

PERSONAL KNOWLEDGE TECHNIQUES

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Abstract

Work towards the development of a new computer-assisted methodology for psychological study and intervention is described. This is referred to as the Personal Knowledge Methodology since it focuses on the elicitation and presentation of personal knowledge. Personal knowledge includes the knowledge individuals have of their life history, their behaviours, their moods, their relationships, their ambitions, and so on. Principles and techniques used in Knowledge Engineering form the basis of the design of the Personal Knowledge Methodology. At the heart of the methodology is the use of a suite of knowledge acquisition and modelling techniques. These are referred to as Personal Knowledge Techniques. Based on a review of a wide-range of literature, eight techniques were selected to be assessed for their possible use as Personal Knowledge Techniques. These included interview-based techniques, repertory grid techniques and diagram-based techniques. Two in-depth studies took place involving 18 participants and a total of 100 knowledge acquisition sessions. The results revealed that each of the eight techniques showed promise at efficiently capturing and structuring aspects of an individual's personal knowledge. In addition, the techniques showed potential for providing help in allowing reflection and revealing insights. In particular, a technique based on the construction and use of a state transition network was found to be the most highly rated by the participants. A content analysis of the knowledge acquired formed the basis of an ontology of personal knowledge that would underpin many uses of the Personal Knowledge Methodology. The empirical work and analysis led to a number of ideas for future developments of the methodology and uses for the Personal Knowledge Techniques.

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This thesis is dedicated to my parents.

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1 INTRODUCTION

Know thyself
(Inscription on a Greek temple, circa 600 BC)

1.1 Overview

The focus of this thesis is on the knowledge that individuals possess of themselves; of their life history, their behaviours, their moods, their attitudes, their relationships, their ambitions, and so on. Such knowledge will be referred to as personal knowledge.

Personal knowledge can be distinguished from two other major types of knowledge* that people possess. One of these is the common knowledge that people use to operate in the everyday world. This includes knowledge in terms of physical activities, facts and basic understanding. The other type of knowledge is of specific domains, typically the knowledge and expertise required to perform expert roles in organisational contexts.

To illustrate these three types of knowledge with an example, one can say that a doctor knows why she became a doctor (*personal knowledge*), knows how to get to the hospital (*common knowledge*), and knows how to diagnose various illnesses (*expert knowledge*).

This segregation of knowledge into three categories is mirrored in the academic fields that study each type of knowledge. The study of personal knowledge is usually the preserve of social psychologists, psychoanalysts and psychiatrists; the study of common knowledge is most associated with cognitive and behavioural scientists; and the study of expert knowledge is undertaken in a branch of artificial intelligence, called knowledge engineering. Principles and techniques have been established within each of these disciplines to study and apply the particular type of knowledge under scrutiny. In general, the principles and techniques used in one discipline are very different from those used in other disciplines. Unfortunately, very little collaboration or cross-use of methodologies is carried out from discipline to discipline, even though this can often lead to interesting new directions and beneficial developments.

* The term 'knowledge' is used in this thesis as it is in Knowledge Engineering (i.e. as a structured and contextualised form of information), rather than the Epistemological notion of true justified belief.

This thesis follows an interdisciplinary approach by treating personal knowledge as if it were a type of expert knowledge. In other words, to take the principles and techniques used by knowledge engineers in domains such as medicine, geology and military planning and apply them to the domain of personal knowledge. Why adopt this perspective? There are two reasons. First, a knowledge engineering approach to personal knowledge might add something to the usual psychological approach. Second, addressing the new domain of personal knowledge might add something to what is already understood and practiced in knowledge engineering. This thesis explores both of these issues, though focuses mainly on the former.

1.2 The Psychological Approach to Personal Knowledge

1.2.1 Studying and Using Personal Knowledge

Why study personal knowledge? A pragmatic answer is that the ultimate aim is to help people. A second answer, from a more scientifically oriented position, is that the ultimate aim is to search for theoretical understanding. As argued later, the peculiarity of people as a subject for scientific enquiry necessitates consideration of the context in which theoretical understanding will be used. From both a theoretical, practical and ethical basis, an understanding of personal knowledge cannot be produced in a vacuum. This position is based on a theory of knowledge related to the pragmatism of William James, John Dewey and George Herbert Mead, which suggests that ideas must be evaluated in terms of their effectiveness, and are only truly known when they have been evaluated in practical situations (Howarth, 1980).

Adopting the pragmatic position, the next question is: How can people be helped? There are four main ways in which this can occur at the level of people's personal knowledge: (i) People can be informed, (ii) People can be advised, (iii) People can be given techniques and tools to use, (iv) Changes can be made to the environment (physical, social or cultural). To provide such help in an effective, efficient and ethical manner requires a number of elements to be in place. The help should be wanted and required, which may vary greatly across individuals and cultures. The help should be based on a sound theory developed using rigorous methodologies. The help should be monitored to verify that what was provided or changed was what was needed. The help should be cost-effective in terms of money, time and other resources. The help should not cause repercussions or side effects to other aspects of a person's life; hence

providers of help should consider the person as a whole.

Various experts are involved in the development, implementation and delivery of help involving personal knowledge. Direct providers of help include psychiatrists, clinical psychologists, psychotherapists, counsellors and a range of other professionals, such as managers, line supervisors, human resources officers, career guidance counsellors, and so on. To provide effective help requires these professionals to understand the particular needs and situation of their clients, which often requires them to implement and often integrate a number of sound theories. A range of social scientists, social psychologists and allied researchers provide such theories. One can view the work of these researchers as being an indirect route towards helping people, as opposed to the direct route of those delivering the help. This distinction between a direct and an indirect route to help is central to this thesis.

