blending it with iconography interpretation knowledge across a vast and varied review of known information (Chapters 2 and 3).

   The framework is a soft appraisal tool to help guide an interpreter to understand further meaning than what is perhaps only noticeable from a cursory regard of a RP.

> The framework should be used iteratively with no prescriptive or constraints to usability. It should be seen as an aid to interpretation with the questions in the framework being asked to encourage interpreter reflection. I suggest the more people take the time to really look at the RP the better their ability to see added meaning. It is hoped that a deeper facilitator investigation of a RP might throw light on unseen elements and suggest new avenues of discovery. Improved RP appreciation by identifying, or at least being aware of, many possible levels of understanding, will give a far better understanding of the problem situation being addressed. I envision the framework to be of most use to those who are new to the RP tool and who wish to use it in a consulting problem investigation manner or as a educator who teaches participatory tools.

This research offers new and unique understanding of the RP tool. I have demonstrated the versatility of the tool and shown the similarity it can have with other forms of artwork interpretation and ancient symbol classification. I suggest that adding small elements of structure to facilitation and construction and using an interpretive framework can, for some, aid the use, delivery and understanding of the RP. The evidence from this study suggests that there are benefits for both the creator and interpreter by providing a pre-drawing session, a common key of symbols and a framework to aid interpretation. The results of this study provide new understanding on the facilitation, construction and interpretation processes of a RP.

I do however; acknowledge the limitations of my approach. Adding structure to the RP, for some, could be seen as leading or rule-giving and thus against the core purpose or ethos of the RP. I argue that for some, participatory group work using pictures can be difficult causing anxiety, concern and even isolation whilst for others it is easy, fun and effortless. Some cannot see the tool relevance whilst for others it hones ideas and gives clarity of meaning. I propose the RP tool requires some agreed-upon guidelines for construction with some possible parameters for evaluation. Hence, I am not suggesting that my research will be of use to everyone. Those who prefer a degree of direction when working within a complex situation might find some solace with using a legend or the guidance given in my framework. One function of my research is to act as a catalyst for debate concerning the role of the facilitator and the resultant interpretation of the RP, a debate which I believe is long overdue. Thus, whilst I acknowledge the approach I have taken is open to criticism, I do however suggest these findings will enhance our understanding of the tool and provide the base for

many more questions requiring further investigation. I discuss a selection of these in the section 6.3.

6.2 Guidance framework

In previous sections I have explored the main areas for consideration when endeavouring to understand a RP. Of course, the obvious procedural step after a RP is to get the RP developers to explain what they drew and why. This focussed interviewing is extremely valuable for a facilitator. I suggest that there are however other ways of gathering even more information by just taking time to really look at the RP. In doing so there is a good possibility that a deep investigation will provide even further insight into the group, or individuals, mind. As we noted in the Introduction Section in Chapter 1 the RP is often considered the by-product of a process or just a tool to aid discussion and debate. In my experience, there is little evidence that people are taking time to really consider what has been drawn and discover the subtle clues and nuances that might lead to improved insight. Bell and Morse (2010, 2012, and 2013) seem to be the only exception to this.

Thus, in this section we explore my framework. The framework can be applied to any RP, independent of domain that will guide an interpreter to understand further meaning than what is perhaps only noticeable from a cursory regard of a RP. My analysis to date has been based on a small dataset of around 300 RPs and a somewhat cursory investigation into the RP in terms of observation. It is envisioned that the text information in Chapter 3 and Appendix A will altered and be improved upon over time if the icon dataset continues to be fed with new RPs and further analysis is applied to the knowledge of RP interpretation. It is impossible to lay claim to a prescriptive icon interpretation as visual representations can be invested with multiple meanings. The icon relationships and patterns of possible understanding discussed in the previous sections are unfortunately only stereotypical. There is a gamut of incompatibilities or misplaced assumptions that may arise that can imperil the attainment of visual understanding. I accept criticism for my rather generalist approach but defend the need to at least take the time to question a RP before it is possibly put into storage or destroyed. I suggest the more people take the time to really look at the RP the better their ability to see added meaning.

Table 6.1 is a framework to be applied to a RP. The questions in the framework might not be applicable to every RP however, and it is up to the interpreter to decide what areas of their own RP they would like to examine in more detail. Answers to questions and discussion on

relevant information can be sourced by reading the sections within Chapter 3 and Appendix A. For the purpose of this project I have had to recreate this on paper as a prototype tool with a key to link to further explanation. Ideally, I envision this to be an automated framework, accessed via an open source website, allowing for icons or elements to be hovered over and also clicked upon. In the website example RPs will be given and described using the framework for meaning clarification. Hovering over the example RP icon area will show many more icons of similar meaning. When clicked into, a new page of text information shall be given about possible meaning interpretations. For example if a cultural icon is hovered over using a mouse a selection of cultural icons shall be offered and when clicked upon then the text information will be delivered. In Figure 6.1 I have, using a RP, given an example of how the framework can be used with pointers to possible text section information sources that might offer insight.

Table 6.1 A framework method for RP Interpretation

QUESTIONS TO ASK OF YOUR RP	LINK TO RELEVANT INFORMATION
Who drew the Rich picture? • Group or individual person? • Gender and Age of group/individual?	Facilitation Appendix A
What tools were available? • Pen colours? • Paper size / whiteboard • In a group session could everyone access the paper, for example, table arrangement • Were examples shown prior to drawing? • If facilitated, then what style was adopted?	Facilitation Appendix A
If a group session then how were the groups arranged? Who decided this?	Section 3.4.1
How long did the session last?	Facilitation Appendix A
Were there dominant group members?	Section 3.4.1
Did subgroups form within the main group? • If so, what did they draw?	Section 3.4.1
What is the overarching mood of your RP	Section 3.3.1 ,3.3.3
What can you understand What is not clear or understandable	Section 3.4.6 , 3.4.4
What emotion do you see	Section 3.2.1, 3.3.1, 3.3.2, 3.3.3
Are colours used? What are they?	Section 3.5
Is your RP connected? If so then how is it connected?	Section 3.2.4
Is there variance in connector styles	Section 3.2.4
How do you think you RP should be read?	Section 3.4.4 , 3.2.3
Do you like the RP? Is it pleasing to you?	Section 3.4.5
Are there negative icons or icons showing a negative connotation?	Section 3.2.1
Are there icons that are attractive? • If so then where are they on the page (in the centre, at the side, upside-down, ect) • Are they humorous or containing metaphor? • What is appealing about them?	Section 3.2.1, 3.3.2, 3.3.3, 3.4.5, 3.3.2
What are the size differences in the icons	Section 3.4.2
Look at the different icons • Is emotion being displayed in you RP? • Are there stick figures? What are they doing / how are they interacting? • Can you see facial expression? • Are there any global brands? • Are there jagged or soft edges to any of the icons? • Are any of the icons angled towards other icons?	Section 3.2 , 3.3.3 , 3.4.5
• Are there icons that might have different cultural meaning?	Section 3.2.3
Are there Isolated icons?	Section 3.4.6and 3.2.4
Are there areas of your RP that make more sense than others? Is there evidence of separate stories being told?	Section 3.4.7, 3.4.3, 3.4.4
Does your RP have a boundary or sub-boundaries?	Section 3.2.5

6.2.1 Using the framework

Try and answer as many questions as possible in any order you decide upon. Many of the questions overlap different sections so you might find the same text information is repeated. Access to facilitation information might not be available, for example you might have forgotten who was in a group and the different ages or genders, and this is not a problem. The important thing is to try and investigate the interesting areas of a RP, even acknowledging areas which are not understandable can lead to improved understanding. I suggest the more you look the more you will see. These questions should not be used as a prescriptive path to answer all aspects of a RP but rather a framework for thinking about a RP. It is hoped that a deeper investigation of a RP by facilitators might throw light on unseen elements and suggest new avenues of discovery.

It is entirely possible to use the framework heuristically as an informal method of evaluation. Creating a tick box and/or grading structure for elements to look out for might be of use for those who want to rate or score their RP. I would, however, add a note of caution to this approach. RPs are all different and icons are often ambiguous. A RP that is regarded as highly rich or very good to one person might be so for another person. I did consider adding an appraisal scale to the framework but decided against. Personally I have reservations on the ethics or worth of scoring or grading the RP. I accept, to be a useful tool for some, there needs to be a purpose or outcome that assists in some way. I also accept that future practitioners might need a way grading or testing their RPs. I, in my analysis, have had to score and get others to score, RPs in my icon-dataset in order to rate in terms of richness, coherence and kinetics. Section 4.5 shows the way I graded the RPs in my dataset. I had to do this in order to gain the results I discuss in Chapter 5. It does however, seem terrible crude to convert such revealing and spontaneous collaborative art into a number on a scale. Appraisal, as I have discussed throughout the chapters, is subjective as per the viewer and always open to interpretation. I envision the framework to be used as a soft appraisal tool to aid interpretation. It is hoped that facilitators will be in a better position to know what further questions should be asked about the situation under investigation. Figure 6.1 shows an example RP being examined under the framework.

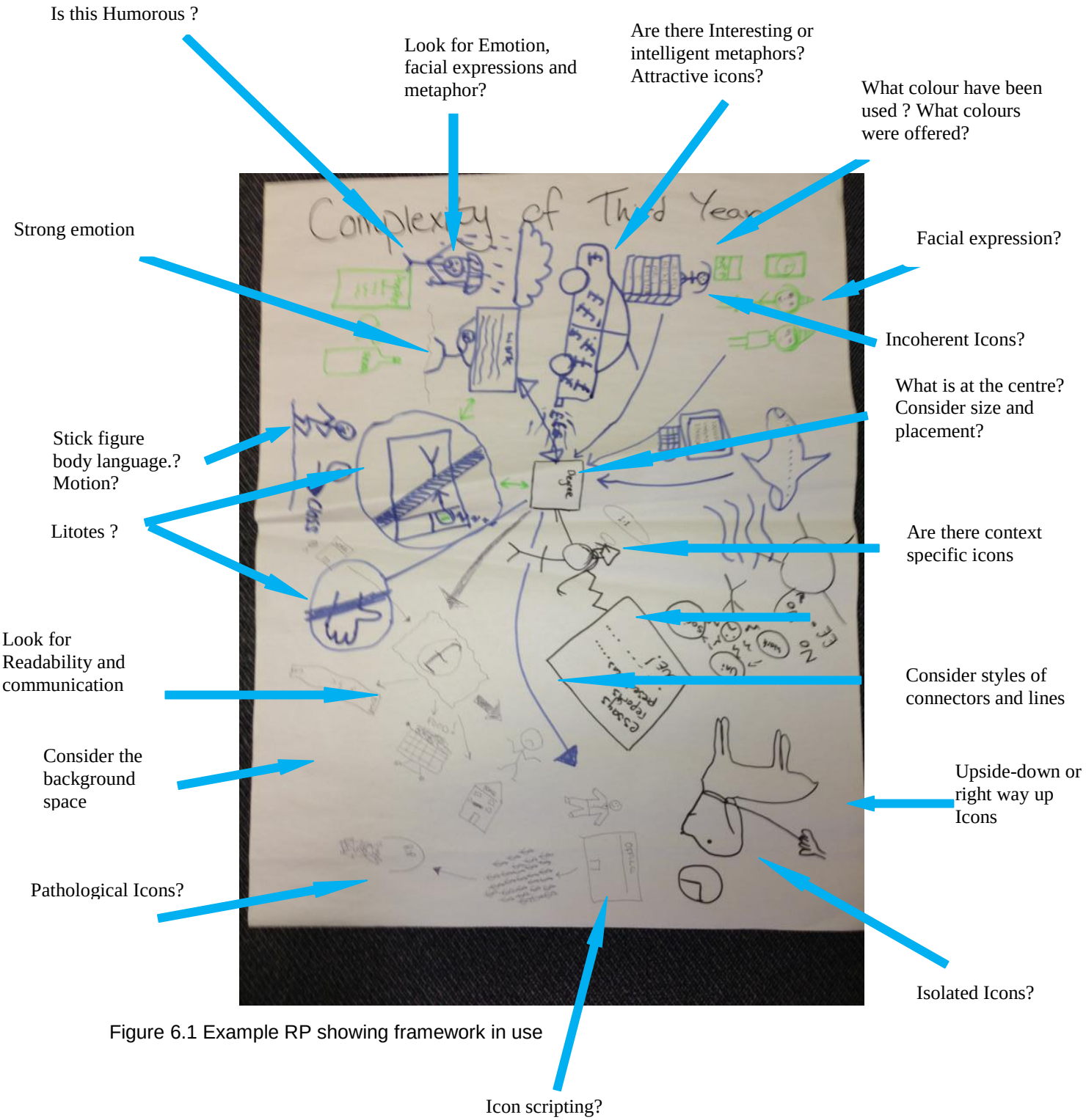


Figure 6.1 Example RP showing framework in use

6.2.2 Framework Discussion

The analytical framework for the RP has been developed from two main areas of this research. Firstly the in-depth literature review which delved into often conflicting and diverse topics of study that are relevant to the RP. By merging fields such as art interpretation, ancient iconography interpretation, semiotics and collaborative group work a contemporary approach to understanding the RP is possible. Secondly, by adding to the knowledge borne of the literature review and analysing the results from the icon dataset is has been possible to combine the two to become a knowledge repository that aids RP interpretation.

I suggest that the framework might be of particular benefit for those who are new to RPs, either teachers or consultants, and would like some guidance on how to facilitate and how to investigate the iconography. I suspect that many experienced facilitators will not need or require such a framework but it would be advantageous in future research to seek further knowledge from these individuals to aid the framework information.

RP icon interpretation has not received much systemic attention from academia. There are lots of reasons for this; complexity of icons, ambiguity of meaning, subjectivity of the interpreter, cultural perceptions and erroneousness levels of accuracy. High level guidelines to aid interpretation could be too general and imprecise whereas low level guidelines are too ad hoc, numerous and incompatible to serve every situation being depicted in a RP. Haramundanis would argue that icons cannot stand alone and must have written descriptions; "*icons alone are not enough. Icons are objects, and objects alone are poor substitutes for written descriptions of objects*" (Haramundanis, 1996). Hortons' (1993) life work showing examples of icons used across the world does seem to suggest there is little universality in graphic perceptions. The RP derives meaning, apart from those who were involved in the drawing, from the viewer. A viewer can interpret what they see in many different ways. The RP tool is a language platform for intercommunication beyond the spoken or the text based. Meaning is derived from pictures and the occasional words but such meaning is often disputable. Contradiction within the conveyance of complex phenomena is seen in many disciplines; for example, in Art; Albers definition of the paradoxical quality in painting's and Eliot's analysis of 'difficult' poetry. In maths there is Godel's inconsistency or incompleteness in mathematics as well as in architecture; Venturi's 'contradiction in architecture'. In system design and problem structuring there is a special requirement to convey the whole in its totality or at least a consensus upon totality. It is far easier to exclude

tricky concepts accepting simplicity rather than embody the difficult unity of inclusion but to do so yields a fascinating insight of the whole. Renowned architect Mies van Rohe would say that, "*God is in the details*" (Whitman, 1969). Excess complication can however clutter and confuse upon the essential components. As Paul Valéry famously said "*Everything simple is false. Everything which is complex is unusable*" (Valéry, 1937).

I have discussed throughout this Chapter the difficulties of icon interpretation whilst identifying patterns, emerging and traditional icons, shapes and orientations that naturally occur within the RP. I suggest, as with other picture based languages, the RP is naturally evolving to have its own unique intuitive grammar which is universally readable.

I have no expectation of giving a framework to decipher all RP meaning and nor am I sure that this can ever be possible. My intention is to improve appreciation by identifying, or at least being aware of, many possible levels of understanding. For future RP interpretation, based on the framework I have devised, I envision an open source and open donate/ write-to website. My goal is not to silence other interpreters who translate visuals in their own ways but rather to offer up a safe place where, theories, ideologies and egos aside, people can collectively name and collectively experience RP visuals. Thus, enabling for everyone who uses the RP, tool a fuller understanding of reading and creating using RP visuals.

6.3 Further Research and Recommendations

The following bullet points highlight areas that require further investigation but have been out with the scope of this current project.

- The whole process of RP facilitation requires further research and as such it has been added to the Appendix and does not reside in the main body of work. I have only manage to show a small subset of differing styles but there needs to be new in-depth research into practitioner application styles. Expert RP facilitators use, and adopt, a variety of differing approaches to engender the types of RPs they find to be most informative. The RP tool is applied to many situations of complexity and thus a comprehensive study of application could throw light on the multifaceted capacity of this tool and thus the way it is being adapted and used by practitioners throughout the world.

- Domain RP icons, as opposed to the standard non-specific icons, need further investigation. Domain icons are icons that are drawn in a RP representing a situation within a particular context; i.e., environmental issues, academic issues, healthcare issues. I have tested, within this body of work, icons that are synonymous to the RP irrespective of domain and concluded that there are many elements that repeat across all RPs. I have added these non-domain specific icons to an icon legend and tested upon the value of the legend tool to aid RP design. Results, suggest that a legend might perhaps be of more use if the icons presented represented elements specific to the domain under investigation. Thus further work is required to explore domain icons and their context particular meaning when applied to a RP.

- RP detachable stickers to aid RP design is an area of work not covered by this research but perhaps could be explored in future studies. A question in this area would be; if you provide stickers that contain difficult images to replicate or draw would participants use them?

- Further work needs to be done to establish whether the 50+ age and gender groups are drawing modern icons or if they are sticking to icons that they know from their past history i.e. is this age group still representing industry and conflict with factory and crossed sword icons or are they using contemporary icons. How does contemporary icons get into our psyche and is there an age at which we stop adopting new icons and if so why?

- Further research pertaining to how humour is drawn and interpreted in RPs would be an interesting project especially with emphasis on the humour within pathological icons.

- A future study investigating why there is a lack of global brands being drawn in a RP would be very interesting. I have touched upon this in section 3 but it is out with the limitations of this research to investigate further.