1.2.2 Problems in the Study and Application of Personal Knowledge

There are a number of problems associated with the study and application of personal knowledge. These problems, and possible solutions, are described in detail in Appendix A, and are summarised as follows in terms of three main problems. First, there is a gap between theorising and implementation, both from a temporal and role perspective. This problem indicates that there should be a much closer unison between the direct and indirect routes to help. A second problem is a dichotomy of psychological approaches into quantitative and qualitative camps. This problem indicates that no single method can do everything. What seems to be needed is a range of methods that can integrate together, rather than the dichotomous nature of quantitative and qualitative methods. What would be ideal would be a methodology that builds upon the strengths of both quantitative and qualitative methods. Such a methodology should allow for the collection of large amounts of rich data from each individual, and also allow large numbers of individuals to be involved. The third problem is the inevitable resource limitations and other professional difficulties of the direct route to help. This problem indicates that the best methods to employ should be as inexpensive as possible to administer, especially in minimising the involvement of professionals. This suggests an emphasis on self-help.

The problems and possible solutions outlined above provide opportunities for an expertise-based approach to personal knowledge. The opportunities are not concerned

at the level of actual theories but with the methods used to develop and apply theories to provide effective interventions. The focus, therefore, should be on identifying principles and techniques in knowledge engineering that can aid psychological research and intervention. The following section describes a methodology that adopts the principles and techniques of knowledge engineering (as described in Chapter 4). The aim of this methodology is to both study and apply personal knowledge while attempting to mitigate the problems described above.

1.3 The Personal Knowledge Methodology

The Personal Knowledge Methodology integrates a number of existing and novel techniques to offer a new approach to both research and intervention involving personal knowledge. It combines the direct and indirect routes into a highly integrated approach. The methodology has two purposes: (i) An intervention method to help people directly via a self-help approach; (ii) A research method to gather structured personal knowledge for analysis and theory construction. At the core of the methodology are the use of computer-based techniques that involve the acquisition, representation, presentation, modelling and analysis of personal knowledge.

The methodology is an evolving system that allows the capture and analysis of personal knowledge from a large number of users. Special elicitation techniques are used to capture personal knowledge providing structured representations of knowledge. These structured representations are analysed to provide new theoretical ideas that are used to modify and improve the elicitation techniques. It should be noted that the users of such a system would not be people with serious psychological problems, but any member of the public wishing to reflect upon and increase their personal knowledge. The ways in which a person can be helped in this way constitute one of the main research aims of this project.

The major components of the Personal Knowledge Methodology are summarised in Figure 1.

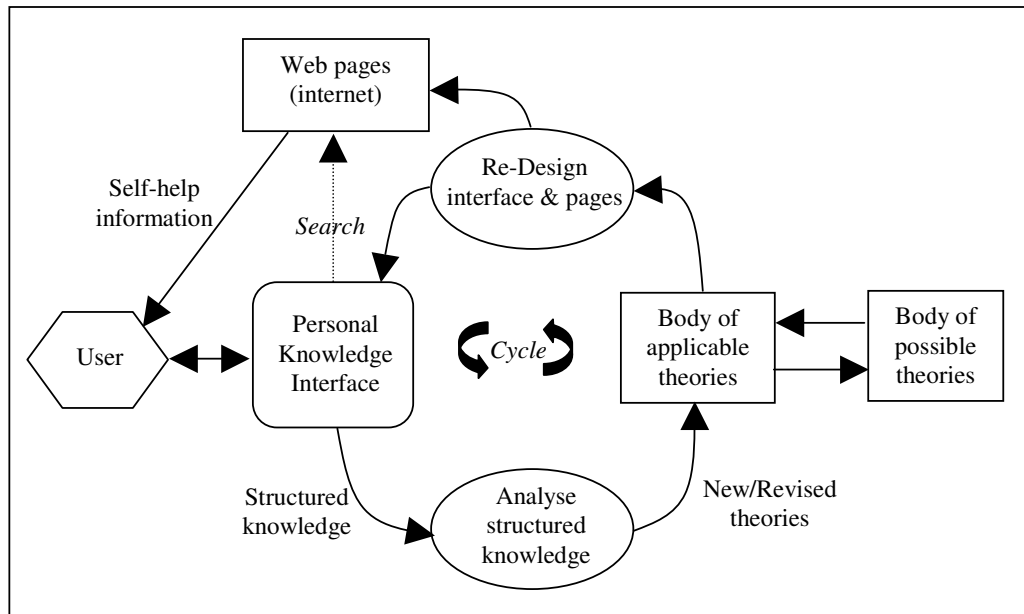


Figure 1: The major components of the Personal Knowledge Methodology

1.3.1 The Personal Knowledge Methodology in Operation

Using Figure 1 as reference, the methodology would operate in the following way.

1.3.1.1 The Personal Knowledge Interface

The user interacts with the **Personal Knowledge Interface**, a computer-based system comprising two elements:

1. A suite of **Personal Knowledge Techniques** to facilitate the acquisition and modelling of personal knowledge. Such techniques would be based on those used in knowledge engineering.
2. An **ontology** to support the knowledge acquisition tools and act as a structured repository of the knowledge captured. In this way, the ontology would be able to aid in knowledge re-use, act as a common language for communication between users, and underpin an advisor on which techniques the user might benefit.

The Personal Knowledge Interface would not only provide a mechanism for eliciting personal knowledge from the user, but also provide a means for the construction of various knowledge representations (or models). The ontology would provide hints and suggestions that encourage the user to look for patterns provided by psychological theories and those found by analysing other users. The ontology would also be used to make suggestions to the user concerning salient **self-help information** contained in a

database or from the internet. In producing and reflecting upon these representations and in viewing other salient information, users are assisted to develop representations of their personal knowledge and increase their self-understanding.

1.3.1.2 Analysis

The tangible results of a user's interaction with the Personal Knowledge Interface are a group of **structured knowledge representations**. The structured knowledge represented in this way is collected (perhaps over the internet) and used to analyse each person across time (idiographically) and also for analyses across people (nomothetically). At this stage, requests for further knowledge or ideas could be directed towards certain individuals in order to clarify or append the knowledge already represented.

As well as analysing the knowledge representations created by a user, other information can be analysed. Since the Personal Knowledge Interface is fully computer-based, the user's interactions can be constantly monitored. Thus, which techniques are used, the way in which they are used and what information is viewed, can all be saved and used for analysis. In addition, it is envisaged that the user's opinions of the techniques and information and what effects they have had on the user would be captured and analysed.

1.3.1.3 Theory Revision and Interface Re-Design

The results of the analysis phase contribute to the development of **new or revised theories**. The increased theoretical understanding would be used to update **the body of applicable theories** used in the methodology.

The body of applicable theories is used to design and re-design the Personal Knowledge Interface and the body of self-help information presented to the users. This final stage in the cycle enables a tight loop of theorising, intervention and evaluation, such that new ideas and techniques can be quickly tested and assessed.

The final element of the methodology requires that the body of applicable theories constantly draws from and updates the **body of possible theories** that involve personal knowledge. This body of theories would not only include those from academic psychology and allied disciplines but also include ideas from popular and folk psychology.

1.3.2 Personal Knowledge Interface

Perhaps the most crucial element of the methodology is the interface with the user. What sort of methods and techniques might be used here? One can categorise any psychological method used by lay people in one of three ways: (1) The method helps the person, but gathers no knowledge from them, (2) The method gathers knowledge from the person, but provides no help to them, (3) The method both gathers knowledge and helps the person. The latter category is the rarest, yet offers a number of promising possibilities for the Personal Knowledge Methodology. The notion of acquiring knowledge whilst simultaneously providing help is at the heart of the requirement to provide a much closer unison between the direct and indirect routes to help. Additionally, these dual-purpose techniques would help satisfy the requirement for the direct route to be as inexpensive as possible to administer. They might help in this way on three fronts. First, the ability to gather knowledge whilst administering help would allow a constant monitoring of how implementation was proceeding, thus aiding efficient decision-making into the next steps of help. Second, this monitoring activity would generate vital knowledge over large numbers of people, perhaps based on trials of different methods to different groups, to aid the development of more efficient help systems. This would not only be performed on a sample of cases, as in current practice, but the possibility is to perform this on all cases. Third, group therapies could exploit the dual-purpose techniques and modern e-based technologies so that groups and therapists could be formed in geographically separate locations, thus saving on travelling costs.

For these reasons, a major aim of this thesis will be to identify and explore the efficacy of various techniques that can both gather knowledge and provide help at the same time. Such techniques will be referred to as Personal Knowledge Techniques.

1.3.3 Personal Knowledge Techniques

Where is it best to look to identify a range of suitable Personal Knowledge Techniques? Since principles and techniques from knowledge engineering were the inspiration for the Personal Knowledge Methodology, identifying candidates from the knowledge elicitation techniques used in knowledge engineering would seem a good starting point. However, none of the elicitation techniques used in knowledge engineering are used to help people directly. To assess the help-providing potential of

such techniques requires an understanding of the processes of help (to be covered in chapter 2). It is also important not to overlook the likelihood that techniques currently used in psychotherapy and psychology might also provide candidate techniques. If such techniques can provide effective and efficient help that can also be monitored and provide structured knowledge, then these should be considered and assessed.

It should be noted at this point, that almost all of the knowledge elicitation techniques used with experts during knowledge engineering projects originated in psychology. However, much effort has been expended in the knowledge engineering community over the past 20 years to make the techniques more structured, efficient and methodological (e.g. with the use of ontologies). During this time, there has been no attempt to export the adapted techniques back into psychology and assess their merits for psychological purposes. This research aims to rectify this by assessing various knowledge elicitation techniques within the psychological domain.

1.3.4 Development and Use of the Personal Knowledge Methodology

For the present research, the Personal Knowledge Methodology has been developed to provide a clear target for the assessment of knowledge engineering principles and techniques in the domain of personal knowledge. It is important that such a target system is in place before the empirical work begins to act as a guide for the decisions that need to be taken and provide a perspective from which the work is to be viewed.

A second role for the Personal Knowledge Methodology in the present research is to provide a framework for the development of the Personal Knowledge Techniques. In this way, the methodology (which is cyclical) can be kick-started by providing the first few cycles around the analyse-design-apply-analyse cycle. In other words, the literature review and empirical research (design, data collection and analysis) can be seen in terms of the cyclical development of the proposed methodology.

1.3.5 Summary

A large socio-technical system, called the Personal Knowledge Methodology, has been developed in order to act as a guiding framework and target methodology for the adoption of knowledge engineering techniques to provide both direct and indirect help involving personal knowledge.

The development of an operable Personal Knowledge Methodology, even a prototype

version, would be a very large undertaking and require resources well beyond those of the present research. The main aim here, then, is to make a few steps towards this goal. In doing this, a start can be made by assessing the utility of taking a knowledge engineering approach to personal knowledge.