- There has been, sadly, a distinct lack of global RPs in the dataset and thus I have been unable to give explicit RP icons that are country specific. A large and global investigation into cultural RP icons across differing countries would be a fascinating project giving rise to a much better understanding on icons that are widespread within certain global areas.
- It is recommended that further research should be undertaken using technology that might allow us further insight into the way that the RP is being evaluated. I suggest a few possible adoptions here:

    - Eye-tracking has advanced way beyond the 60's experiments of Yarbus (1967). Using eye tracking to investigate RP interpretative direction could further advance knowledge in the way we view and are attracted to certain icons.

    - Smart pens are a relatively new technology with the first pens being mass produced by Live-scribes in 2008. The newest smart pens on the market in 2013 can translate text, calculate numbers and record audio in handwritten texts. They are being marketed to be of use to interviewers. The pens also have the ability to record conversations around certain drawing dynamics and could thus offer a novel approach to RP drawing and simultaneous recording of live discussions.

    - Using computer software to design the RP, might offer a new and novel approach to modernising the tool. I personally have reservations about such a design endeavour as it would inevitably move away from the ad-hoc and rule less nature of the RP tool. I suggest that to computerise the RP there would be a lack of the tacit and unscripted attractiveness of the tool and thus giving a hard and perhaps over structured approach to design. Ontology construction of a pre-existing RP, using a computerised drawing tool, is however a novel approach for creating a more formal model of the RP situation. Ontology constraint modelling on a RP could be useful to match relationships and find inconsistencies.

Finally, my intention is to re-work the dataset into something that has meaning to others. Ideally I envision an open source website platform. The dataset at present has no polished front end or usable GUI and thus the dataset has little meaning to others without complicated instruction. It would be a simple, but time-costly, job to create a database with preset SQL commands to allow others to access question and compare the data. I envision that the data used in this project should become open source subject though to further funding. I have been sent many RPs during the duration of this project and there are many that have not yet been added to the dataset. It would be my intention to simplify the RP inputting process into the dataset which, at present, is a lengthy and timely procedure. Ideally, practitioners should be able to, not only, add their RP to the dataset but also be advised on how they could score/rate the pictures under a certain criteria. Hence the dataset of RPs could grow and be accessible to everyone who has interest and the website could offer a collaborative community space for RP enthusiasts.

6.4 Concluding remarks

We use many tools to portray system complexity and intricacy and one such tool is the RP. The RP can show differing world views or understanding s of a complex situation. Such viewpoints are often seen to contradict in comparative content depending upon the creator (s) interpretation of the situation. A RP consists of a set of entities called iconography. Iconography can be simple pictures of objects, stick figures and commonly used symbols. Such iconography is mostly drawn free hand but can be copied or reproduced from another source. Besides objects, the RP will contain icons that represent processes. These processes express action or emotion within a diversity of past, present and future events. An icon is never complete in itself, it gains meaning from the wider RP from whence it came from. An icon does not represent something new, original or exceptional and it is rarely autonomous. It expresses itself through a wholly symbolic language therefore allowing comprehension without the need for specialised knowledge. A RP icon is not conventional as it is not rule bound in both form and content. The creator (s) is not constrained by standardisation or conformist norms but is instead encouraged to add subjective interpretation to the picture. For groups the resulting picture is seen as a collaborative collection of related icons that represent a mutual faith or belief on their interpretation of the situation under investigation.

The RP is multifaceted in its abilities. The RP is useful if it facilitates understanding and initiates problem solving in a permissive environment. This tool has the powerful capacity to recreate in the present what has happened in the past, represent the now whilst offering insight into the future. The RP icon script provides a reminder of what it portrays; it is a consciousness of the past in the present. The RP is above the personal or singular when picturing collaboratively and thus can never be repetitious or bound by tradition because it has to constantly be adaptive to new concepts, situations and icons.

The RP opens up various opportunities to view the cultural system of an organisation from several, often conflicting, perspectives using unique organisational iconography. The tool has, to date, been seen simply as an enquiry or discussion aiding tool and its real usefulness expires after completion. I suggest that the RP, possessing the unique iconography used to represent areas of concern, should not be discarded as a by-product. These pictures containing individual graphics are valuable recyclable assets for organisational learning. Even without syntax and rules being enforced on the RP there are distinguishable enablers that improve correct readability. Context, domain, neighbouring icons, size, text, sub-boundaries, colour, shape and orientation all help to interpret meaning from the picture. I accept that the RP, in its totality, is far greater than the sum of the individual iconography however there still is plenty to learn from the icon elements that will aid the wider understanding process.

6.5 Author Publications that have emerged from this Research

Berg, T. (2010,). The Application of Rich Pictures to System Problem Solving. *HeriotWatt, MACS, Project Library* . Edinburgh.

Berg, T., Pooley, R., & Queenan, J. (2011). Achieving Consensus within SSM. *International Journal of Humanities and Social Science , 1* (4).

Berg, T., & Pooley, R. (2012a). Contemporary Iconography for Rich Picture Construction. *Systems Research and Behavioural Science* .10,1 (P31-42)

Berg, T., & Pooley, R. (2012b). Rich Pictures: Collaborative Communication through Icons. *Systemic Practice and Action Research* .1,16

Berg, T., & Pooley, R. (2012c). Rich Pictures: A valuable means to explore complex IS issues. *17th international UK academy of Information Systems.* London: AIS Online library.

Bibliography

Ackermann, F., & Eden, C. (2010). *Strategic Options Development Analysis: A practical guide.* London: Springer.

Ackoff, R. (2003). iconoclastic management authority, advocates a ‘‘systemic’’ approach to innovation. (R. J. Allio, Ed.) *STRATEGY & LEADERSHIP , 31* (3), 19-26.

Ackoff, R. (2004). *Keynote at ICST2004*. Retrieved August 27, 2010, from Philosophy and Culture, with Russell Ackoff: http://knol.google.com/k/philosophy-and-culture-with-russell-ackoff#

Ackoff, R. (1978). *The Art of Problem Solving.* United States: John Wiley & Sons.

Ackoff, R. (2008, December 12). *U.Tube*. Retrieved July 13, 2010, from Dr. Russell Ackoff on Systems Thinking: http://www.youtube.com/watch?v=IJxWoZJAD8k

Ackoff, R. (2006). Why few organizations adopt systems thinking. *Systems Research and Behavioral Science , 23*, 705–708.

Ackoff, R., & Emery, F. (1972). *On Purposeful Systems.* London: Tavistock Publications.

Ackoff, R., Emery, F., & Ruben, B. (2005). *On purposeful systems: an interdisciplinary analysis of individual and social behavior as a system of purposeful events.* New York: Transaction Publishers.

Alok, J. (2012, 06 14). *Neanderthals may have been first human species to create cave paintings*. Retrieved 07 2012, 02, from The Guardian News: http://www.guardian.co.uk/science/2012/jun/14/neanderthals-first-create-cave-paintings#_

Argyle. (1988). *Bodily communication* (2 ed.). Taylor & Francis.

Argyris, C., & Schön, D. (1978). *Organizational Learning: A theory of action perspective.* Reading , MA: Addison-Wesley.

Armson, R. (2011). *Growing Wings on the Way.* Axminster: Triarchy Press.

Ashby, W. (1956). *An Introduction to Cybernetics.* Chapman & Hall.

Avison, & Fitzgerald. (2003). *Information Systems Development:Methodologies Techniques and Tools* (3rd Edition ed., Vol. 3). London: McGraw-Hill.

Avison, D., & Woodharper, T. (1990). *Multiview: An Exploration in Information Systems Development.* New York: McGraw-Hill.

Avison, D., Golder, P., & Shah, H. (1992). Towards an SSM Toolkit: rich picture diagramming. *Journal of Information Systems , 1* (6), 397-407.

Avison, Shah, & Golder. (1993). Tools for SSM: a justification – a reply to 'critique of two contributions to soft systems methodology. *European Journal of Information Systems* , 312-313.

Baer, J., & McKool, S. (2009). Assessing Creativity Using the Consensual Assessment Technique. In *Handbook of Research on Assessment Technologies, Methods, and Applications in Higher Education* (pp. 65-77). IGI Global.

Banister, P., Burman, E., Parker, Taylor, M., & Tindall, C. (1994). *Qualitative methods in psychology: a research guide. Buckingham* (Vol. Chapter 1 and 2). Buckingham: Open University Press.

Bannister, P., Burman, E., Parker, I., Taylor, M., & Tindall, C. (1994). *Qualitative methods in Psychology. A research guide.* Buckingham: Open University Press.

Barnard, C. (1938). *The functions of the Executive.*

Barratt, D. (1996). *Co-operating Then and Now*. Retrieved 03 14, 2013, from Collaborative Arts: http://collabarts.org/?cat=2

Barratt, T. (2000). About Art Interpretation for Art Education. *Studies in Art Education , 42* (5), 5-19.

Barrett, T. (1994). *Criticizing Art: Understanding the Contemporary.* California: Mayfield Publishing Company.

Barry, D. (1996). Artful Inquirey: A Symbolic Constructivist Approach To Social Science. *Qualitative Inquirey , 2* (4), 411-438.

Barthes, R. (1957). *Mythologies.* Paris.

Barthes, R. (1964). *Elements of Semiology.* (A. L. Smith, Trans.) London: Jonathan Cape.

Basden, A., & Wood-Harper, A. (2002). *A Philosophical Enrichment of CATWOE.* Retrieved 01 07, 2010, from All of Life Redeemed: http://www.allofliferedeemed.co.uk/basdencatwoe.htm

Baskerville, R., & Myres, M. (2009, 12). Fashion waves in Information System Research and Practice. *MIS Quarterly , 33* (4).

Bateson, G. (1979). *Mind and Nature: A Necessary Unity (Advances in Systems Theory, Complexity & the Human Sciences.* New Jersey: Hampton Press.

Beer, S. (2002). What is cybernetics? *Kybernetes , 31* (2).

Bell, F., & Adam, A. (2004). The Problem of Integrating Ethics into IS Practice. *The European IS Profession in the Global Networking Environment.* Finland: ECIS.

Bell, S., & Coudert, E. (2005). *A practitioner's guide to 'Imagine', the systemic and prospective sustainability analysis. Blue Plan Papers (3).* Valbonne, France: UNEP.

Bell, S., & Morse, S. (2012). How People Use Rich Pictures to Help Them Think. *Systemic Practice and Action Research* .

Bell, S., & Morse, S. (1996). *Learning with Information Systems.* Routledge.

Bell, S., & Morse, S. (2012a). *Resilient Participation: Saving the human planet.* Abingdon: Routledge.

Bell, S., & Morse, S. (2010). Rich pictures: a means to explore the 'Sustainable Group Mind'. *Sustainable Development.*

Bell, S., & Morse, S. (2013). Towards an understanding of how policy making and groups use indicators. *Ecological indicators* .

Bell, S., & Wood-Harper, A. (1992). *"Rapid Information Systems Development: a non-specialist's guide to analysis and design in an imperfect world.* Maidenhead: McGraw Hill.

Bell, S., & Wood-Harper, T. (2003). *Information Systems :a non specialist guide to the Multiview approach.* London: Earthscan.

Bennett, P., & Cropper, S. (1986). *Recent Developments in OR:Helping people choose: Conflict and other perspectives in Belton, .* CA: Pergamon.

Berg, T. (2010, April). The Application of Rich Pictures to System Problem Solving. *HeriotWatt, MACS, Project Library* . Edinburgh.

Berg, T., & Pooley, R. (2012a). Contemporary Iconography for Rich Picture Construction. *Systems Research and Behavioural Science* .

Berg, T., & Pooley, R. (2012c). Rich Pictures: A valuable means to explore complex IS issues. *17 international UK academy of Information Systems.* London: AIS Online library.

Berg, T., & Pooley, R. (2012b). Rich Pictures: Collaborative Communication through Icons. *Systemic Practice and Action Research* .

Berg, T., Pooley, R., & Queenan, J. (2011). Achieving Consensus within SSM. *International Journal of Humanities and Social Science , 1* (4).

Berniker, E. (2003). From Text to Images: Leveraging bandwith to Displace Alphabets with Iconic Scripts. *IAMOT Conference Proceedings.* Nancy,Francy.

Bertalanffy. (1968). *General System theory: Foundations, Development, Applications.* New York: George Brazille.

Beyer, H., & Holtzblatt.K. (1999). "Contextual design. *interactions 6.1* , 32-42.

Biggerstaff, D., & Thompson, A. (2008). Interpretative Phenomenology Analysis: A qualitative methodology of choice in healthcare research. *Qualitative Research in Psychology , 5* (3), 214-224.

Birren.F. (1961). *Creative Colour.* USA: Reinhold Publishing Corporation.

Birrin, F. (1978). *Colour & Human Reponse.* USA: van Nostrand Reinhold.

Boje, D. (1991). The Storytelling Organisation:a study of story performance in an office supply firm. *Administrative Science Quarterly* (36), 106-26.

Boud. (1985). *Reflective:Turning Experience into Learning.* London: Kogan page.

Boulton, M. (2005, 10 15). *Design Thinking, Web Delivery*. Retrieved 06 09, 2009, from Journal: http://www.markboulton.co.uk/journal/comments/icons_symbols_and_a_semiotic_web/

Brant, H. (1945). *The Psychology of seeing.* New York: Philosophical Library.

Bristow, W. (2011). *The Stanford Encyclopedia of Philosophy (Summer 2011 Edition)*. Retrieved February 12, 2013, from Enlightenment: http://plato.stanford.edu/archives/sum2011/entries/enlightenment

Bronte-Stewart. (1999). Regarding Rich Pictures as Tools for Communication in Information Systems Development. *Computing and Information systems , 6*, 83-103.

Brown, A. (2006). *Yarbus*. Retrieved Mar 20, 2013, from The Homo discens project: http://www.homodiscens.com/home/ways/perspicax/active_vision_sub/yarbus/index.htm

Brown, K. (1992). The world as a Total System. *European Journal of information Systems* , 387-395.

Brown, S., Rohde, M., & Kleon, A. (2010, May 06). *Slide share*. Retrieved 2 21, 2013, from Visual Note-taking 101: http://www.slideshare.net/austinkleon/visual-notetaking-101-from-sxsw-2010

Bryant, J. (2007). Drama theory: dispelling the myths. *Journal of the Operational Research Society , 58*, 602-613.

Bryant, J., & Chin, C. (2000). Integrating approaches to revitalise a church's mission strategy. *Journal of Operational Reearchs Society , 51*, 689-699.

Bulzan, T. (1992). *Use your Head .* London: BBC Publications.

Cambridge-University-Press. (2010). *The Development of Writing.* Retrieved 12 11, 2012, from Linguistics: http://www.cambridge.org/features/linguistics/yule/downloads/sample_21.pdf

Campbell Williams, M. (1998). Interpreting Rich Pictures Symbolically. *SYST.RES , 15*, 55-59.

Carayannis. (1999). *Fostering Synergys between Information Technology and Managerial Organisational Cognition.* Elsevier Science Ltd.

Cash, J. (1976). *Metrolyrics*. Retrieved 10 22, 2012, from One Piece At A Time Lyrics: http://www.metrolyrics.com/one-piece-at-a-time-lyrics-johnny-cash.html

Castells, M. (1996). *The Rise of the Network Society, The Information Age: Economy, Society and Culture* (Vol. 1). Oxford: Blackwell.

Chandler, D. (2009, 01). *Semiotics for Beginners*. Retrieved 06 09, 2009, from Aberdeen University: http://www.aber.ac.uk/media/Documents/S4B/sem02.html

Checkland. (1985). Optimising to learning:A Development of Systems Thinking. *Journal of Operational Research* , 36,9,757-767.

Checkland. (2000). SSM:A Thirty Year Retrospective. *Systems research and Behavioral science* , s11-s58.

Checkland. (1981). *Systems Thinking,Systems Practice.* Chichester: Wiley.

Checkland, & Scholes. (1991). *Soft Systems Methodology in Action.* Chichester: Wiley & Sons.

Checkland, & Scholes, 1. p. (1999). *Soft System Methodology in Action.*

Checkland, P., & Holwell, S. (1998). *Information, Systems and Information Systems - making sense of the field.* Chichester, UK: John Wiley and Sons.

Checkland, P., Forbes, P., & Martin, S. (1990). The Use of the Term 'Weltanschauung' in Soft System methodology. *Journal of Applied Systems Analysis , 13*, 109-115.

Clayton, & Radcliffe. (1996). *Sustainability: A Systems Approach.* Boulder: Westview Press.

Cobley, P., & Litza, J. (1997). *Semiotics: a graphical guide.* London: Icon Books Ltd.

Cohen, L., & Manion, L. (1996). *Research Methods in Education.* London: Routledge.

Conkin. (2005). *Dialogue Mapping: Building Shared Understanding of Wicked Problems.* USA: Wiley & sons Ltd.

Conklin, E. (1996). *Designing organizational memory: preserving intellectual assets in a knowledge economy.* (C. Institute, Ed.) Glege Creek.

Conradin, K; Kropac, M; Spuhler, D. (2010). *The SSWM Toolbox. Basel: seecon international gmbh. URL:*. Retrieved Dec 17, 2012, from Sustanable Sanitation and Water Management toolbox: http://www.sswm.info/category/planning-process-tools/exploring/exploring-tools/preliminary-assessment-current-status/rich

Cooper, J. (1997). *Plato: Complete Works.* Indianapolis: Hackett.

Coxon, A. (1999). Sorting data: Collection and analysis. *Sage University Papers Series on Quantitative Applications in the Social Sciences* , 7-127.

Coyle, R., & Alexander, M. (1997). Two approaches to qualitative modelling of a nation's drug trade . *System Dynamics Review , 13* (3), 205-222.

Crane, A., & Matton, D. (2007). *Business Ethics.* New York: Oxford University Press.

Crawford, L., & Costello, K. (2000). Towards a Transferable Methodology for Managing Strategic Change. *IRNOP IV Conference - Paradoxes of Project Collaboration in the Global Economy: Interdependence, Complexity and Ambiguity.* University of Technology, Sydney.

Crotty, M. (1998). *The Foundations of Social Science:Meaning and Perspective in the Research Process.* SAGE.

Curtin, C. (2007, Aug). Scientific American. *297* (2), p. 104.

Daellenbach, H. (1994). *Systems and Decision Making.* John Wiley and Sons.

Danto. (1981). *The transfiguration of the commonplace: A philosophy of art.* Harvard University Press.

Darzentas, & Spyrou. (1994). Defining the Design 'Decision Space: rich pictures and relevant subsystems . *The Amodeus project document TA/WP 21* .

Davison, R. (2000). Professional Ethics in Information Systems: A Personal Perspective. *Communications of AIS , 3* (8).

DeBono, E. (1985). *Six thinking hats.* USA: Little Brown and Company.

Demming, P. (2005, April). Is computer science science? *48 (4)* .

Denning, S. (2011). *the leaders guide to storytelling.* San Francisco: Josse Bass.

Diaper, D. (1989). *Knowledge elicitation: Principles,techniques and applications.* Chchister: Ellis Harwood.

Dreyfuss, H. (1972). *Symbol Sourcebook : An Authorative Guide to International Graphic Symbols.* New York: John Wiley and Sons INC.

DSA. (2001). *History of the Highway Code*. Retrieved 6 7, 2011, from Department for Transport: http://www.dft.gov.uk/dsa/Category.asp?cat=345

Eco, U. (1976). *A Theory of Semiotics.* Bloomington: Indiana University Press.

Eden, C., Jones, S., & Sims, D. (1983). *Messing About in Problems.* London: Pergamon Press.

Edwards, B. (2008). *Drawing on the Right Side of the Brain.* London: Harper Collins.

Edwards, M. (2008). *Fragrances of the world.* Michael Edwards and Co.

Encausse, G. (1896). *Tarot of the Bohemians by Papus.* London: G.Redwat.

Fahey, L., & Prusak, L. (1998). The Eleven Deadliest sins of Knowledge management. *California Management Review , 40* (3), 265-276.

Farrington, J. (2011). Seven plus or minus two. *Performance Improvement Quarterly , 23* (4), 113-116.

FitzGerald, J., & FitzGerald, A. (1973). *Fundamentals of Systems Analysis.* USA: John Wiley & Sons.

Flemingn, N., & Mills, C. (1992). Helping Students Understand How They Learn. The Teaching Professor. *7* (4).

Flood, R. (2010). The Relationship of 'Systems Thinking' to Action Research. *Systemic Practice and Action Research , 23*, 269-284.

Forster, Cebis, Majteles, Morgan, Preuss, Tiwari, et al. (1999). The role of story-telling in organizational leadership. *Leadership & Organization Development Journal , 20* (1), 11-17.

Fortune, J., & Peters, G. (1995). *Learning from Failure.* Chichester: Whiley & Sons Ltd.

Fourcade, M. (1968). *L'Arche de Noé.*

Fox, K. (199*). *The Smell Report: An Overview of Facts and Findings.* Oxford.

Fractal.org. (n.d.). *The Nature of Emotions*. Retrieved 8 14, 2012, from Fractal.org Centre for Fractal Design and Consultancy : http://www.fractal.org/

Freelon, D. (2010). ReCal: Intercoder Reliability Calculation as a Web Service. *The international Journal of Internet Science , 5* (1).

Friend, J. (1998). Managing development projects and programmes : fresh perspectives towards an action. Working Paper No. 21.

Frug, S. (2011). *Attempts*. Retrieved 10 23, 2012, from Xu Bing's Book from the Ground : http://stephenfrug.blogspot.co.uk/2011/07/xu-bings-book-from-ground.html

Geertz, C. (1973). *The interpretation of cultures.* New York: Basic Books.

Giles, C. (1992). *The Tarot: History, Mystery and Lore.* New york: Fireside.

Glaser, B. (1992). *Emergence vs Forcing Basics of Grounded Teory Analysis.* Mill Valley: Sociology Press.

Glaser, B., & Strauss, A. (1967). *The discovery of grounded theory: Strategies for qualitative research.* h New York: Aldine de Gruyter.

Goffman, E. (1959). *the presentation of Self in Everyday Life.* new york: Doublesday.

Goldsmith, E. (1984). *Research into Illustration : an approach and review.* Cambridge: Cambridge University Press.

Goldsmith, E. (1984). *Research into Illustration : an approach and review.* Cambridge: Cambridge University Press.

Gray, D., Brown, S., & Macanufo, J. (2010). *Gamestorming.* CA: O'Reilly Media Inc.

Halsey, A. (1972). *Educational priority volume 1: Educational priority area problems and policies.* London: HMSO.

Haramundanis, K. (1996). Why icons cannot stand alone. *Asterisk Journal of Computer Documentation, . , 20* (2), 1-8.

Harry, M. (1994). *Information Systems in Business.* Pitman.

Hart, A. (1985). Knowledge elicitation: issues and methods. *Computer Aided Design , 17* (9), 455-462.

Hart, D., Scoular, G., & Brigg, A. (2001). Qualitative analysis of psychosocial impact of diagnosis of Chlamydia trachomatis: implications for screening. *British Medical Journal , 322*, 195-199.

Harvey, J. (1996). *The Albilene Paradox and other Meditations on Management.* San Francisco: Jossey-Bass.

Herbert, F. (1965). *Dune.* USA: Chilton.

Herzog, W. (Director). (2010). *Cave of Forgotton Dreams* [Motion Picture].

Hicks. (2004). *Problem Solving and Decision Making* (2nd Revised edition ed.). Thomson Learning.

Hicks. (1991). *Problem Solving in Business Management.* London: Chapman and Hall.

Higley, S. (2007). *Lingua Ignota, invented by Hildegard of Bingen's Unknown Language: An Edition, Translation and Discussion .* Palgrave Macmilla.

Hildreth, p., & Kimble, C. (2002). The Duality of Knowledge. *Information 8 , 8*.

Hillman, J. (1972). *The Myth of Analysis.* London: Northwestern University Press.

Hirschheim, R., & Klein, H. (1995). *Information System Development and Data Modelling.Conceptual and Philosophical Foundations.* UK: Cambridge University Press.

Hirschheim, R., & Newman, M. (1991). Symbolism and Information Systems Development: Myths,metaphors and Magic. *Information Systems Research* , 29-62.

Hitchcock, G., & Hughes, D. (1995). *Research and the teacher: A qualitative Introduction to School-Based Research* (2nd Edition ed.). London: Routledge.

Hogben, L. (1959). *Signs of Civilisation.* London: Rathbone.

Horan, P. (2002). A new and flexible graphic organiser for IS learning. *Proceedings of Informing Science conference,.* Cork,Irleland.

Horn, R. (1998). *Visual Language:Global Communication for the 21st Century.* Bainbridge: MacroVU.

Horton, W. (1991). *Illustrating Computer Documentation.* USA: John Wiley and Sons INC.

Horton, W. (1993). The Almost Universal Language: Graphics for International Documents. *Journal of the Society for Technical Communication , 40* (4), 682-693.

Howard, N. (1993). The role of emotions in multi-organizational decision-making. *Journal of the Operational Research Society , 44*, 613–623.

Hudson, W. (1960). Pictorial depth perception in sub-cultural groups in Africa. *Journal of Social Psychology , 52*, 183-208.

Hutson, G. (1992). Cause, Effect, Efficiency & Soft Systems Models , vol. 44 (4), pp 333-344. *Journal of the Operational Research Society , 44* (4), 333-344.

ISO. (2007, November). *Graphical symbols - Public information symbols*. Retrieved 12 11, 2012, from ISO7001: http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=41081

Jackson, M. (1975). *Principles of Program Design.* London: Academic Press.

Jackson, M. (1991). the origins and nature of criticle System thinking. *Systemic Practice and Action Research , 4* (2), 131-149.

Janis, I. (1974). *Victims of Groupthink.* USA: Houghton Mifflin Company.

Jarvis. (1997). Checklands CATWOE and Soft Systems Methodologies. *Bola project* .

Jayaratna, N. (1994). *Understanding and evaluating methodologies: NIMSAD A Systemic Framework.* Berkshire: McGraw-Hill.

JISC. (2012). *JISC.* Retrieved 12 6, 2012, from Pestle and Swot analysis: http://www.jiscinfonet.ac.uk/tools/pestle-swot/

Kandinsky, W. (1977). *Concerning the Spritual in Art: Translated with an introduction by Sadler.* London: Dover Publications.

Kandinsky, W. (1977). *Sounds (Hausder Kunst).* Munich.

Kasser, J. (2010). Holistic Thinking and How It Can Produce Innovative Solutions to Difficult Problems. *Proceedings of the 7th bi-annual European Systems Engineering Conference (EuSEC),* (pp. 1-17). Stockholm, Sweden: INCOSE.

Kaufman, J., J Plucker, J., & Baer, J. (2008). *Essentials of Creativity Assessment.* new jersey: Wiley and Sons.

Kellert, S. (1993). *In the Wake of Chaos: Unpredictable Order in Dynamical Systems.* Chicago: University of Chicago Press.

Kelly, G. (1955). *The psychology of personal constructs.* New York: Routledge.

Kennedy, J. (1974). *A psychology of picture perception.* San Francisco: Jossey-Bass Publishers.

Khisty. (1993). *Citizen Participation using a Soft System Perspective.* Washington: Transp res.

Koestler, A. (1967). *The Ghost in the Machine.* UK: Hutchinson.

Kress. (2000). *Text as the Punctuation of Semiosis: Pulling at some of the threads.* Manchester: manchester University Press.

Lackoff, G., & Johnston, M. (1980). *Humans as symbolic creatures.* Chicago: Chicago Press.

Langer, S. (1942). *Philosophy in a New Key.* Cambridge: Harvard University Press.

Lewis. (1992). Rich Picture Building in the Soft Systems Methodology. *European Journal of Information Systems , Vol. 1* (5), 351-360.

Lin, R. (1999). Cultural differences in icon recognition. *Proceedings of the Eighth International conference on Human -Computer Interaction* (pp. 725-729). Amsterdam: Elsevier.

Lombard, M. (2002). Content analysis in mass communication. *Human Communication reasearch , 28* (4), 587-604.

Lord, T. (1990). Enhancing learning in the life sciences through spatial perception. *Innovative Higher Education , 15* (1), 5-16.

Lorenz, E. (1993). *The Essence of Chaos.* Seattle: University of Washington Press.

MacErlean, F. (2012, 2 10). *First Neanderthal cave paintings discovered in Spain .* Retrieved 7 18, 2012, from New scientist: http://www.newscientist.com/article/dn21458-first-neanderthal-cave-paintings-discovered-in-spain.html

Magee, K. (1987). The elicitation of knowledge from designers. *Design Studies , 8* (2), 62-69.

Malinowski, B. (1922). *Argonauts of the Western Pacific.* Long Grove,IL: Waveland Press.

Mangham, I., & Overington, M. (1987). *Organisations as a Theatre: A Social Psychology of Dramatic Appearances.* Chichister: Wiley and Sons ltd.

Manson, R. (1995). Applying Ethics to Information Technology Issues. *Communications of the ACM , 38* (12), 55-57.

Marshall. (2011, 4 19). *Bear DNA is clue to age of Chauvet cave art.* Retrieved 7 18, 2012, from New Scientist: http://www.newscientist.com/article/mg21028093.900-bear-dna-is-clue-to-age-of-chauvet-cave-art.html

Marshall, C., & Rossman, G. (1990). *Designing Qualitative Research (1st edition).* London and New Delh: Sage Publications.

McAvoy, J., & Butler, T. (2007). The impact of the Abilene Paradox on double-loop learning in an agile team. *Information and Software Technology , 49* (6), 552–563.

McCloud, S. (1993). *Understanding Comics: The Invisible Art.* New York: HarperPerennial.

McCormack.K. (1998). *Tarot Decoder.* London: Quantum Publishing Ltd.

McLoud. (2001). *Qualitative research in counselling and psychotherapy.* London: Sage.

Mead, M. (1928). *Coming of age in America.* New York: Morrow.

Merton, R., Fiske, M., & Kendall, P. (1956). The Focused Interview . *The American Journal of Sociology , 51* (6).

Metcalf, M. (2006). *Reading critically at university.* London: Sage Publications Ltd.

Mingers, J. (1992a). Criticizing the Phenomenological Critique-Autopoiesis and Critical Realism. *Systems practice 5* , 173-180.

Mingers, J., & Rosenhead, J. (2004). Problem structuring methods in action. *European Journal of Operational Research , 152*, 530-554.

Monk, & Howard. (1998). *The Rich Picture: A tool for reasoning about work content*. Retrieved 05 23, 2009, from http://www.ics.uci.edu/~wscacchi/Software-Process/Readings/RichPicture.pdf

Mullekom, T., & Vennix, J. (2008). Structuring managerial problem situations, assessing the suitability of different methodologies. *The 20th International Conference of The System Dynamics Society .* The Netherlands.

Mumford, E. (1996). *Systems Design.* London: Macmillan Press.

Munroe, T. (1928). *Scientific method in Aesthetics.* New York: W.W.Norton & Company.

Myres, M., & Klein, H. (2011, March 01). A set of principles for conducting critical research in information systems. *MIS Quarterly , 35* (1), pp. 17-36.

Nelson, D. L., Reed, V., & Walling, J. (1976). Pictorial superiority effect:Human Learning and Memory . *Journal of Experimental Psychology , 2* (5), 523.

Nelson, T., & E, M. (1998). Facilitating problem-solving groups:Facilitator Competences. *Leadership & Organization Development Journal , 19* (2), 72-82.

Nielsen, J. (1995, May). *Card Sorting to Discover the Users' Model of the Information Space.* Retrieved 12 6, 2012, from useIT.com: http://www.useit.com/papers/sun/cardsort.html

Nonika, I. (1991). The Knowledge Creating Company. *Harvard Business Review , 69* .

Open-University. (2009). *Systems Thinking and Practise*. Retrieved 11 30, 2012, from T552: http://systems.open.ac.uk/materials/T552/

OR54. (2012, Sep). *Operational Research*. Retrieved Nov 30, 2012, from Conference website: http://www.theorsociety.com/Pages/Conferences/OR54/OR54.aspx

Paivio, A. (1968). Why pictures are easier to recal than words. *Psychonomic Science , 11* (4), 138.

Parker, K. (1991). *Developement of a Toolkit for Soft Systems.* Birmingham: Aston Aniversity.

Patching, D. (1990). *Practicle Soft System Analysis.* London: Pitman Publishing.

Patton, M. (1980). *Qualitative evaluation methods.* London: Sage Publications.

Peirce. (1931-1958). *Collected Writings* (2 ed., Vol. 2). Cambridge: Harvard University Press.

Perls, F. (1973). *The Gestalt Approach & Eye Witness to Therapy.* New York: Bantam Book.

Pidd, M. (1996). *Tools for thinking,modelling in management science.* London: Wiley.

Pink, D. (2008). *A Whole New Mind.* London: Marshall Cavendish International.

Poole, A., & Ball, L. (2003). Eye Tracking in Human-Compute rInteraction and Usability Research: Current Status and Future Prospects. *Encyclopedia of Human-Computer Interaction* .

Pooley, R., & Stevens, P. (1998). *Using UML - Software Engineering with Objects and Components.* London: Addison-Wesley.

Rafaie, E. (2003). Understanding visual metaphor: The example of newspaper cartoons. *Visual Communication , 2* (1), 75-95.

Ragsdell, G. (2000). Engineering a paradigm shift? *Journal of Organizational Change Management , 13* (2), 104-120.

Ralstom, e. a. (2000). *Encyclopaedia of Computer Science.* Native Publishing Group.

Refaie, E. (2003). Understanding Visual metaphor. *Visual Communication* , 75-95.

Rimmel, E. .. (1865). *Book of Perfumes.* London: Chapman and Hall.

Rittel, H., & Webber, M. (1984). *Planning Problems are Wicked problems.* (N.cross, Ed.) Chichester: Wiley & Sons.

Roam, D. (2009). *The back of the Napkin.* London: Marshall Cavendish Ltd.

Rosbergen, E., Pieters, R., & Wedel, M. (1997). Visual Attention to Advertising: A Segment-Level Analysis. *Journal of Consumer Research* , 305–14.

Rosenhead, J., & Mingers, J. (2001). *Rational Thinking for a Problematic World* (2 ed.). Chichister: Wiley and Sons.

Ruggles, R. (1998). The state of the notion: Knowledge management in practice. *California Management Review, , 40* (3), 80-89.

Saussure, F. d. (1916). *Cours de linguistique générale.* Otto Harrassowitz Verlag.

Schminke, M., Ambrose, M., & Noel, T. (1997). The Effect of Ethical Frameworks on Perceptions of Organizational Justice. *The Academy of Management Journal , 40* (54), 1190-1207 .

Seedhouse, D. (1998). *Ethics: the Heart of Healthcare.* Chichister: Whiley .

Seely, Brown, J., & Duguid, P. (1998). Organizing Knowledge. *California Management Review , 3*.

Seidman, I. (1998). *Interviewing as qualitative research: A guide for researchers in education and the social sciences.* New York: Teachers College Press.

Sein, M., Olfman, L., Bostrom, R., & Davis, S. (1993). Visualization ability as a predictor of user learning success. *International Journal of Man-Machine Studies , 39* (4), 599-620.

Senge. (1990). *The Learning Organisation*. Retrieved 05 25, 2009, from Informal Education: http://www.infed.org/thinkers/senge.htm

Senge, P. (1990). *The Fifth Discipline: the Art and Practice of the Learning Organization.* New York: Doubleday/Currency.

Senge, P., Ross, R., Smith, B., Roberts, C., & Kleiner, A. (1994). *the Fith discipline fieldbook: Strategies and Tools for Building a Learning Organisation.* london: Nicholas Brealey.

Shepard, R. (1967). Recognition memory for words, sentences and pictures. *Journal of Verbal Learning and Verbal Behaviour , 6*, 156-163.

Sherwood, D. (2002). *Seeing the Forest for the Trees.* London: Nicholas Brealey Publishing.