1.4 Research Aims

The research aims fall into two groups, operating at separate levels. At the first level, there are aims associated with the Personal Knowledge Techniques. At the second, more general, level there are aims associated with the Personal Knowledge Methodology. The aims at these two levels include a number of research questions, as described below.

1.4.1 Research Aims Associated with Personal Knowledge Techniques

An assessment of which techniques could be included in the Personal Knowledge Methodology provides the first set of research questions:

- Which techniques are most suitable as Personal Knowledge Techniques?
- What types of personal knowledge can each technique capture?
- Does the process of capturing a person's personal knowledge increase his/her personal knowledge, or have some other effects or benefits?
- Is a person helped by having his/her personal knowledge increased?
- Do the results of capturing and representing personal knowledge in an explicit format (e.g. transcripts, diagrams, grids) help the person?
- Can a person operate the techniques on his/her own?
- Are there any differential effects in the use and usefulness of the techniques associated with demographic details (e.g. the gender, age, qualifications and personality of the person)?

1.4.2 Research Aims Associated with Personal Knowledge Methodology

An assessment of the usefulness and usability of the Personal Knowledge Methodology provides the second set of research questions:

- How useful might the methodology be to the person using it?
- How useful might the methodology be for research purposes?
- Would people want to use the methodology?
- What ontology should be used?
- Can the methodology be computer-based?

- What is the best way to develop the methodology?
- What metrics and assessment methods can be used to assess the effects and effectiveness of the methodology?

1.4.3 Comments on the Research Aims

Rather than provide a detailed account of the reasoning behind the choice of research questions just described (which will become more apparent over the next few chapters), some brief comments will be made at this stage.

For a research project such as this, one might argue that the number of research questions is too large. Why have so many? It is believed that the best way to approach the development of the Personal Knowledge Methodology is on a broad basis rather than to choose one or two aspects and examine these in great detail. The danger of a narrow, depth-first approach is that a focus on limited aspects of the methodology might mean important issues are not covered and are missed. Due to the cyclical nature of the methodology, incorporating multiple techniques in a possibly synergistic way, means that a broad, breadth-first approach is more encompassing and more appropriate in a methodologically-oriented project such as this. The down side is that some research questions may not be addressed in great enough detail. On balance, it is felt that this danger is less important than the need to gain a comprehensive assessment of the methodology as a whole and the relative effectiveness of various Personal Knowledge Techniques.

As will be discussed in chapter 4, there are many problems associated with an experimental investigation into the relative effectiveness of different elicitation techniques within knowledge engineering. Hence, when comparing techniques for their appropriateness as Personal Knowledge Techniques, the emphasis will be on their relative merits in helping the user to capture, reflect upon and increase their personal knowledge.

From a knowledge engineering perspective, it may be argued that the development of an ontology of personal knowledge should be the prime aim. The development of an ontology is a large and complex undertaking and would probably require the full research effort available. Given the aim of the Personal Knowledge Methodology to provide help to the user, it is felt that the development of an initial, prototype ontology should be an aim at this stage, and that lessons learnt when addressing the

other research aims will be beneficial to later developments of the ontology.

1.4.4 Investigating the Research Aims

Investigating the research aims will require covering a wide range of background literature as well as substantial empirical work. The background literature will cover two main areas: (i) various therapeutic approaches and methods, (ii) various ways in which knowledge can be captured and used for research purposes.

Each of the research questions listed previously will be addressed at a number of points in the thesis. They will form the structure of the summary and discussion sections at the end of the literature review chapters (chapters 2 and 3). In the final chapter of the thesis (chapter 9), each of the research questions will be addressed in order to summarise and discuss what has been learned from the project.

1.5 Thesis Structure

The structure of the thesis is shown in Figure 2.

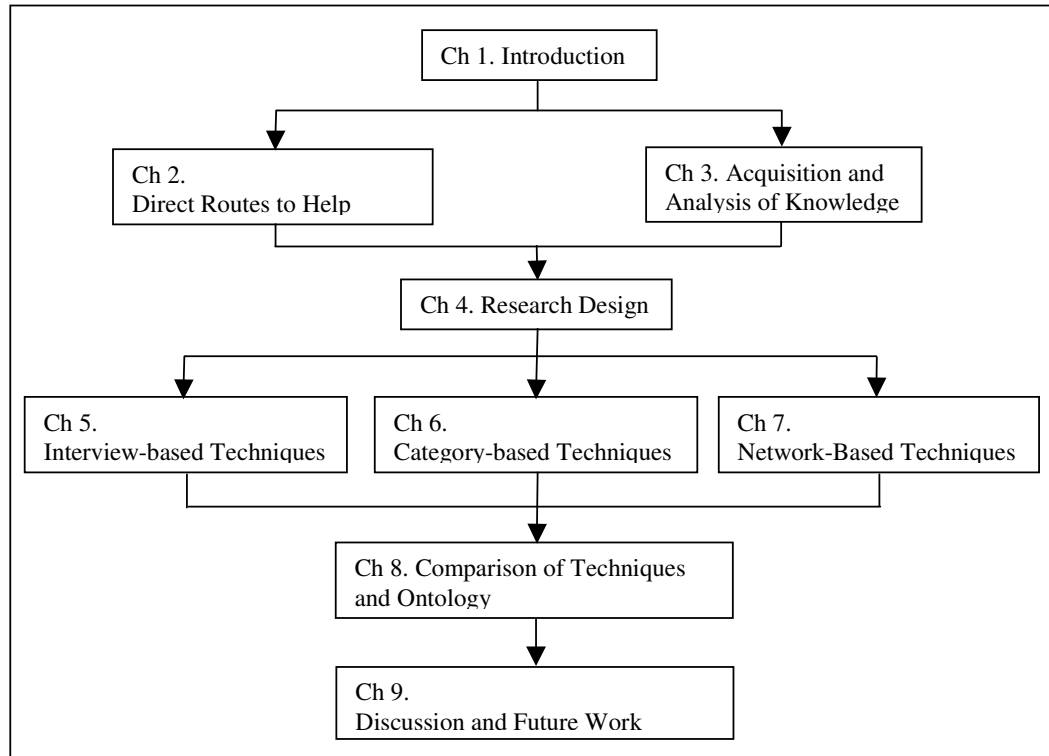


Figure 2. Structure of the thesis

There are nine chapters, a number of which can be read in non-consecutive order. In particular, the empirical work described in chapters 5, 6 and 7 can be referred to in any sequence. Following the introductory chapter, the remaining eight chapters fall into

three parts: chapters 2 and 3 cover background literature, chapters 4 to 8 describe the empirical work, and chapter 9 contains conclusions and a discussion.

1.5.1 Part One: Background Literature

The first part of the thesis consists of chapters 2 and 3, and reviews an extensive range of literature to critically assess the research questions. Chapter 2 explores the direct route to help, with an emphasis on the processes that might operate in the Personal Knowledge Methodology to facilitate self-help. To do this, a wide variety of psychotherapies and other help techniques are surveyed. Chapter 3 focuses on the indirect route to help, with an emphasis on identifying candidate Personal Knowledge Techniques from those used in knowledge engineering and psychology.

1.5.2 Part Two: Empirical Work

The second part of the thesis consists of chapters 4 to 8, and covers the empirical work. Chapter 4 covers the overall design of the study. It explores the methodological issues involved, including resource limitations, the populations to be involved and methods of assessment. Chapters 5, 6 and 7 describe the assessment of eight knowledge techniques. Chapter 5 describes work on two interview-based techniques: a semi-structured interview technique and an interview review technique. Chapter 6 covers work on three category-based techniques: a repertory grid involving people, a repertory grid involving events/periods and a personality assessment technique. Chapter 7 describes work on three network-based techniques: an events diagram technique, a state transition network technique and a combined decision tree and aspirations network technique. Chapter 8 brings together the results obtained separately for the eight techniques to provide a critical comparison. It also includes a proposed ontology for the Personal Knowledge Methodology.

1.5.3 Part Three: Discussion and Future Work

The final chapter addresses the research questions posed earlier and outlines a number of areas that future work might address. Firstly, it presents some tentative conclusions to the research aims, and describes further issues that have arisen. It then discusses some implications of the research conducted and how future work might address the issues involved.

2 DIRECT ROUTES TO HELP

*'Know thyself' said the old philosopher. 'Improve thyself' sayith the new.
(Bulwar-Lytton, 1849)*

This chapter describes direct routes to self-help that use aspects of an individual's personal knowledge. As mentioned in the first chapter, there are four main ways to provide help involving personal knowledge: information, advice, techniques and environmental change. The basis of the Personal Knowledge Methodology is that direct help is delivered to a person via computer-based techniques. Hence, environmental change, which is a more indirect route, will not be considered.

The chapter covers a wide range of literature to address the research aims described at the end of the previous chapter. In particular, the focus is on a number of specific questions: How are people helped in the most effective way possible? How do the computer-based, self-help aspects of the Personal Knowledge Methodology compare to other methods? What types of Personal Knowledge Techniques are best suited to direct help?

To address these questions, the chapter covers two main aspects of direct help:

1. The provision of therapeutic information, advice and techniques to people with behavioural or emotional problems
2. The use of psychological theories and techniques to help people more generally, in areas such as decision-making, behavioural change and creative thinking.

Unfortunately lack of space and the need to cover a large literature necessitates a broad, shallow approach rather than a narrow, deep approach. As such, this chapter will mainly address the methods involved in the different fields with some brief descriptions of the underlying theories. A critical analysis and comparison of the different theories and particular research studies will not be covered (but can be found in the cited references).

As a start, the archetypal method of direct help will be covered, i.e. the face-to-face interaction between a professional and a person requiring help. The professional could be a psychiatrist, a psychotherapist, a clinician or a counsellor. Within the literature, and depending on the situation, the person requiring help is referred to as either the

patient or the client. Both of these terms will be used as and when appropriate. The general term 'therapist-assisted help' will be used to describe this form of help.

2.1 Therapist-Assisted Help

Therapist-assisted help is the concern of two main disciplines: Psychotherapy and Counselling. Although these are separate disciplines, they overlap in many ways, and both have the aim to directly help people live better lives, mainly by overcoming maladaptive thoughts, feelings and behaviours. As will become apparent, a wide range of approaches and methods are used.

There is a long running debate concerning the differences between Psychotherapy and Counselling. Some believe there is no essential difference, whereas others point to a number of factors that differentiate the two fields (Woolfe, 1997). These differentiating factors are summarised in Table 1.