Shoulson, M. (2012). *The Klingon Language Institute*. Retrieved Dec 11, 2012, from Klingon: http://www.kli.org/

Sidhu, M., Jani, H., & Ramesh, s. (2001). Critical Evaluation of Rich Pictures as a Pictorial Technique in SSM for Resolving Unstructured Problems. *National Conference on research and developement in Computer Science* , 137-143.

Sinek, S. (2010, May). *TED: Simon Sinek: How great leaders inspire action*. Retrieved August 27, 2010, from Ideas worth speading: http://www.ted.com/talks/simon_sinek_how_great_leaders_inspire_action.html

Skidmore, S. (1987). *Business Computing.* London: Edward Arnold.

Stowell, F., & West, D. (1994). *Client-led design: a systemic approach to information system definition.* London: McGraw-Hill.

Stretton, A. (1998). A Synthesis of Generic Process Steps for Managing Organisational Change as Projects. *Internal Monograph, Project Management Program* .

Surowiecki, J. (2004). *The Wisdom of Crowds.* London: Random House Inc.

Thompson, A., Kent, G., & Smith, J. (2002). Living with vitiligo: Dealing with difference. *British Journal of Health Psychology , 7*, 2-3-225.

Tolkien, J. R. (1954). *The Fellowship of the Ring, The Lord of the Rings.* Boston: Houghton Mifflin .

Tufte, E. (1990). *Envisioning Information.* Cheshire: Graphics Press.

Urry, J. (2005). The Complexities of the Global. *Theory, Culture & Society October , 22* (5), 235-254.

Uvaraj, T., Begum, M., & Gopi, P. (2011). Cognitive Semiotics Approach for Communication Development of Language Learners. *Theory and Practice in Language Studies , 1* (10), 1420-1423.

Vail, P. (1989). *Managing as a Performing Art.* San Francisco: Josse-Bass.

Valéry, P. (1937). *Our Destiny and Literature.* Pantheon.

Vickers.J. (1968). *Value Systems and Social Process.* Middlesex, England: Pelican Books.

Vidal, V. (2005). The Art and Science of Problem solving. *Investigacao Operacional , 25*, 157-178.

Vitz, P. (1966). Preference for different amoounts of Visual Complexity. *Behavioural Science , 11*, 105-114.

Vitz, P. (1966). Preference for different amoounts of Visual Complexity. *Behavioural Science , 11*, 105-114.

Walker, S. (2011, December 11). *eSTEeM IBZL Phase 1 event.* Retrieved 1 24, 2013, from IBZL The infinite bandwith zero latency project: http://ibzl.wordpress.com/category/workshop/

Waring, A. (1996). *Practicle System Thinking.* London: Thompson learning.

Waring, A. (1989). *System Methods for Managers.* Oxford: Blackwell Scientific Publications.

Weick, K. (1993). The Collapse of sensemaking in Organizations: the Mann Guich Disaster. *Administrative Science Quarterly , 33*.

Weinberger, E. (2006). *Pragmatic Information and Gaian Development.* Retrieved 08 25, 2010, from http://arxiv.org/abs/nlin.AO/0606012

Weiss, R. (1994). *Learning from Strangers: The Art and Method of Qualitative Interview Studies.* The Free Press.

Wenger, E. (1998). *Communities of practice. Learning, meaning and identity.* Cambridge: Cambridge University Press.

Westcombe, M. (2002). Problem Structuring: The process of SODA Modelling. *ACM Hypertext Conference.* USA: University of Maryland.

Whitman, A. (1969, 8 17). Mies van der Rohe Dies at 83; Leader of Modern Architecture. *The New York Times* .

Williams. (2000). Soft System Case study Investigating the Information System. *1st International Conference on Systems thinking* , 647.

Williams, M. C. (1996). The use of symbo-constructive pictures to explore the shadow side of teaching -learning. *5th Annual Teaching Learning Forum* (pp. 179-184). Perth: Murdoch University.

Williams, T., Mulligan, C., Koprowicz, K., Miller, J., Reimann, C., & Wang, D. (2004). Does isolating a visual element call attention to it?: Results of an eye-tracking Investigation of the effects of Isolation on Emphasis. *Communication , 52* (1).

Willig, C. (2008). *Qualitative research in Psychology* (2nd edition ed.). New York: McGrawHill.

Wilson. (1984). *System Concepts: Methodologies and Applications.* Chichister: John Wiley & sons.

Wilson, B. (1984). *System Concepts,Methodologies and Applications.* Chichester: John Wiley & Sons Ltd.

Wilson, T. (2002). The nonsense of Knowledge Management. *Information Research , 8* (1).

Wood-Harper, A., Corder, S., Wood, & Watson, H. (1996). How we Profess the Ethical System Analyist. *Communications of the ACM , 39* (3), 69.

Wood-Harper, Anthill, L., & Avison. (1985). *Information Systems Definition: The Multiview Approach.* Blackwell Scientific.

Wright, A. (1942). *Islandia.* Rinehart & Company.

Yarbus. (1967). *Eye Movements and Vision.* New York: Plenum.

Yates, F. (1966). *The Art of Memory.* Routledge & KeganPaul.

Zhang, Smith, & Watson. (1997). Towards computer support of the soft systems methodology:an evaluation of the functionality and usability of an SSM toolkit. *European Journal of Information Systems* , 129-139.

Appendix A: Facilitation

Rich Picture Facilitation

This section looks at the first part of my core research on RPs. This is a background study section investigating the way facilitation of group work occurs and the differing styles of facilitator delivery. This study, residing in the appendix of my thesis, cannot report to be empirical and could perhaps be seen as mainly based on observational opinion. I acknowledge this criticism and do not purport my work on RP facilitation to be any more than anecdotal at present. I do however, emphasise the importance of this background section and purport the relevance of any study, however small in data size, on the complex, and under acknowledged in literature, field of RP facilitation.

I do also acknowledge that not all RPs are facilitated. Many, and I have lots of examples in my icon dataset, sketch out an RP for an individual purpose. Not all RPs require formal facilitation; for example two people sitting together and using the tool to aid their thinking process on a problem (Armson, 2011). I expect numerous people have discovered the RP through reading books on IS and more specifically Checklands SSM work (Checkland, 1981). For many though, the first time they discover, or at least attempt to draw the RP, is in a workshop or lecturing environment and for these people the introduction is given by a facilitator or lecturer. In this chapter I am interested in facilitated RPs that are drawn in groups.

A group RP can be a tool to aid communication. The RP is often drawn to be experienced by people other than its creators. The process of those who use the RP tool can be a, 'Cycle of Communication' (Figure 1) between creators, facilitators and other stakeholders. The group RP process often begins (phase 1) with practitioner facilitation wherein the RP is introduced and instructions are given on what is required of the group. Phase two (group internal discussion) usually, but not always, precedes phase 3. Phase 3 on the cycle is RP construction, an act in which groups ideally both communicate and accommodate perceptions

of the world through images and metaphor. This phase requires an ability to transcend and appreciate other, perhaps even juxtaposed, perceived realities than just one's own. Ideally, through communication of ideas and feelings and bringing the private to the public realm by diagramming together, the group produces an agreed upon RP. This is not always the case however, as group work is often dominated by certain individuals. It should be therefore noted that I am offering a generalist perspective of the RP process and my cycle is not the only way to proceed. Thus said, the fourth and final phase of a stereotypical cycle is often to show ones drawing to others for response. The final phase seeks to communicate the RP meaning by verbal explanation to the facilitator and/or other groups or external participants. Following on from phase 4 the facilitator might ask for more RPs to be drawn to expand upon certain issues that come from the first RP and thus the process can begin again.

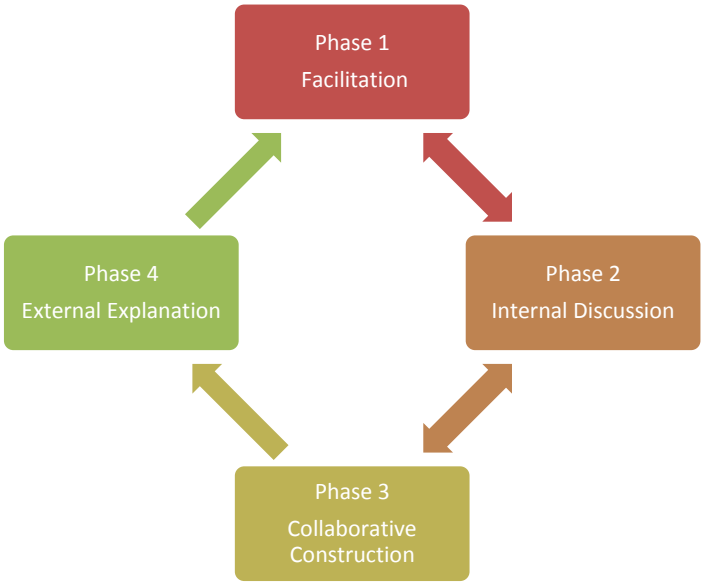


Figure 1 The RP Idealized Cycle of Communication

As figure 1 illustrates, the communicative cycle requires more than just the creators of the RP. There is an iterative process of facilitation within the cycle. The communicative potential of the created RP as an aesthetic artwork has been seen to arouse and engage emotion, challenge ideas and stimulate senses through a process of mutual discovery (Bell & Morse, 2012). The first phase of the communication cycle is facilitation. In this chapter I investigate the way the RP might be communicated **prior** to when the actual drawing begins. I am particularly interested in finding out what instructions, if any, are given to groups and how these instructions affect the final RP.

To be able to provide evidence to the hypothesis statement it is important to understand how RPs are being facilitated, if at all, in terms of introduction, delivery style, instructions and

expertise of the facilitators. The hypothesis claims that adding structure to the RP tool will improve the RP output. I am suggesting that the way the RP is facilitated is a form of structure. What is being assumed here is that, *how the workshops are facilitated directly impacts upon the construction and style of picturing which in turn impacts upon interpretation*. In order to address this 'how' statement and to meet the emergent RP issues identified in the literature review, summarised in Table 2.3, it is necessary to study RP facilitation. It is fully acknowledged that the wider domain of RP group work, in terms of group participation, is a vast subject area which has, to some extent, been documented (Bell & Morse, 2012a) (Bell & Morse, 2013). This section however, is specifically looking at RP facilitation and the role of the facilitator. I will be looking at phases 2 and 3 in detail in Chapter 4. In Chapter 5 I look at interpretation of a RP before explanation, or further verbal communication is given, so I will not be investigating phase 4. Phase 4 does however require further investigation but is not relevant in the scope of my hypothesis which looks at adding elements of structure to the RP process.

It has become apparent, during my research, that there are a number of differing styles of RP facilitation being employed and they can be seen to differ considerably depending on audience, domain and experience of the facilitator. For example the RP is being taught as a core PSM (Problem Structuring Method) tool in many Universities and yet, upon investigation, there seems to be little 'best practise' advice, not only on 'how to teach' but also on, 'how to facilitate a RP group'. Personal discussions and observations of facilitation confirm initial impressions that facilitation is very much left up to the facilitator. The following bullet points highlight the RP facilitation advice that I can find in literature to date.

- The Open University TU811 and T552 courses offer explicit information on what is expected and what to include in the pictures (Open-University, 2009). Bell and Morse are prominent researchers into RPs and they give clear indication on how they manage their facilitation. Bell and Morse have done considerable research into group dynamics and how to ensure good participation (Bell & Morse, 2010); (Bell & Morse, 2012); (Bell & Morse, 2012a). They suggest the following as a way of facilitation:
    - *The researcher wears plain black clothes so as not to stand out.*
    - *The researcher places chairs against the wall around the workshop room.*
    - *The researcher sits on these chairs observing the group*

- *The researcher moves slowly from point to point around the groups sitting on different chairs too observe from different angles*
- *The researcher does not speak to the group while they work*
- *The research does not comment on the group work while the group is working*
- *The researcher looks for the group action in terms of BECM: Being, Engaging, Contextualising and Managing*. (Bell & Morse, 2012a)

- The SSWIM (sustainable sanitation and water management) website authors (Conradin, K; Kropac, M; Spuhler, D, 2010) offer some rules of RP engagement based upon Monk and Howards' work (Monk & Howard, 1998). They state *"a rich picture requires only a large drawing surface and writing utensils of different colours. A rich picture can be drawn in whatever way best suits the needs of the individual or group, and good drawing skills are not necessary. Anything that is seen as significant should be added to the rich picture, and care should be taken to identify all stakeholders* who *are involved in or may be affected by the system. Because it is important that the rich picture be clear to everyone involved, certain techniques are sometimes used to represent elements like* stakeholder *perspectives (such as thought bubbles) and relationships (such as crossed swords for* stakeholder *conflicts). These or other techniques may be used, as agreed upon by the group."(Ibid)*. What is unique on this website is the SSWM toolkit tutorial that they openly share their instructions to help 'understand your system'. The toolkit offers advice on where to start and what to draw by giving illustrations of structural, process and concern elements. This website is specific for the domain of sustainable water management systems and therefore the icons and computerised development platform are not able to be generic across other domains. I should note that I find this website very leading with their instructions and they seem to structure so many rules and guidelines that I wonder if it can really be a RP they are in fact describing.

- Advice for drawing individual RPs is given by Armson who also writes out of the OU tradition. Armson suggests that there are 4 basic rules to getting started:

- Don’t Structure the RP in any way.
- Don’t use too many words
- Don’t exclude observations about cultures, emotions and values
- Include other points of view (Armson, 2011)

Armson does expound upon these rules but it should be noted she uses the RP as a tool for making sense of a messy situation from a small group (her sister and herself) perspective.

Facilitators of RP workshops note that one of the problems with getting participants to use the tool is trying to encourage people to draw in pictures (Berg & Pooley, 2012c). Drawing pictures is often a skill that is left behind in primary school and rarely encouraged, used or developed past the age of 12 (Gray, Brown, & Macanufo, 2010). Such activity is often seen as not professional enough for undertaking a serious large project (Bronte-Stewart, 1999). During the time of my research there have been opportunities to observe lecturers and experienced industry facilitators’ practising RP group-work. It is important to note that I am NOT looking at how RPs are facilitated in terms of their follow on process i.e. the methods that facilitators use with the RP after drawing. Instead this chapter is focussed on the very first introduction to RP’s for groups and the way they are facilitated / taught or delivered prior to the actual drawing within groups. The reason for this distinction between facilitation is that, in my opinion, it seems it is possible to discover evidence of comparable difference within the ‘prior-to’ facilitation stage by observation and participation. However, the *ad hoc* nature of the different ways facilitators move on ‘after’ picturing is considerably multifaceted and seems to be very much down to facilitator experience, knowledge of domain, methodology adoption, demands of differing projects and culture or need of the organisation.

The remainder of this chapter is not going to offer a ‘best practice of facilitation’ or a fully prescribed structure to ‘how to facilitate’ because, I believe, it would be presumptuous and ill-conceived to prescribe answers to, what seems to be, the concept of best RP facilitation advice. Rather, this chapter offers the potential for a discussion into differing methods of facilitation. Much of what follows is my own interpretation of the behaviour of facilitators of which I have witnessed. I am interested in the materials used by facilitators; paper size, colours offered, type of pens. Based on my facilitation observations I devise, test and evaluate my own small RP facilitation exercise. I suggest that such an exercise might be a useful way, for some facilitators, to initiate an RP session to eradicate some of the problems identified in Chapter 2. It should be noted however, that style and instruction is a vast and very personal subject amongst facilitators. Experienced facilitators have, and do successfully

run, their own personal styles but perhaps there could be a useful sharing and 'meeting of minds' for these such professionals to collaborate and offer advice to inexperienced academics and facilitators. Such advice might encourage more to use the RP tool and teach new students of its potential benefits. It is hoped that this chapter of my research will act as a catalyst for debate concerning the role of the facilitator.

Styles of facilitation

This section discusses the some different styles and the, often contradictory, level of information given to participants of RP drawing sessions. The information presented and direct quotes are taken from 3 annonymised workshops/ lectures that were observed from an AR standpoint, i.e. I participated in many of the sessions[13].

This participatory style of enquiry was undertaken because I felt that it would gain a better and more engaged understanding of what is being asked of a RP participant rather than a formal external observation exercise. Another reason for this method of enquiry was that it allowed me to discuss and connect with other participants. The following Tables present the 3 observed RP facilitation workshops.

Workshop1
Type of RP session: workshop for a large annonymised project
Year: 2011
Time taken : 10 minute discussion and 45minute picturing session
Attendees: 2 men 4 women in 1 group
Facilitator (s): 2 men both academics and expert industry professionals
Paper size : flipchart size
Colours offered : 5 coloured pens (1x black, 2x red,1xgreen and 1x orange)
Introduction platform: PowerPoint presentation
Style of delivery : engaging, fun, personable and friendly and expert
Discussion on previous pictures: showed a few pictures and discussed their strengths and weaknesses
Most notable quotes from facilitator when discussing the RP: "*this is a crap one in comparison*" and "*there are no rules*"

Observation from Workshop1 (W1)

[13] *In approaching this section, I was conscious to account for my own experiences in relation to who, what, where and how I was gathering and interpreting the research material. I fully acknowledge that my own identity and personal experiences will inevitably shape any such observations. The way I went about participating, interviewing, observing, collecting and storing of data is only one way to attempt such a study and it is accepted there are many other ways to acquire and disseminate such information. It should be therefore be noted that I am a 41-year-old, white, British, degree educated female. I have lived most of my life in Scotland. I have held a variety of both blue and white collar positions. I am a wife and mother.*

Workshop2
Type of RP session: workshop during a conference
Year: 2012
Time taken : 10 minute discussion and 35minute picturing session
Attendees: 4 men 2 women in 2 groups with 26 conference delegates observing
Facilitator (s): 1 man. 25 years in both academia and industry project facilitation
Paper size : flipchart size but facilitator suggested they prefer a white board when available
Colours offered : 3 coloured pens for each group (1x black, 1x red,1xgreen)
Introduction platform: PowerPoint presentation
Style of delivery : engaging, authoritative , personable and friendly and expert
Discussion on previous pictures: showed a few pictures and discussed their strengths.
Most notable quotes from facilitator ; "*the picture itself is not important*"; "*sometimes I find it is easier and less problematic if I draw the picture whilst the group discusses*"

Observation from Workshop 2 (W2)

Workshop3
Type of RP session: lecture on SSM and RPs
Year: 2010
Time taken : 30 minute discussion on RP and reminder of previous lecture on SSM and 15minute picturing session
Attendees: 8 students, 2 groups of 4 (this was a solely observed workshop with no involvement)
Facilitator (s): 1 female. Lecturer in IS. No experience of facilitation in industry
Paper size : A3
Colours offered : 10 coloured pens in pack given to each group
Introduction platform: PowerPoint presentation
Style of delivery : authoritative, teaching, engaging, friendly , non expert
Discussion on previous pictures: showed a few pictures as examples. No discussion on their strengths and weaknesses. High level teaching on link of RP to SSM
Most notable quotes from facilitator "*there seems to be few rules* " *" it will be in your exam so we better have a go*"

Observation from Workshop 3 (W3)

Discussion on workshop facilitation styles

This section will be solely looking at the facilitation of the workshops and **not** at the resultant RPs. The reason the pictures and iconography will not be compared is because I was only able to gain access to one of the pictures after the workshops. In the following section I compare pictures and iconography with facilitation styles.