	Psychotherapy	Counselling
Aim	Concerned with personality change	Helping an individual to utilise their own coping resources
Clients	Working with people with a history of pathology and psychological disturbance	Helping solve problems for people who are basically emotionally healthy
Length	Long-term process	Short-term process
Training	Training is based upon personal analysis combined with the development of diagnostic and analytical skills	Training focuses on the process of goal setting and the tasks involved in achieving this
Basis	Rooted in the psychodynamic approach	Largely based on the humanistic approach
Setting	Found mostly in clinical and medical settings	Found in a large range of institutional and workplace settings

Table 1: Differentiating Factors between Psychotherapy and Counselling

Although Table 1 indicates many differences between Psychotherapy and Counselling, many agree that both fields are broad churches and involve a good deal of overlap in theories and methods (Ivy *et al.*, 1987). To indicate the breadth of the domains, Dryden's handbook of individual therapies (1990) contains accounts of twelve major theoretical approaches, many of which can be found in the literature on both Psychotherapy and Counselling. These twelve approaches are Psychodynamic (Freudian), Psychodynamic (Kleinian), Psychodynamic (Jungian), Adlerian, Person-Centred, Personal-Construct, Existential, Behavioural, Cognitive, Gestalt and Transactional Analysis. Within these approaches there are very many variants, such

that the total number of different forms of psychotherapy numbers over 250 (Meichenbaum, 1997).

To make some sense of this huge range of approaches, each with its own advocates and supposed claims of efficacy, one can identify three main traditions to which each belongs: the analytical/psychodynamic, the humanistic (person-centred) and the cognitive-behavioural. These different traditions vary in a number of ways, such as the underlying theoretical orientation, how prescriptive and structured is the treatment, the relationship between the therapist and patient, the importance of verbal communication, the length of the treatment, and the importance of an educational component. The following sections briefly review each of these three traditions with an emphasis on the underlying theories and the techniques used. Lack of space does not permit a detailed discussion of the comparative efficacy of each tradition and technique, but this has been well documented elsewhere (e.g. Lindsay & Powell, 1994; Baum *et al.*, 1997).

2.1.1 Psychodynamic Approach

The Psychodynamic approach has its historical roots in the Psychoanalytic tradition of Freud and his followers. As such, it is based on both theories of mind (e.g. the ego, superego and id) and developmental theories (e.g. the oral, anal, and genital stages). Therapy is based essentially on interview sessions, with analyses and interpretation by the therapist. Thus, this type of therapy has been described as a ‘talking cure’ (Rycroft, 1995). A number of post-Freudians rejected much of Freud’s theories but carried on with his essentially verbal therapeutic approach. For instance, Adler contributed the notions of power as compensation for feelings of inferiority; Horney proposed the idea that neurotic problems are due to a genuine lack of warm affection during childhood and lack of fair treatment; Carl Jung contributed a focus on spiritual matters, the collective unconscious and archetypes.

One of the key strategies in all Psychodynamic therapies is the uncovering and revelation of unconscious memories, wishes, motivations and fears. These are seen as the cause of emotional disturbance and are not able to be explicitly verbalised due to a coping mechanism of internal repression. To uncover the unconscious, Freud used techniques such as free association and the analysis of dreams. In free association, the therapist picks up on any unforced remarks made by the patient that may unwittingly

reveal wishes and motivations not able to be explicitly disclosed. A more formalised version of this is the association test introduced by Jung. Here the therapist uses a list of prepared words, maybe fifty or sixty, which are called out one by one to the patient who responds as quickly as possible with the first word that comes to mind. After Jung, other techniques were developed along the same lines that use the patient's interpretation of meaningless or ambiguous images, a prime example being the use of random inkblots in the Rorschach test.

2.1.2 Humanistic Approach

The person-centred approach is inspired by the work of Carl Rogers (1951) and places great importance on empathy, unconditional positive regard, authenticity, congruence and genuineness. Person-centred practices derive from the philosophy of humanistic psychology, the primary characteristic of which is an optimistic view of human nature. Hence, the object of most person-centred therapies is to help the person become what he or she is capable of becoming, i.e. achieve 'self-actualisation' (Maslow, 1968). A recent movement that follows this tradition is that of Existential-Humanistic psychology.

Existential-Humanistic psychology locates the source of therapeutic change in the client, whilst the therapist is the provider of opportunities, ideas and experiences. Thus, this approach is directly opposed to the medical-like model of an expert professional diagnosing what is wrong and then treating the disorder, which is the main paradigm of both the Psychodynamic and Cognitive-Behavioural approaches. Bohart & Tallman (1996) provide compelling evidence supporting the Existential-Humanistic approach over the medical-like model.

Existential-Humanistic psychology uses many techniques, but no one is seen as necessary nor is mechanistically applied. They are better seen as ways of being with a client rather than procedures that operate to make things happen in the client. Here the client is treated as a whole person, as opposed to the part-person model of other approaches. Therapists view psychological problems as arising from fundamental issues in living, e.g. the need to deal with such paradoxical challenges as life vs. death, meaning vs. absurdity, freedom vs. determinism, and community vs. aloneness. (Greening, 1992). Therapists believe it is the actions and choices by the whole person, as he/she struggles to live, that result in dysfunctional behaviour.

2.1.3 Cognitive-Behaviour Therapies

Cognitive-Behaviour therapies include a family of approaches based on empirical psychological research and having the modification of behaviour and/or cognitions as the main therapeutic goal. The two main traditional approaches in this area are Behaviour Therapy and Cognitive Therapy.

Behaviour Therapy is based on the Behaviourist movement of experimental psychology with the work of such people as Pavlov, Watson and Skinner. The underlying idea is that maladaptive behaviour is learned via conditioning. Therapy aims to break these maladaptive associations, e.g. learning not to associate a fearful response with a particular stimulus. Techniques such as systematic desensitisation and token economies are used (Murdoch & Barker, 1991).