The 3 workshops (W1, W2, and W3) as described in the previous tables all displayed slightly different ways of facilitating the RP. All the workshops showed previously drawn RPs on PowerPoint slides. W1 was facilitated in a lively and fun manner with one male taking the lead role and the other observed as being a close friend. They were seen to bounce funny stories and incidents relating to other workshops and pictures thus the group were seen to visibly relax and smiles and laughter were observed. The atmosphere was quite laid back. In W1 the facilitators were keen to emphasise in their PowerPoint examples of both weak and strong RPs. They were observed showing examples of their "*worst ever picture*" and proceeded to discuss areas of colour, connectivity and unrelated icons. It was however, noted that although a picture they showed was, in their words, "*crap*" it was still useable, "*there is still plenty to learn*". As a participant in this workshop I wrote the following statement down during the presentation, "*at this point I feel the need to please....ie, not draw a bad rich picture*". W1 showed the groups a wide variety of RPs and they spent time pointing out rich elements and interesting icons. W1 was the only workshop that showed RPs from around different parts of the world pointing out interesting cultural distinctions. W2 was facilitated in a similar way to W1. A notable difference was the style of delivery. W2 was less jovial and fun than W1 as the facilitator was more authoritative.W2, as with all the workshops, was facilitated first using a power point presentation. This presentation also gave examples of RPs but, compared to W1, they were delivered without comment on their weakness but rather areas of richness and strength were pointed out. In W2 the facilitator used the word, "*scruffy*" to single out one picture and proceeded to give advice to the groups, "*identify systems in the situation*" and "*resist decision making*". In W2 the facilitator asked for volunteers to split into two groups of three with one person who as the client, another as the interviewer and the third person as the illustrator. The client was to think of a problem situation in their own lives. In all the workshops I observed, the facilitators rarely got involved or gave comment during the

picturing process. Questions were however answered when asked of the facilitators. W1 showed interest in icons and metaphors along with pointing out humour and ambiguity in the pictures they showed prior to drawing. The facilitator in W2 did not show any interest in the icons. It was clear that the picture was a way of aiding discussion and debate and bringing a level of clarity to a situation. The facilitator stated, "*the pictures are not important, I don't even try, nowadays, to understand them".*

W3 was a lecture on SSM with the RP being used as an activity for students to attempt. W3 had 2 groups of 3rd year degree students. The lecturer, whose background is in computer science, did not show a great deal of energy or encouragement with the activity saying, "*it will be in your exams so we had better have a go*". Thus said, the group work was started in a lack lustre way with only a few of the more diligent students partaking in the picturing exercise. The two groups in W3, after 5 minutes, seemed to enjoy the exercise and got really involved in their pictures. The lecturer stopped the groups drawing after 15 minutes as that was the end of the lecture. The groups carried on for a few minutes and then swapped their pictures between groups. The room was noisy and there was considerable laughter from both groups. In W3 the lecturer offered each group a full pack of 10 coloured pencils whilst in both the other workshops the facilitators offered no more than 4 or 5 large marker pens.

W1 and W3 both encouraged groups to draw and 'have a go', whereas W2, although encouraging volunteers to draw, stated, "*sometimes I find it is easier and less problematic if I draw the picture whilst the group discusses*".

A noticeable distinction between all 3 workshops is the time given to draw W1 offered 45minutes, W2 offered 35 and W3 gave only 15 minutes. W1 and W3 gave a '*5 minutes left to draw*' signal whilst W2 came to an abrupt end saying, "*Right, put down your pens please*".

W1 and W3 acknowledged participants' uneasiness at being asked to draw by offering advice such as, "a common place to start is to draw yourself" "*sometimes starting in the middle can help*" and "*it's not about being a good drawer*". What is a common and very verbal theme amongst all the groups in the workshops were the cries of, "*I can't draw*" and it was noted that participants were, at least at first, very uncomfortable drawing pictures. In W3 the students were interested to look, and not discouraged by the lecturer, at the other group's picture as they were all drawing the same scenario i.e., 'The complexities of University life'.

In W2 this was actively discouraged by the facilitator, "*never compare the pictures*". The resultant pictures in W2 and W3 [14] were surprisingly detailed given the time allowed.

In summary for this section, I have looked at three workshops and compared materials and facilitation styles. I do recognise that these workshops are not indicative of all facilitation practices and my small comparative study is perhaps more anecdotal than empirical. What is interesting is that even within a small study of three workshops there are notable differences in style, delivery, time allocated and materials offered. This concurs with conclusions of many of the authors in my literature review, wherein they discuss the ad-hoc approach that practitioners take to working with the tool. In my opinion the diversity of differing RP facilitation approaches raises questions, for some, on how best to implement workshops and in turn impedes many who might like to use the tool. To provide evidence for my opinion I include requests (Figure 2) I received from a research associate in Copenhagen and a social network message from a Lecturer of IS in Peru.

30/11/11
HI Tess

Could I ask you for some academic advice?

I would like to ask a group of 15-20 people to draw rich pictures of their situations, but the pictures should only depict critical issues within the organisation. How do I run a session? Should I show other rich pictures to the group before hand?
Should I split up the group of 15-20 people in 2 groups or more?
- How much time do they need to draw a picture of the critical issues?
- How much time do they need to present the pictures? So that I can write down single issues on a flipchart?

Unfortunately I cannot allow much time for these activities...the shortest the best, but at the end I should have a list of issues...and the exercise should make sense.
Many thanks Elena.
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

27/10/12
Tessa I enjoyed your presentation at the OR conference. I would like to gain more information on how I can use your rich picture tool. I think my students would like to learn about this one and it seems fun. I cannot find a user guide or any useful papers on how to use and teach. Can I perhaps have a copy of the slides you used or a copy of any papers you have written on using or applying the rich picture?

Julián

Figure 2 requests for facilitation advice

[14] For ethical reasons (sensitivity of domain) I was not allowed to keep the pictures from workshop 3. The pictures from W2 were destroyed even though I requested the pictures prior to the workshop.

I have taught RPs to the 3rd year IS students at Heriot Watt University for the last two years (2011-2012). In each of these lectures I have had students drawing RPs. The following section investigates a two year study wherein a small change to facilitation was made in 2012 in the hope of eliminating issues that were observed to be problematic in the drawing of RPs. All resultant RPs were based on the same scenario, "Managing the Complexity of your 3rd year at University". In 2011 I taught a fairly standard lecture and encouraged the students to draw RPs. Noticing the lack enthusiasm and slow pen-to-paper pick up rate I implemented a facilitation test in 2012 that sought to address some of issues associated with RPs. The test was a simple collaborative drawing, warm-up exercise prior to RP commencement. From this I was able to compare the test's resultant data along with the pictures from the previous year.

Facilitation Research

In February 2011 I taught RPs to 3rd year Information Systems (IS) students. During the lecture the students were split into groups and asked to draw a RP. As this was year one of my PhD I was aware that this might be the beginning of possible longitudinal study [15] of 3rd year IS students using RPs. I took careful note of my facilitation style in terms of time allowed for drawing of RPs, paper size, pens colours, pen pick up rate. I wrote down observational data such as student emotion, enthusiasm, noise, confidence and dis-interest in task. Figures 3 and 4 are the resultant RPs from the 2011 workshop.

[15] . A longitudinal study involves repeated observations of the same variables over years.

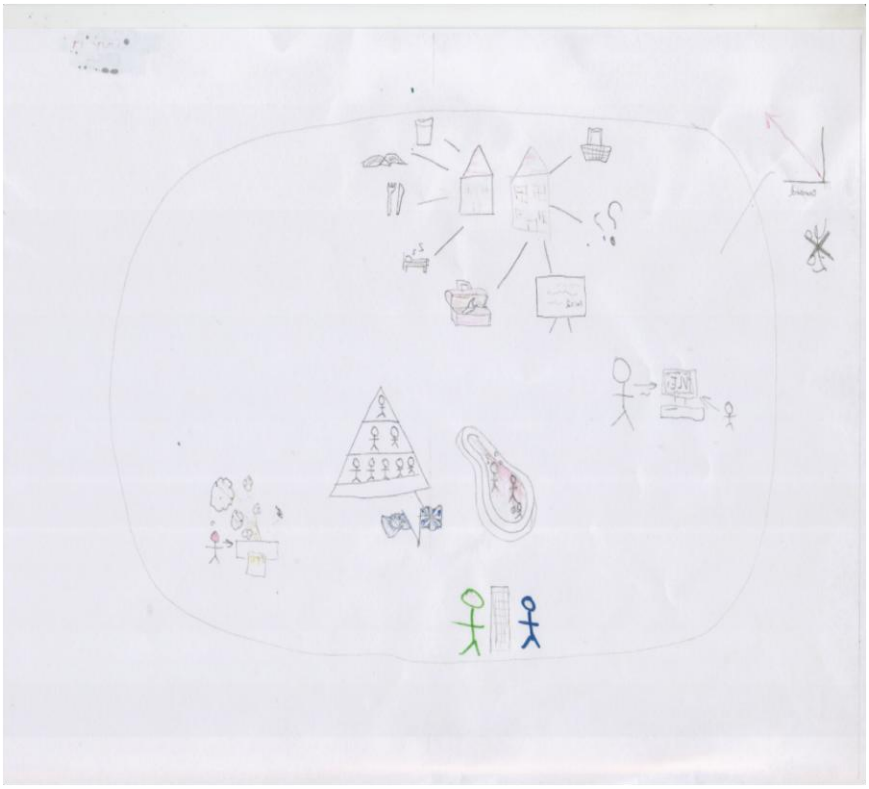


Figure3 RP from students in 2011

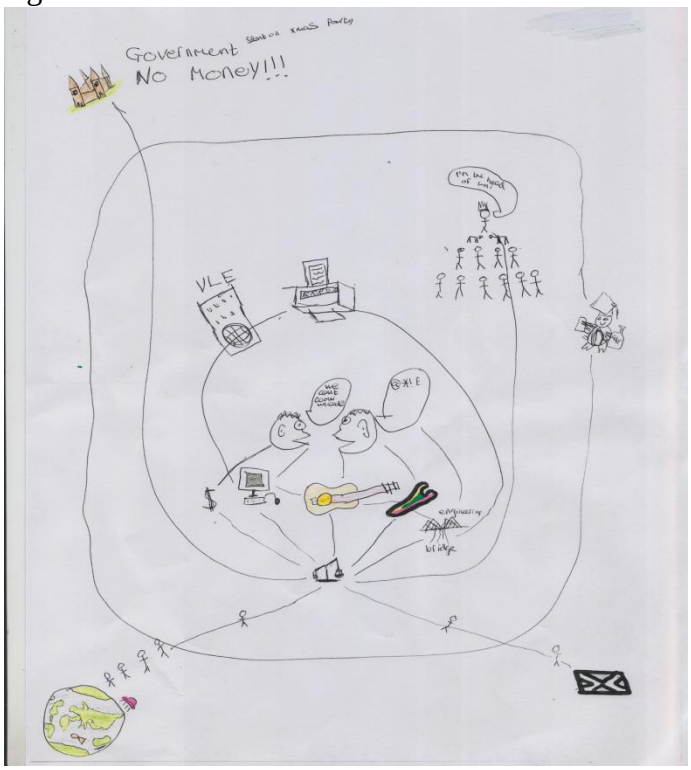


Figure 4 RP from students in 2011

From studying this data I realised that there were clear problems with getting the students to begin drawing. This echoed the academic writing discussed in my literature review on the

problems of using the RP tool. I observed that when the students began to put pen to paper, the noise and enthusiasm in the room gained momentum, but there were noticeably some students that did not engage in the task at all. The students were given 25 minutes to complete the task but, after much complaining, they carried on drawing for another 10 minutes. If I had insisted on only 25 minutes the resultant pictures would have been very poor in icons connectors and colour. Most of the drawing occurred in the last 10 minutes. Once time was called, after 35 minutes, panic drawing commenced with comments such as*, "just let us colour in the houses of parliament"* and *"just another minute".* There was an absolute reluctance to stop the exercise and an unwillingness to submit diagrams

It was also clear to see that the A5 sheet of paper given to the 2 groups was not big enough to allow everyone in the group to draw at the same time. It was also noted that a large selection of coloured pens was not required as the students in both groups used the same limited colours. I discuss colour in more detail in Chapter 3. The two RPs from this workshop (Figures 3 and 4) were of reasonable quality in terms of icons and connectors. Figure 4, in my opinion, is less rich than Figure 4 because it tells less of a story through the icons and connectors. Figure 4 is well linked and shows better boundary structure and more use of colour. I would suggest that neither picture is particularly rich though. I discuss in detail what constitutes a rich and poor RP in Chapter 5. Both pictures were in colour. Both pictures had areas which were not initially comprehensible; for example, both groups drew a steak to represent stakeholders. Perhaps, one could suggest, the students did not fully understand the term 'stakeholder'.

From reviewing this data and researching other visualisation techniques (Gray, Brown, & Macanufo, 2010); (Bulzan, 1992) I devised a facilitation experiment to be implemented in year 2 (2012) of teaching the same year group. It should be noted that both years of IS students drew RPs of the same scenario and were shown the same power point slide (Figure 5).

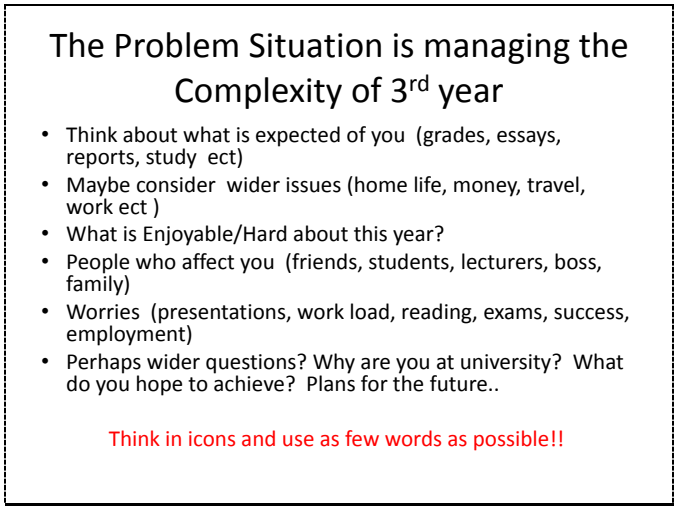


Figure 5 PowerPoint slide from facilitation experiment

Facilitation Experiment

This facilitation experiment was created from studying the observed data in 2011. The purpose of this experiment was threefold. I primarily sought to find out if a practice drawing session before the RP process begins would aid or deter the process in the following ways.

1. Will a practice session speed up the RP pen pick-up rate?
2. Does seeing the facilitator draw pictures encourage participants to draw?
3. Are the resultant pictures richer in icon, connector and comprehension?
4. Is there a difference to the overall engagement with the task in terms of group-work?
5. Are the icons of better quality after a practice session?
6. Does an undemanding, relaxed approach to the pre-RP session promote an unsettled and careless attitude towards the RP exercise?

A second area for consideration was to see if it is possible to speed up the whole RP process whilst still maintaining quality or richness of pictures. Finally, I wanted to know what choice of paper size would be most preferable when working together in a group. The results for this test are compared and contrasted with the 2011 workshop.

The Test:

In February 2012 twenty-one IS students were placed (no choice) into four groups. There were five girls in the class. Ages ranged from 19 to 25.The students were asked to draw a RP diagram based upon the slide shown in Figure 5. All groups were provided with a selection of

pens and a choice of A3 or flipchart paper. No student had ever drawn a RP before. Information, via a presentation, on what to include and how to draw a RP was given to all students. Examples of different styles of RPs were given to the groups during the presentation. A 10 minute pre-RP drawing session was performed with the students prior to RP commencement. Once the task was completed the students were asked to deliver an informal talk on what they drew and why.

Description of pre-drawing Session

The pre-drawing session was inspired by the work of Sunni Brown, Dan Roam, Scott McCloud ,Tony Bulzan and many other visual thinkers (Brown, Rohde, & Kleon, 2010); (Roam, 2009); (McCloud, 1993); (Bulzan, 1992). The premise behind this was *not* to give an art lesson but rather to encourage and motivate, giving students a friendly platform to put pen to paper. The aim was to get everyone drawing together in a collaborative way. There was no suggestion of 'getting things wrong' or 'not drawing well enough'. The whole purpose was *not* to produce 'good pictures' or to teach 'how to draw' but instead to engender a willingness, and even bravery, to begin or try to draw. Discussion, laughter and peer to peer support were encouraged.

The session lasted 10 minutes. The students were asked to copy what I drew live for them on a flipchart and blackboard. It was light-heartedly suggested that most people in the room could, and will, draw better than myself. Figure 6 was drawn and copied by the students to show the simple way of getting 9 emotions from 3 basic shapes. Figures 6 and 7 were sketched out live to show different ways of achieving movement and interaction with artefacts and stick figures. There was lots of encouragement to develop and improve their own pictures that were being copied from the flipchart in front of the students. At one point I moved to drawing on the class blackboard because the flipcharts were getting overcrowded and I needed more space.

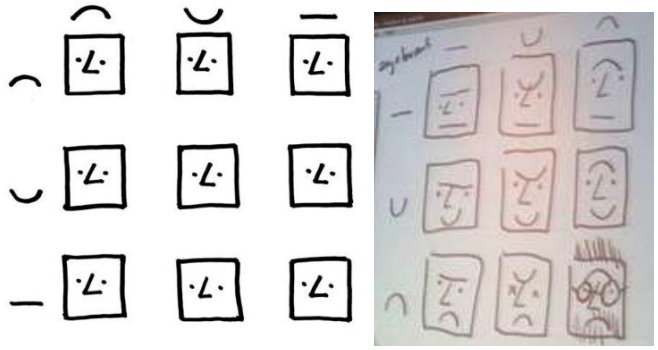


Figure 6 Copied from Sunni Brown (Brown, Rohde, & Kleon, 2010)

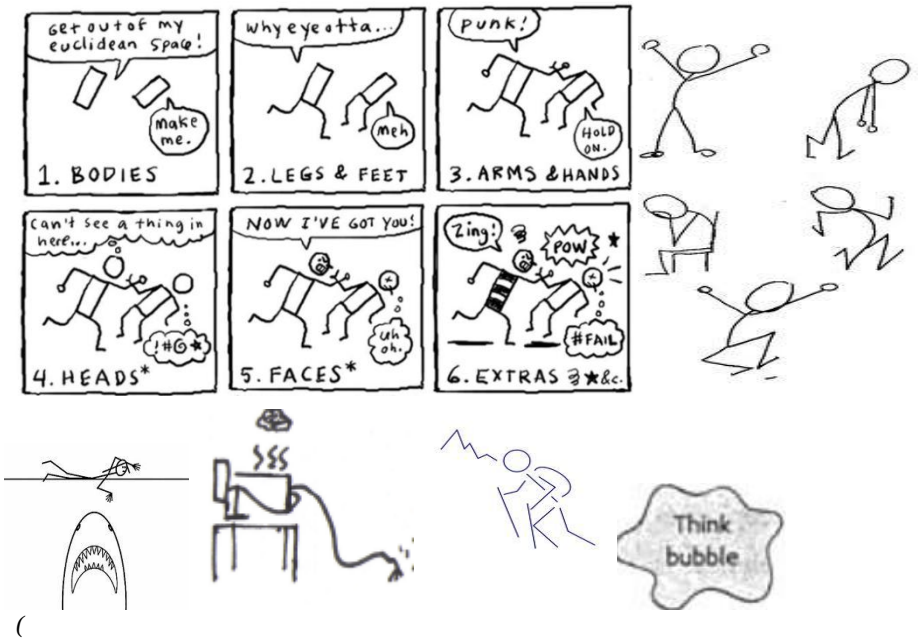


Figure 7 Examples of pictures drawn/copied in the pre-RP session

Observations by the facilitator on the pre-RP drawing session

The students were initially unsure and fairly unwilling to engage in the session but quickly started to become active when they realised all they had to do was copy. Many of the more gregarious students started to make comments and draw their own pictures. The exercises allowed individuals to share their illustrations within their groups. One student brought out her ipad and drew pictures on the device instead of the paper provided. I encouraged this. After Figure 6 was completed many of the students added more detail, such as glasses, hair, ears and beards to faces. The students seemed to enjoy the experience and the mood in the room was fun, noisy and interactive. Students showed each other their pictures and some helped others by making corrections and suggestions. The students were disappointed to finish the session after the 10 minutes.

RPs from test

Figures 8-11 are copies of the resultant RPs drawn by the 2012 students after a pre-drawing session.

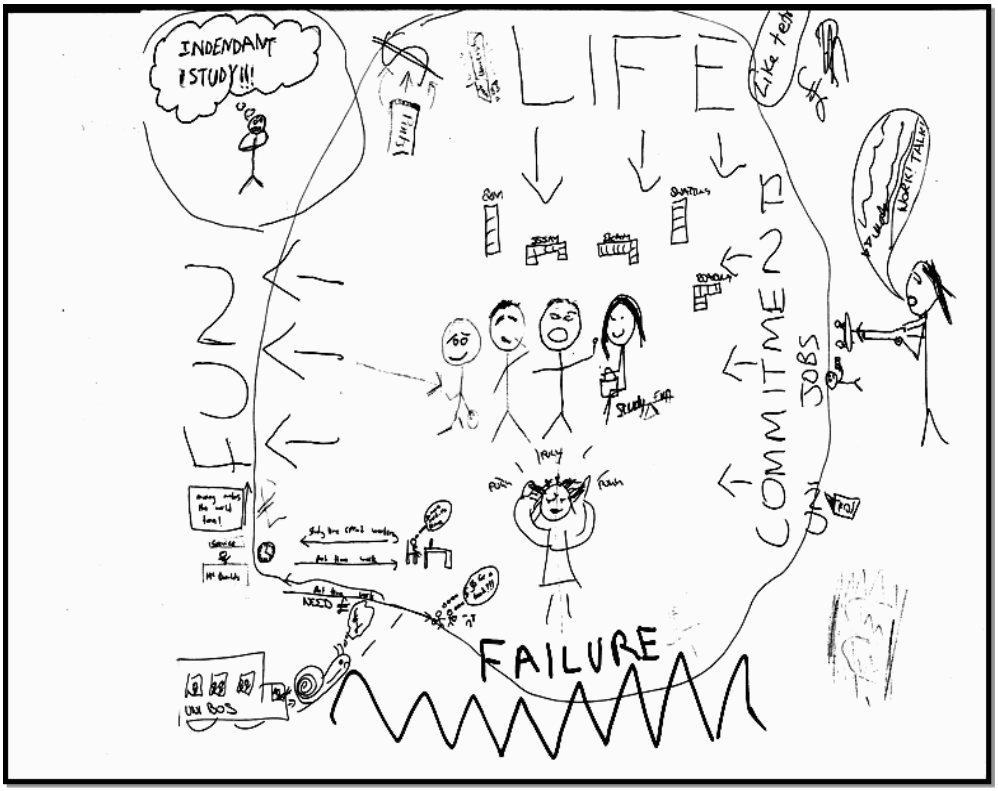


Figure 8 RP from 2012 experiment

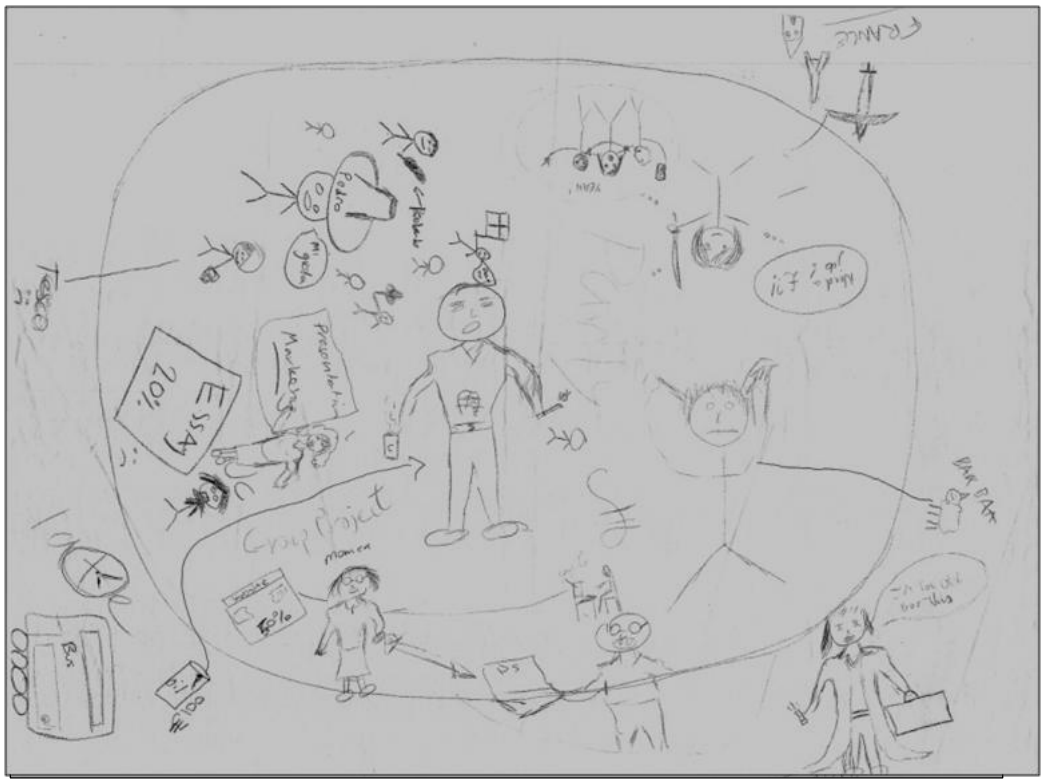


Figure 9 RP from 2012 experiment

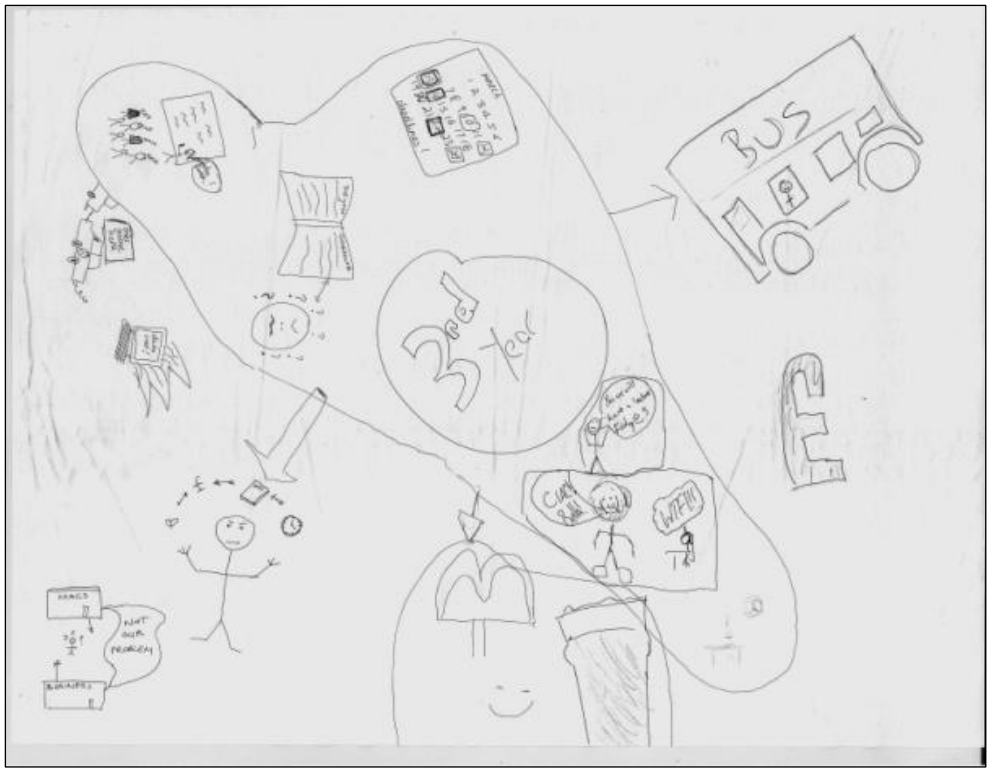


Figure 10 RP from 2012 experiment

Figure 11 RP from 2012 experiment

Figures 8-11. These are black and white copies of the originals. Attempts were made to take photos of the resultant RPs but the quality was too poor to use. All pictures were in colour but unfortunately I found no way of colour scanning large flipchart paper.

Observations by the Facilitator on the RPs

The Previous 2011 student RP workshop indicated that 25 minutes was not long enough to complete the RP task. The RPs in this 2012 experiment were all completed within 12-15 minutes even though 25-35 minutes were offered as per the previous 2011 test workshop. The drawing of icons began immediately with no delay in any of the groups. The process was noisy at the very start and there seemed to be an excitement about creating their pictures rather than copying from the facilitator as with the pre RP drawing session. In the Previous 2011 workshop session the participants spent a long time discussing what to draw and what icons to use before committing ideas to paper. The groups in this 2012 experiment jelled and collaborated with ease from the start. It was as if the shared drawing experience allowed the group work in tighter harmony. Previous strengths and weaknesses of individual art work had already been highlighted within the group at the pre-RP session and there seemed to be less embarrassment and awkwardness than seen in the previous 2011 session. Thus, with the usual group discomfort being avoided, the group members seemed to know and self-administer their individual roles without the need for further discussion. Those who were better, or at least more confident, artists took control of the dominant themes and icon drawing with the less artistic individuals encouraging those persons and offering up creative solutions. Sub-groups were seen to emerge but, apart from Figure 11, they all merged back and forth within the wider whole group during the exercise. Not everyone drew in all four groups but everyone was seen to be engaged in the process.

Analysis of the RP's

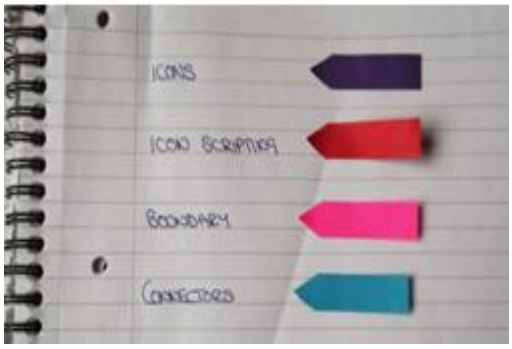


Figure 12 Coloured zone analysis key

Figure 13 Analysis of the pictures

At the risk of being repetitive, I do acknowledge that appraisal of the RP is contentious so far as it is open to broad interpretation. So, with due consideration I suggest the following is one way, but not the only way, to analyse the pictures. I also acknowledge this Appendix section is one based on facilitation and not icon analysis which is the subject of Chapter 5. The following discussion is therefore a brief overview on how I analysed the resultant RPs and what data is particularly significant with relevance to a new facilitation style.

The pictures were analysed by using coloured arrow indicators to categorise repetition into 4 taxonomy zones; icon elements, icon' scripts, boundary and sub-boundaries and connectors (Figures 12 & 13). An icon script is described in detail further into this section. The results from each picture showing the totals of zone repetition can be seen in the following Table 4:

Picture	Icons Elements	Icon Scrip	Boundary	Connectors
Figure 4.8	27	2	2	16
Figure 4.9	25	0	2	7
Figure 4.10	15	3	2	3
Figure 4.11	15	2	1	2

Table 4Taxonomy zone repetition

Three of the RPs (Figures 8-10) are considered to be rich as they have an abundance of relevant icons, are well connected, colourful and the narrative was clearly understood. One of the groups (Figure 11) took the exercise as a way to be jovial and their picture is heavy on rude metaphors and discourteous remarks about certain lecturers. There was frequent reference to alcohol and the winning of particular sporting events in their picture. The richest of the pictures all had clearly defined boundaries showing elements both inside and outwith the area of concern. They showed good use of connectors making for a clear story being told of their concerns and constraints. This experiment suggests that a richer RP does not necessarily have the most icons or indeed need to show an abundance of lines and arrows.

What is important is the relationship or correlation of an icon and its way of connection within the whole RP. If an icon in a RP is connected showing direction or confluence with other elements then the quality of the picture in terms of richness and comprehensibility goes up. This is a central discovery within my research and I offer evidence to substantiate this in Chapter 5 through correlation tests on my icon dataset.

I use the term 'icon script' to describe icons that are linked with a number of other icons in a single image. Figures 14-16 (taken from Figures 8-11) are examples of icon scripts as they are a series of icons portraying specific meaning in a single image that tell a small story of a concern within the wider whole RP. An icon script, in essence, can be likened to a sentence in the English language, for example Figure 14 could be written or spoken as meaning, 'A student has to juggle and manage their love life, finances, university work and time'. Figure 13 could be written or spoken as saying, 'there is a problem with communication between the MACS department and Business Department within the university and neither one is willing to take responsibility for the student concerns'.

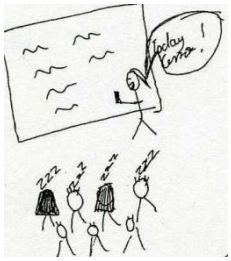


Figure 14 Example of icon script

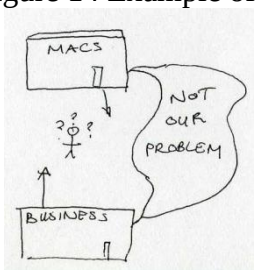


Figure 15 Example of icon script

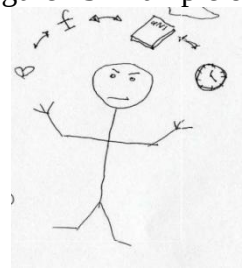


Figure 16 Example of icon script

The icon script within a RP is of particular interest and I discuss this further in Chapter 3. A series of icons in a single image within a wider RP shows a rapid way of communicating a

single concern. The icon script is a particularly good way to demonstrate the use and importance of visuals to convey meaning. Not only are the visuals easily and quickly drawn but they also provide a way of gaining information about a concern in a way that might not have been articulated well , or at all, in a spoken or written format. For example in Figure 16 the student is potentially unlikely to discuss their love life, coursework, money and time constraints with an unknown person such as myself. In Figure 14 a student would perhaps be wary of offending or giving a wrong impression if they were to say that some lectures are dull and put students to sleep. I believe the use of visuals gives a rare insight into personal and group concerns that might not be highlighted as relevant in a more structured knowledge elicitation process such as a focus group, questionnaire or interview. This idea that people will draw what they will rarely say or write is key to my research. It is noted over and over again by Bell and Morse and is well understood in the psychodynamic tradition (Bell & Morse, 2012a).