Cognitive Therapy is based on the idea that symptoms (e.g. of depression) and negative automatic thoughts about self (e.g. "I'm worthless") are locked in a vicious cycle, one reinforcing the other (Beck *et al.* 1980). The negative automatic thoughts are seen as the result of negative experiences early in life which lead to dysfunctional assumptions. Therapy comprises four strategies. First, there are behavioural strategies, such as monitoring daily activities using diaries, scheduling activities and task assignments. Second, there are cognitive strategies, such as distraction from negative thinking. Third, there are cognitive-behavioural strategies, such as identifying, questioning and disrupting negative automatic thoughts. Fourth, there are preventative strategies, such as identifying and challenging underlying assumptions, and preparing for future life changes.

More recently the umbrella term of Cognitive Behaviour Therapy has emerged. This is a broad church that attempts to integrate various forms of psychotherapy. It takes a more constructivist perspective than previous therapies, inspired by the work of constructivists such as George Kelly (described in the next section). It also takes a biopsychosocial perspective that emphasises the reciprocal interdependence of thoughts, feelings, behaviour, consequences, social context and physiological processes (Meichenbaum, 1997).

2.1.4 Other Approaches to Psychotherapy and Counselling

A number of other approaches to psychotherapy and counselling are used. Two of

these, of particular relevance to the current research, are Personal Construct Psychology and personality tests. Space does not permit description of other approaches such as use of narratives (White and Epston, 1990; Schafer, 1992) and change processes (Mahoney, 1991).

2.1.4.1 Personal Construct Psychology

Personal Construct Psychology is a constructivist system of psychology developed by George Kelly (1955). Kelly was a clinical psychologist and educator hence the major impact of his work has been in psychotherapy and education. However, Personal Construct Psychology presents a complete psychological system, and has provided techniques that are used in a wide range of other disciplines, such as management studies and knowledge engineering.

Personal Construct Psychology is based on the idea that a person's psychological processes are driven by the way in which events are anticipated. As such, people are viewed as being analogous to scientists and are driven by the need to cope with future events. Prediction of future events is based on a person's constructs, i.e. the ways in which the individual construes certain entities as being similar or different from each other. As events occur in a person's life, they reveal the person's predictions as either correct or misleading. This acts as the basis for the revision of constructs and, eventually, of whole construct systems.

Maladaptive thoughts and behaviours are seen to stem from inappropriate constructs. Hence, the therapeutic approach is based on encouraging the client to develop alternative construct systems through which to construe life events. The main method of achieving this centres on the use of the Role Construct Repertory Test, now referred to as the Repertory Grid (Collett, 1979). The technique involves the construction of a grid of elements (e.g. people) against constructs (e.g. personality traits). The grid consists of numerical ratings of each element for each construct. Creation of the constructs involves a technique called triadic elicitation in which three elements are taken at random and the participant is asked in what way two of them are similar but different from the other one. This is a brief description of the technique that will be described at more length in the next chapter.

There is a body of evidence indicating that revelation of underlying constructs using the Repertory Grid technique may have beneficial effects on mood and decision-

making (e.g. Beail, 1985; Smith, 1990). In the words of one researcher:

Many of the people I know who have used grids professionally also use them personally; self-understanding, relationship difficulties, work planning, decision-making - all these and countless other psychological domains are the natural subjects for exploration of one's construct system. (Davies, 1985, p346).

2.1.4.2 Personality Tests

In complete contrast to the constructivist approach of Personal Construct Psychology is the trait approach adopted in most personality tests. Here the emphasis is on the commonalities in the way people behave and think, as opposed to the differences inherent in the constructivist approach.

Personality and temperament tests are much used by trait theorists to measure and categorise personality characteristics (to be covered in the next chapter). However, some of these tests are also used to facilitate help. For example, they are popular techniques in organisational contexts for a range of uses such as career development and team building (Huczynski & Buchanan, 1991). The standard format involves the use of a questionnaire to acquire data about a person's attitudes and behaviours. The answers from each question, typically ratings or forced-choice, are used to classify the respondent into a particular category. For instance, the popular Myers-Briggs Type Index has 16 categories based on four dimensions developed from the work of Carl Jung (Quenk, 2000). Information on the typical attributes, attitudes and behaviour patterns of these categories are presented to the respondent to increase and challenge their self-understanding.

2.1.5 Summary of Therapist-Assisted Treatments

In summary, therapist-assisted treatments vary substantially as do their theoretical bases. However, there are a number of commonalities such as the need to elicit knowledge from the client that is then challenged in some way. The revelation of ideas previously not consciously known to the client is another common theme. Evidence from work in Existential-Humanistic psychology suggests that the therapist is the provider of opportunities for revealing and challenging knowledge rather than being a provider of professional insights and knowledge. It seems possible that it may be attributes of the method rather than attributes of the therapist that are the key to successful help. In the next section, this will be investigated further by looking at treatments that do not directly involve a professional.

2.2 Methods of Self-Help

Three methods of self-help will be covered in this section: self-help books, bibliotherapy and diaries. Paper-based materials are the primary media for these methods, however, computer-based methods have started to be used more recently. Computer-based techniques will be covered in a later section.

2.2.1 Self-Help Books

For many years the public have been able to read general books of advice for personal problems. More recently, a wide variety of specific treatment books have become available, targeted to specific problems and written by leading experts in the fields of psychotherapy or clinical psychology (Rosen, 1987). Use of such books (and other media) by people for therapeutic purposes is usually referred to as self-help. The increased involvement of psychologists in self-help follows American psychologist George Miller's urging to "give psychology away" in order to help people to help themselves (Miller, 1969).