Boundaries are not necessary on all RPs but they can, however, make distinction and clarify specific wider concerns within the picture. The students in this test were not told to include boundaries in their RPs. However, it could be suggested that the wording in the PowerPoint (Figure 5) implies there are concerns that are internal and external in RPs. Figures 8-10 have clear and distinct boundaries showing areas of concern which are perhaps more implicit and factual within the lines and tacit or softer concerns outside the boundary lines. Sub-boundaries are also seen in Figures 8 and 10 to teeter upon the edge of the main boundary line demonstrating the overlap of soft and hard issues of concern (Figure 17). In Chapter 3 I will discuss the RP boundary in more detail and use the icon dataset to compare boundary lines to areas such as richness and coherence.

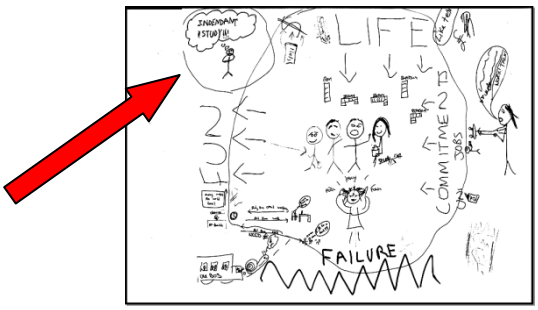


Figure 17 Picture 1 showing sub-boundary

Figure 11 is considered to be of poorer quality in terms of information displayed than the other pictures. The RP is not considered to be poor because of the offensive icons or language

though. How people express themselves through a RP should not be limited. Figure 4 is poor on connection so the icons are seen to be unlinked to each other. The group who drew picture 11 were, by far, the noisiest group but they were not seen to be able to collaborate well or come to any firm decisions. They were not seen to discuss and debate what they were going to draw as other groups did but rather they split into two sub-groups with one group trying, amongst the noise, to draw sensible icons and another taking a comedic approach to the exercise. Thus the RP ended up being disjointed, lacking in direction, poorly managed and organised.

It is accepted in the literature (Bronte-Stewart, 1999); (Bell & Morse, 2012) that a conventional RP is not to be structured in terms of rules and enforcement of syntax. This literature (Ibid) agrees that there is no 'correct' way to organise the picture in terms of arrangement or construction. This is a deliberate aspect of the ethos of using visuals to convey meaning in a RP. As such, groups decide upon some interesting and often creative solutions for what to include and how to configure and organize the picture to determine what suits them aesthetically. Figure 8 depicts the group of four participants as a central feature in the RP within a boundary. The RP is represented as a tetras game with moving, shape altering blocks. The falling tetras blocks resemble concerns; Exam, Essay, Swotting and Reading. The blocks are surrounded by internally bounded issues of 'Commitment', 'Life' and 'Failure' with 'Fun' being outside the boundary. The blocks are falling towards Failure which is shown as having jagged lines outside the boundary. There is a powerful image of a person tearing their hair out as the blocks fall down. Figure 8 is considered to be the richest of the four pictures as it gives the most meaning and conveys a considerable amount of complexity within the visuals. Noticeably Figure 8 can be seen in Table 4 to have the highest amount of icons and connectors.

Another consideration when accessing a RP is text. According to all the literature that I have examined there is a consensus of opinion that text should be kept to a minimum. There is however, no advice on what constitutes 'a minimum' amount of text. Interestingly, the picture (figure 8) that I suggest is the richest of all the four RPs has more than double the amount of text than the other pictures do. So, does this mean I am in disagreement with literature or perhaps it suggests that I am making a wrong assessment? I would say neither. I do, in principle, agree with avoiding the use of text in a RP but, if and when, it is necessary it should used to aid icon understanding and avoid ambiguous understandings. I suggest figure 8 uses both text and icons collectively and the text serves to benefit the entire illustration of the situation. Dan Roam, although not writing directly about RPs, attests to this theory,

"*Whoever said a picture is worth a thousand words has forever warped our understanding of pictures. The goal of a picture isn't to eliminate a thousand words; it's to replace those that are better represented pictorially, so that the words we do use are the ones that trigger real insight*" (Roam, 2009).

Findings from the 2012 Experiment

Will a practice session speed up the pen pick-up rate of a RP?
Yes, Pre-session and RP drawing in 2012 took a total of 25 minutes maximum as opposed to the 35 minutes allowed during the 2011 session.

Does seeing and copying the facilitator drawing encourage participants to draw the RP?
Yes, after the pre-RP session the participants were seen to take to the RP task in a lively and active way. All the groups seemed to have strong opinions on what they wanted to draw and what were to be the essential components they felt the need to express. The room was noisier and more animated than the previous RP workshop.

Are the resultant pictures richer in icon, connector and comprehension?
Inconclusive. There is little difference in quality of picture pertaining to icon and connector. Previous pictures in the 2011 workshop have fewer icons in their pictures but considerably more connectors. Comprehension is better in this 2012 test compared to the previous workshop in terms of the understanding and interpretation of icons. This type of question is difficult to quantify without further testing but initial results do show that the pictures are no less rich than others of a similar test.

Are the icons of better quality?
Yes. The 2011 workshop icons are, in part, seen to be ambiguous in meaning and sometimes totally incomprehensible without further explanation. There were no icons drawn in the 2012 experiment by any of the group members that could not be understood.

Is there a difference to the overall engagement to the task in terms of group-work?
Yes. The participants took to the exercise well in terms of immediate discussion, drawing and collaboration. Noise level was up and enjoyment and satisfaction seemed to be considerably better due to the fact that all groups had time to finish and consider what they had completed.

Does an undemanding, relaxed approach to the pre-RP session promote an unsettled and careless attitude towards the RP exercise?
Yes. Three groups worked hard and took to the exercise in a professional manner. One out of four of the groups took a laid back and seemingly uncaring approach to the task. Of this group certain group members felt relaxed enough in the environment to display unsuitable and rude comments and pictures in their RP. Other group members of this group created a sub-group and attempted to work in a more serious, professional way but were provoked by the stronger team members to become jovial and inattentive throughout the exercise.

What size of paper would be most preferable when working together in a group?
Flipchart. The groups were offered A3 and flipchart paper. All groups chose to work with flipchart size paper.

Has the lead in session steered or led the groups to certain conclusions?
Inconclusive. This is difficult to confirm because I cannot say, with any certainty that the students were only reacting solely to my lead-in session. For example year 2012 might have been a more functional group of students than year 2011 or perhaps an event prior to my lecture put them in a good mood. The only variables I can confirm are that they were the same year group on the same course and in the same month each year. So my conclusions should be taken as subjective and open to criticism. This is off course a problem with any human experiment.
In my opinion in the session did not lessen creativity but I am unsure if I can say with any certainty that the groups were more innovative than they would have been had they not had the pre-drawing session. I can, however, say that enjoyment levels (noise, discussion and laughter) were obvious from the start of picturing which was not evident in the 2011. In terms of task orientation the groups in 2012 were seen to get stuck into what was being asked of them quicker than the 2011 students but they were then seen to take nearly 20 minutes less time on the RP exercises than 2011 which might suggest that the exercise was being rushed. The groups in 2012 can be observed as being more functional in terms of performing the exercise and interrelating with one another. Further testing would have to be done to answer this question.

Summary of 2012 Experiment

The pre-drawing session can be seen to be successful in terms of the time taken to draw and the engagement by participants to the task. The experiment does also show a preference for a large sheet of paper. Creating a relaxed and positive atmosphere does seem to engender more positivity to the task and a willingness to draw. This small experiment cannot be taken as proof however but it does imply that a larger scale experiment using a pre-drawing session might yield richer and more coherent RPs. Further investigation is required from participants who are not just students. Perhaps looking at specific domains such as healthcare, child education, travel or public sector workers might produce a variety of different results.

Conclusion to Facilitation Work

Appendix A has looked at different styles of facilitation and pointed out some of the various methods of instigating RP group work. There is little evidence to suggest that experienced practitioners need, or even require, a best practice structure for their facilitation of the RP. Their experience and knowledge allows them to adopt an approach which best serves their need and the needs of the client. There does however, seem to be a lack of knowledge inhibited by a dearth of literature by those who are inexperienced in using the RP tool. I have

found no strong evidence to prove that practitioners are put off from using the tool because of the lack of structure or direction but I suggest it is a possible likelihood. There does seem to be a case for some best-practice guidelines for those who how have not worked with the RP tool as a means to encourage and accelerate confidence. The pre-drawing session does show some interesting results but to be robust it would need to be a larger sample size and to cover more domains having a greater variety of participants. This chapter set out to determine a broad overall view of how RPs are facilitated and thus it is limited in determining hard or clear cut results. The most obvious finding from this Appendix is that the way in which a practitioner approaches their RP facilitation will impact upon the participants and the way they draw their picture. I would conclude from this that the following tentative observation can be made: the better the facilitation the better the RP. This would require further testing to be confirmed.

Appendix B: Form used for rating RPs

1. When looking at the whole picture do you see any of these following emotions or sentiments being displayed by the artist (s)? Please tick all that apply. Feel free to leave blank if not applicable.

Serenity		Joy		Ecstasy		Love	
Acceptance		Trust		Admiration		Submission	
Apprehension		Fear		Terror		Awe	
Distraction		Surprise		Amazement		Disapproval	
Pensiveness		Sadness		Grief		Remorse	
Boredom		Disgust		Loathing		Contempt	
Annoyance		Anger		Rage		Aggressiveness	
Interest		Anticipation		Vigilance		Optimism	
None							

2. Please rate (in your opinion) the 'richness' of the picture. I am asking you to take the following criteria on board when making your decision; colour, connectors showing direction, expression, understandable symbols/icons, coherence and communication.

1.	Very rich picture , including elements such as colour, direction, expression, boundary and icons ect
2.	Good picture with reasonable amount of colour, direction, expression, icons ect
3.	Acceptable picture displaying some visual symbolic elements with some understandable communication icons
4.	Poor picture with few elements/ icons
5.	Very poor/ no visual elements, mainly text
6.	None of the above. Please give reason:

Your Rating: ☐

(PTO)

3. Please rate the use of the connectors in the picture. Connectors will be lines, pointers and arrows. I am interested in tone, size, ability to direct and variety of different connectors. Please note I am *only* looking for your opinion on the connectors *and not* the whole picture. I fully accept that not all pictures will show connectors.

1.	Good variety of connectors showing direction, tone, grading of thickness and size
2.	Reasonable use of connectors for showing direction but little use of thickness, size and tone
3.	Poor use of connectors showing no variance in thickness, size and tone, little direction being shown
4.	No connectors in the picture
5.	None of the above. Please give reason:

Your Rating: ☐

4. Please rate the visual coherence or narrative of the picture. To what extent is there a story in the picture? Are the visual elements clearly related to one another or simply stuck on the page with little thought to their coherence? Is the story mainly in text? I am interested in the icons and how well you understand them in relation to their neighbouring icons. I am less interested in the text so do not worry if you cannot read/ see all the text.

1.	Clear Story being told using relevant visual elements showing an obvious sequence of events
2.	At times there is a coherent story but often the elements are unclear in their meaning
3.	Unclear story using ambiguous/confusing visual elements
4.	Few visual elements with story mainly in text
5.	Text only
6.	None of the above. Please give reason:

Your Rating: ☐

Appendix C: Pivot Table and Chi Square test results

PT1

Richness versus Gender	Column Labels					
Gender	**1**	**2**	**3**	**4**	**5**	**Grand Total**
Female	25	4	5	3	5	42
Male	18	13	8	11	7	57
Grand Total	**43**	**17**	**13**	**14**	**12**	**99**

Expected values						
Gender	1	2	3	4	5	Grand Total
Female	18.24	7.21	5.52	5.94	5.09	42
Male	24.76	9.79	7.48	8.06	6.91	57
Grand Total	43	17	13	14	12	99

(no difference)

Probability level	0.051

PT2

Richness versus Legend	***Richness rating***					
Legend	***1***	***2***	***3***	***4***	***5***	***Grand Total***
No Legend	*114*	*64*	*36*	*29*	*14*	*257*
Test legend given	*8*	*4*	*3*	*2*	*1*	*18*
Grand Total	***122***	***68***	***39***	***31***	***15***	***275***

Expected Values

Legend	1	2	3	4	5	Grand Total
No Legend	114.01	63.55	36.45	28.97	14.02	257
Test legend given	7.99	4.45	2.55	2.03	0.98	18
Grand Total	122	68	39	31	15	275

Probability Level 0.997866676 (no difference)

PT3

Richness versus Group/Individual	**Richness rating**					
Group/Indiv	**1**	**2**	**3**	**4**	**5**	**Grand Total**
Group	23	9	5	3		40
Individual	42	15	14	15	12	98
Grand Total	**65**	**24**	**19**	**18**	**12**	**138**

Expected Values

Group/Indiv	1	2	3	4	5	Grand Total
Group	18.84	6.96	5.51	5.22	3.48	40
Individual	46.16	17.04	13.49	12.78	8.52	98
Grand Total	65	24	19	18	12	138

Probability value 0.077064218 (no difference)

PT4

Richness versus computer generated/hand drawn	Richness rating					
Computer generated	**1**	**2**	**3**	**4**	**5**	**Grand Total**
Mixed	2					2
No	107	52	28	21	11	219
Yes	23	20	14	15	5	77
Grand Total	**132**	**72**	**42**	**36**	**16**	**298**

Expected values

Computer generated	1	2	3	4	5	Grand Total
Mixed	0.89	0.48	0.28	0.24	0.11	2
No	97.01	52.91	30.87	26.46	11.76	219
Yes	34.11	18.60	10.85	9.30	4.13	77
Grand Total	132	72	42	36	16	298

Probability Value	0.101706543	(no difference but results for mixed too small)
Probability value (no mixed)	0.02900273	(yes, there is a significant difference)

PT5

Richness versus Kinetics	**Richness rating**					
Kinetic rating	**1**	**2**	**3**	**4**	**5**	**Grand Total**
1	31	12	5	3		51
2	48	24	14	7	6	99
3	35	25	16	21	8	105
4	18	11	7	5	2	43
Grand Total	**132**	**72**	**42**	**36**	**16**	**298**

Expected Results

Kinetic rating	1	2	3	4	5	Grand Total
1	22.59	12.32	7.19	6.16	2.74	51
2	43.85	23.92	13.95	11.96	5.32	99
3	46.51	25.37	14.80	12.68	5.64	105
4	19.05	10.39	6.06	5.19	2.31	43
Grand Total	132	72	42	36	16	298

Probability Value 0.060181204 (no difference)

PT6

Richness versus Boundary score	richness rating					
Boundary score	**1**	**2**	**3**	**4**	**5**	**Grand Total**
1	32	14	6	7	2	61
2	26	14	9	9	4	62
3	4	3	1			8
4	70	41	26	20	10	167
Grand Total	**132**	**72**	**42**	**36**	**16**	**298**

Expected values

Boundary score	1	2	3	4	5	Grand Total
1	27.02	14.74	8.60	7.37	3.28	61
2	27.46	14.98	8.74	7.49	3.33	62
3	3.54	1.93	1.13	0.97	0.43	8
4	73.97	40.35	23.54	20.17	8.97	167
Grand Total	132	72	42	36	16	298

Probability value	0.9389687	(no difference)

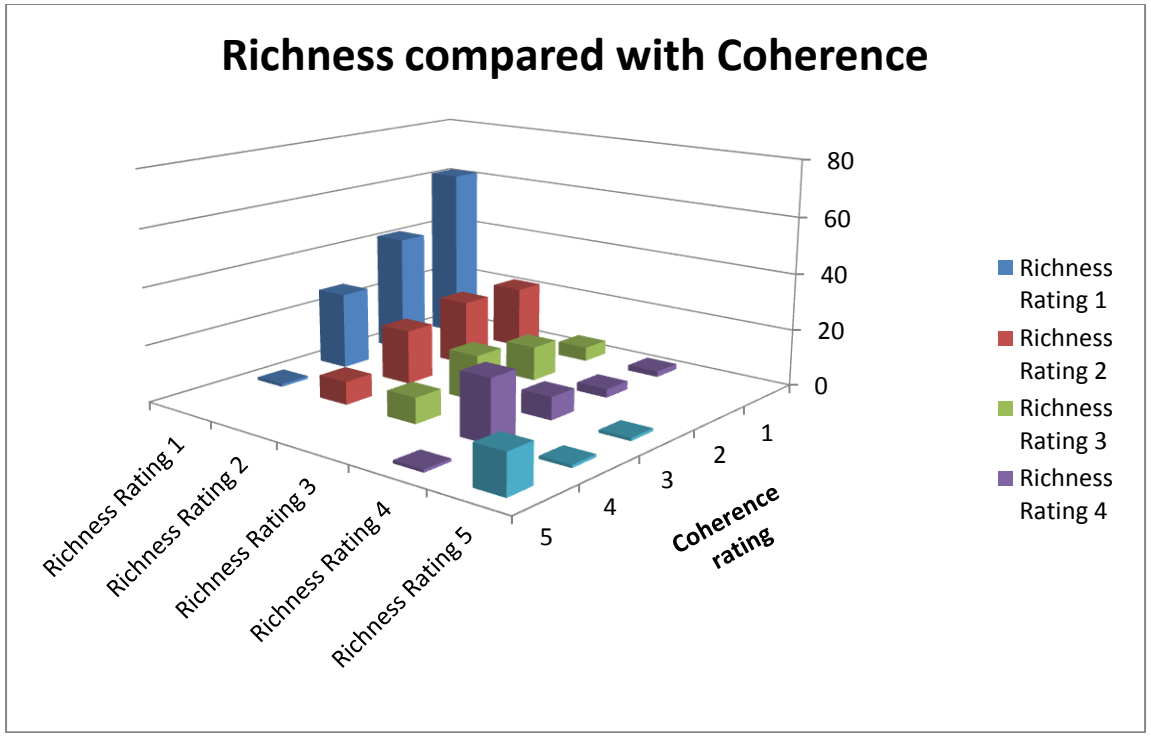
PT7

Richness versus coherence	Richness rating					
Coherence rating	**1**	**2**	**3**	**4**	**5**	**Grand Total**
1	62	22	5	2		91
2	42	23	12	3		80
3	27	19	16	8	1	71
4	1	8	9	22	1	41
5				1	14	15
Grand Total	**132**	**72**	**42**	**36**	**16**	**298**

Expected results

Coherence rating		1	2	3	4	5	Grand Total
	1	40.31	21.99	12.83	10.99	4.89	91
	2	35.44	19.33	11.28	9.66	4.30	80
	3	31.45	17.15	10.01	8.58	3.81	71
	4	18.16	9.91	5.78	4.95	2.20	41
	5	6.64	3.62	2.11	1.81	0.81	15
Grand Total		132	72	42	36	16	298

Probabilty Value 2.8356E-65 (significant difference)



PT8

Coherence versus Indiv/group	Coherence Rating					
Indiv/Group	**1**	**2**	**3**	**4**	**5**	**Grand Total**
Group	4	19	15	2		40
Individual	41	21	12	13	11	98
Grand Total	**45**	**40**	**27**	**15**	**11**	**138**

Expected results

Indiv/Group	1	2	3	4	5	Grand Total
Group	13.04	11.59	7.83	4.35	3.19	40
Individual	31.96	28.41	19.17	10.65	7.81	98
Grand Total	45	40	27	15	11	138

Probability Value 3.02432E_06 (significant difference)

Coherence rating Scale
1= Clear story told using relevant visual elements
2= At times there is a coherent story but often ambiguous in meaning
3= Unclear story using ambiguous visual elements
4= little or no visual elements with no obvious story
5= Text only

Rating 1: group = 10%
indiv = 41.9%
Rating 2: group = 47.5%
indiv = 21.4%
Rating 3: group = 37.5%
indiv = 12.2%
Rating 4: group = 5%
indiv = 13.3%
Rating 5: group = 0%
indiv = 11.2%

What these results suggest is that although individuals draw the most highly coherent pictures (rating 1) the groups do however draw coherent parts within their pictures (rating 2). On the lower end of the ratings it is clear that individuals are more likely to draw few visual elements and, for some, text is preferable than visuals.

PT 9

coherence versus colour	colour			
Coherence rating	No	One or two colours	Yes	Grand Total
1	54	7	30	91
2	32	2	46	80
3	22	9	40	71
4	26	7	8	41
5	6	5	4	15
Grand Total	**140**	**30**	**128**	**298**

Expected Result

Coherence rating		No	One or two colours	Yes	Grand Total
	1	42.75	9.16	39.09	91
	2	37.58	8.05	34.36	80
	3	33.36	7.15	30.50	71
	4	19.26	4.13	17.61	41
	5	7.05	1.51	6.44	15
Grand Total		140	30	128	298

Probability value	2.12142E-06	(significant difference)
probability value on yes and no only	4.26922E-05	

PT10

Coherence versus Gender	gender		
coherence rating	Female	Male	Grand Total
1	20	19	39
2	9	13	22
3	5	10	15
4	3	9	12
5	5	6	11
Grand Total	**42**	**57**	**99**

Expected results

coherence rating	Female	Male	Grand Total
1	16.55	22.45	39
2	9.33	12.67	22
3	6.36	8.64	15
4	5.09	6.91	12
5	4.67	6.33	11
Grand Total	42	57	99

Probability value	0.506742826	(no difference)

PT11

Coherence versus Age	age					
coherence rating	18-29	30-39	40-49	50-59	60+	Grand Total
1	7	13	11	1		32
2	4	4	3		5	16
3	4		2	2	1	9
4	2	2	1		1	6
5	5	1	1	3	1	11
Grand Total	**22**	**20**	**18**	**6**	**8**	**74**

Expected results

coherence rating	18-29	30-39	40-49	50-59	60+	Grand Total
1	9.51	8.65	7.78	2.59	3.46	32
2	4.76	4.32	3.89	1.30	1.73	16
3	2.68	2.43	2.19	0.73	0.97	9
4	1.78	1.62	1.46	0.49	0.65	6
5	3.27	2.97	2.68	0.89	1.19	11
Grand Total	22	20	18	6	8	74

Probability value 0.013496986 (significant difference)

PT12

Coherence versus Legend	legend			
Coherence rating	Legend drawn by Author	No Legend	Test legend given	Grand Total
1	8	78	5	91
2	6	65	9	80
3	3	65	3	71
4	6	34	1	41
5		15		15
Grand Total	**23**	**257**	**18**	**298**

Expected results

Coherence rating	Legend drawn by Author	No Legend	Test legend given	Grand Total
1	7.02	78.48	5.50	91
2	6.17	68.99	4.83	80
3	5.48	61.23	4.29	71
4	3.16	35.36	2.48	41
5	1.16	12.94	0.91	15
Grand Total	23	257	18	298

Probability value	0.168876517	(no difference)

P13

Coherence versus computer generated	Computer generated		
Coherence rating	**Mixed**	**No**	**Yes**	**Grand Total**
1		66	25	91
2	2	62	16	80
3		61	10	71
4		19	22	41
5		11	4	15
Grand Total	**2**	**219**	**77**	**298**

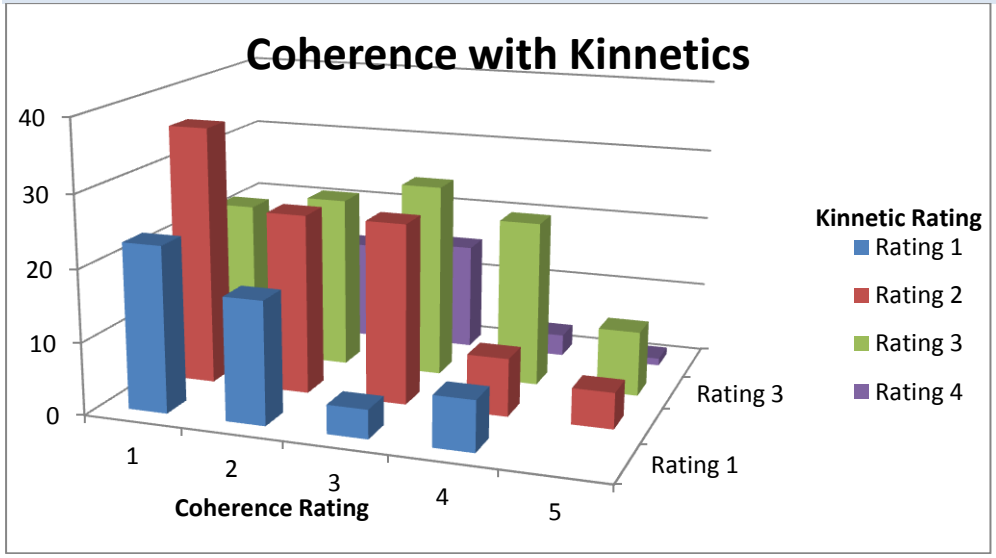
Expected result

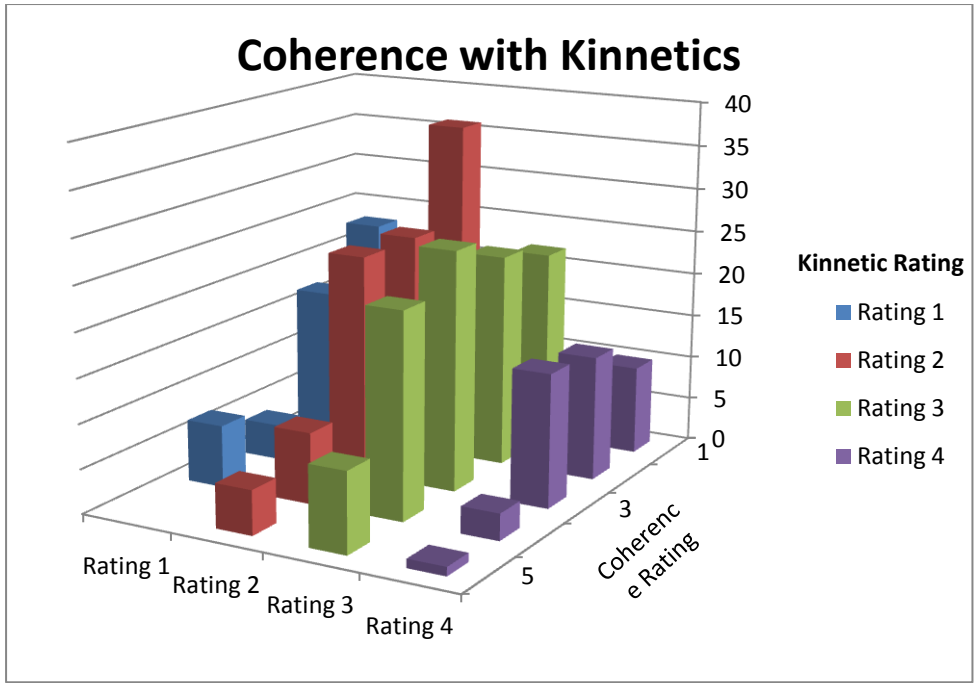
Coherence rating	Mixed	No	Yes	Grand Total
1	0.61	66.88	23.51	91
2	0.54	58.79	20.67	80
3	0.48	52.18	18.35	71
4	0.28	30.13	10.59	41
5	0.10	11.02	3.88	15
Grand Total	2	219	77	298

Probability value	0.000392569	(Significant difference)	(weak result due to low values)

P14

Coherence/kinnetic ratings	Kinnetic rating				
coherence rating	1	2	3	4	Grand Total
1	23	36	22	10	91
2	17	25	24	14	80
3	4	25	27	15	71
4	7	8	23	3	41
5		5	9	1	15
Grand Total	**51**	**99**	**105**	**43**	**298**





Expected result

coherence rating		1	2	3	4	Grand Total
	1	15.57	30.23	32.06	13.13	91
	2	13.69	26.58	28.19	11.54	80
	3	12.15	23.59	25.02	10.24	71
	4	7.02	13.62	14.45	5.92	41
	5	2.57	4.98	5.29	2.16	15
Grand Total		51	99	105	43	298

Probability value	0.000924554	significant difference

PT15

Boundary and group/individual	Group/individual		
Boundary score	**Group**	**Individual**	**Grand Total**
1	9	20	29
2	5	26	31
3		2	2
4	26	50	76
Grand Total	**40**	**98**	**138**

Expected Result

Boundary score	Group	Individual	Grand Total
1	8.41	20.59	29
2	8.99	22.01	31
3	0.58	1.42	2
4	22.03	53.97	76
Grand Total	40	98	138

Probability value 0.22392266 (No difference)

PT16

Boundary score /gender/group and individual analysis	Gender		
boundary score	Female	Male	Grand Total
1	**11**	**9**	**20**
Individual	11	9	20
2	**13**	**13**	**26**
Group		1	1
Individual	13	12	25
3		**2**	**2**
Individual		2	2
4	**18**	**31**	**49**
Group	1	1	2
Individual	17	30	47
Grand Total	**42**	**55**	**97**

- Not able to run statistical test due to low results on group/individual totals. The low numbers cannot produce reliable expected results in order to run a Chi Square test.

PT17

boundary versus coherence	coherence					
boundary score		**1**	**2**	**3**	**4**	**5**	**Grand Total**
1		22	21	8	8	2	61
2		22	11	15	11	3	62
3		3	5				8
4		44	43	48	22	10	167
Grand Total		**91**	**80**	**71**	**41**	**15**	**298**

Expected result

boundary score		1	2	3	4	5	Grand Total
	1	18.63	16.38	14.53	8.39	3.07	61
	2	18.93	16.64	14.77	8.53	3.12	62
	3	2.44	2.15	1.91	1.10	0.40	8
	4	51.00	44.83	39.79	22.98	8.41	167
Grand Total		91	80	71	41	15	298

Probability value	0.094049699	(no difference)

PT18

Richness versus age	richness rating					
age	**1**	**2**	**3**	**4**	**5**	**Grand Total**
18-29	8	4	3	2	5	22
30-39	11	6		2	1	20
40-49	12		3	2	1	18
50-59		1	1	1	3	6
60+	3	1	2	1	1	8
Grand Total	**34**	**12**	**9**	**8**	**11**	**74**

Expected result

age	1		2	3	4	5	Grand Total
18-29	10.11		3.57	2.68	2.38	3.27	22
30-39	9.19		3.24	2.43	2.16	2.97	20
40-49	8.27		2.92	2.19	1.95	2.68	18
50-59	2.76		0.97	0.73	0.65	0.89	6
60+	3.68		1.30	0.97	0.86	1.19	8
Grand Total	34		12	9	8	11	74

Probability value	0.106679394	(no difference)

PT19

Colour compared with Richness	**Richness Rating**					
Colour	**1**	**2**	**3**	**4**	**5**	**Grand Total**
No	47	35	28	22	8	140
One or two colours	5	12	2	7	4	30
Yes	80	25	12	7	4	128
Grand Total	**132**	**72**	**42**	**36**	**16**	**298**

Colour	**Count of RP Number**
No	140
One or two colours	30
Yes	128
Grand Total	**298**

Expected results

Colour	1	2	3	4	5	Grand Total
No	62.01342282	33.82550336	19.73154362	16.91275168	7.51677852	140
One or two colours	13.2885906	7.248322148	4.228187919	3.624161074	1.61073826	30
Yes	56.69798658	30.9261745	18.04026846	15.46308725	6.87248322	128
Grand Total	132	72	42	36	16	298

Probability value	7.3313E-07	Significant difference

PT 20

Colour compared with Connectors	Connector Rating				
Colour	**1**	**2**	**3**	**4**	**Grand Total**
No	21	42	57	20	140
One or two colours	5	12	9	4	30
Yes	25	45	39	19	128
Grand Total	**51**	**99**	**105**	**43**	**298**

Expected result

Colour	1	2	3	4	Grand Total
No	23.96	46.51	49.33	20.20	140
One or two colours	5.13	9.97	10.57	4.33	30
Yes	21.91	42.52	45.10	18.47	128
Grand Total	51	99	105	43	298

probability value	0.663645367	no difference

PT21 (this is a jpeg of the PT21 because it was too big to add directly to the appendix)

Colour compared with humour	Humour Rating				
Colour	clearly humorous	None	possible interpretation on a few elements	possible interpretation on many elements	Grand Total
No	1	116	15	8	140
One or two colours		23	7		30
Yes	5	99	14	10	128
Grand Total	**6**	**238**	**36**	**18**	**298**

- Not able to run statistical test due to low results on totals. The low numbers cannot produce reliable expected results in order to run a Chi Square test.

PT22

Colour compared with Individual verses group RP's	**Group/Individual**		
Colour	**Group**	**Individual**	**Grand Total**
No	2	59	61
One or two colours	4	12	16
Yes	34	27	61
Grand Total	**40**	**98**	**138**

Expected Results

Colour	Group	Individual	Grand Total
No	17.68	43.32	61
One or two colours	4.64	11.36	16
Yes	17.68	43.32	61
Grand Total	40	98	138

Probability value	1.30353E-09	(Significant difference)

PT23

Colour compared with age	**Age Range**					
Colour	**18-29**	**50-59**	**60+**	**40-49**	**30-39**	**Grand Total**
No	11	3	5	9	13	41
One or two colours	3	2	1	3	2	11
Yes	8	1	2	6	5	22
Grand Total	**22**	**6**	**8**	**18**	**20**	**74**

Expected Results

Colour	18-29	50-59	60+	40-49	30-39	Grand Total
No	12.19	3.32	4.43	9.97	11.08	41
One or two colours	3.27	0.89	1.19	2.68	2.97	11
Yes	6.54	1.78	2.38	5.35	5.95	22
Grand Total	22	6	8	18	20	74

Probability value	0.907270606	no difference

PT24

gender compared with colour	**gender**		
colour	**Female**	**Male**	**Grand Total**
No	24	34	58
One or two colours	2	10	12
Yes	16	13	29
Grand Total	**42**	**57**	**99**

Female/ No = 24/42= 57%

Males / no = 34/57 = 60%

Females/ yes = 18/42 = 43%

Male/yes = 23/57= 40%

Expected Results			
No	24.6	33.4	58
One or two colours	5.1	6.9	12
Yes	12.3	16.7	29
Grand Total	42	57	99

Probability value	0.073725826	no difference

PT25

Age and Gender compared with Richness	**richness rating**					
	1	**2**	**3**	**4**	**5**	**Grand Total**
18-29	**8**	**4**	**3**	**2**	**5**	**22**
Female	5	1	1	1	3	11
Male	3	3	2	1	2	11
30-39	**11**	**6**		**2**	**1**	**20**
Female	8	3		1	1	13
Male	3	3		1		7
40-49	**12**		**3**	**2**	**1**	**18**
Female	5		1	1	1	8
Male	7		2	1		10
50-59		**1**	**1**	**1**	**3**	**6**
Female			1			1

Male		1		1	3	5
60+	**3**	**1**	**2**	**1**	**1**	**8**
Female	1		2			3
Male	2	1		1	1	5
Grand Total	**34**	**12**	**9**	**8**	**11**	**74**

- Not able to run statistical test due to low results on totals. The low numbers cannot produce reliable expected results in order to run a Chi Square test.

Count of RP Number	**richness rating**					
	1	**2**	**3**	**4**	**5**	**Grand Total**
Female	25	4	5	3	5	42
Male	18	13	8	11	7	57
Grand Total	**43**	**17**	**13**	**14**	**12**	**99**

- Not able to run statistical test due to low results on totals. The low numbers cannot produce reliable expected results in order to run a Chi Square test.

PT26

boundary with kinetics boundary	kinetics	1	2	3	4	Grand Total
1		10	25	20	6	61
2		15	17	23	7	62
3		2	2	4		8
4		24	55	58	30	167
Grand Total		**51**	**99**	**105**	**43**	**298**

Expected result

boundary		1	2	3	4	Grand Total
	1	10.4	20.3	21.5	8.8	61
	2	10.6	20.6	21.8	8.9	62
	3	1.4	2.7	2.8	1.2	8
	4	28.6	55.5	58.8	24.1	167
Grand Total		51	99	105	43	298

Probability value 0.405797722 no difference