2.2.1.1 Popularity of Self-Help Books

In America, the 1970s marked the beginning of a near explosion in the mass marketing of popular psychology (Grodin, 1991). By the late 1980s, a number of surveys had been conducted in the USA that demonstrated the popularity of self-help books. It was found that over 2000 self-help books were being published each year in the USA (American Psychological Association, 1989), and that one in three Americans had purchased a self-help book (Wood, 1988). Most readers were found to be female, college-educated and middle-class, nearly all finding the genre to be helpful (Shapiro, 1987; Starker, 1988). So ingrained have self-help books become in American culture that top-rated television shows, such *Oprah Winfrey*, often feature the author of a self-help book as the resident expert (Grodin, 1991).

2.2.1.2 Potential Benefits of Self-Help Therapies

The potential benefits of self-help material have been summarised by the American Psychological Association Task Force on Self-Help Therapies (1978). They noted that properly developed programmes accompanied with accurate claims:

- Have tremendous potential for helping individuals to understand themselves and others

- Promote human welfare through the amelioration of emotional and behavioural problems
- Are able to reach large numbers of individuals on an extremely cost-efficient basis
- Can help individuals to maintain their autonomy and individuality by decreasing reliance upon professionals
- Can serve important education and preventive functions.

2.2.1.3 Use of Self-Help Books

Studies of the way in which people choose and use self-help books are rare. A notable exception is that of Grodin (1991) who investigated the use of self-help books by women. Grodin found readers use self-help books in complex, and often empowering ways. Factors such as choice and autonomy are important in the process of selecting a book to read, i.e. searching for and finding a book appears to be part of the therapeutic process. Female readers often read for the purpose of extricating themselves from patriarchal authority and establishing personal autonomy. Themes of both ‘finding oneself’ and ‘finding others’ emerged. Readers are both selective and interpretative of what they read, and acknowledge what works for one, may not work for someone else. They believe that being a professional helper enables the writer to see patterns of activity among people not perceptually or pragmatically available in day-to-day life. This gives the author an authority and distinguishes him/her from the reader.

2.2.1.4 Problems with Self-Help Books

Although the benefits of self-help books may be great, a number of risks exist as well. Do-it-yourself therapies may be applied inappropriately. Should treatment failure occur, there are risks of negative self-attributions, of anger towards self and others, and of reduced belief in the efficacy of therapeutic techniques (Barrera, Rosen & Glasgow, 1981). A further problem is that commercial considerations, rather than professional standards, have been influencing the development of treatment books, with many being marketed with exaggerated claims (Rosen, 1987). However, as Holtje (1988) points out, sales of psychologically sound material would inevitably suffer if these claims were not made.

2.2.2 Bibliotherapy

Bibliotherapy refers to the use of self-help books as part of clinical or counselling

therapies. Some authors also use the term to include self-help material presented in the form of audiotape, videotape or computer programs.

2.2.2.1 Popularity and Use of Bibliotherapy

Surveys of practicing psychologists and psychotherapists have found that around 90% of respondents make some use of self-help books with their clients, with about 50% doing so on a regular basis (Starker, 1988; Marx *et al.*, 1992). However, there is a wide variation in the ways in which books are incorporated into treatment programmes, from no follow-up after a book is suggested, to giving specific homework assignments. Additionally, there is little consensus about the value of specific books. Indeed, a number of books recommended as classics by some therapists are considered unsuitable for treatment by other therapists (Marx *et al.*, 1992). This lack of consensus has also been found by Quackenbush (1991) who surveyed 47 university counselling centres inquiring for the most useful self-help resources available. The result was a total of 271 different self-help books, the vast majority of which were recommended by three or less counselling centres.

2.2.2.2 Effectiveness of Bibliotherapy

Over the past 30 years, around 300 studies have examined the effectiveness of various bibliotherapies (Marrs, 1995). Based on various subsets of these, a number of reviews and meta-analytic studies of the literature have been made. The majority of these are rather subjective reviews (e.g. Craighead *et al.*, 1984; Rosen, 1987), which have generally concluded that bibliotherapy is moderately successful with some types of problems. However, there is little agreement among reviewers as to which problems are most appropriate.

More recently, two meta-analytic studies have carefully examined the empirical literature (Gould & Clum, 1993; Marrs, 1995). Gould & Clum identified 40 studies to analyse. Marrs identified 70 studies, which covered 10 different problem categories: anxiety, assertion, weight loss, impulse control, depression, studying, sexual dysfunction, career, self-concept and others. Among these studies, Marrs found that 7 different dependent variables were used to assess the effectiveness of the treatment. The most popular measures were standardised self-reported measures (e.g. MMPI, BDI) which were used in 35% of studies, and behaviour observed by researchers, used in a further 17% of studies. Other measures used were unstandardised self-report

measures, physiological measures, self-reported behaviour, academic achievement and scale-rating by others.

Both Marrs and Gould & Clum found no significant difference between the effectiveness of self-help and therapist-assisted interventions. This is supported by another meta-analytic study by Smith & Glass (1977) who found very similar effect sizes for psychotherapy and behaviour therapy as that found by Gould & Clum for self-help. In addition to effectiveness, there seems to be no significant difference in the rate of drop-out between self-help and therapist-assisted therapies.

Both Gould & Clum and Marrs found that bibliotherapy is differentially effective across problem types. Gould & Clum found bibliotherapy to be most effective with fear reduction, headache, depression and training of skills, and less effective for diet/exercise and habit behaviours. Marrs found assertion, anxiety and sexual dysfunction to be best, and weight loss, studying problems and habit behaviours to be less amenable to treatment.

Both studies found evidence that the medium of the treatment had some moderating effects. Marrs found that assertion treatments were more effective using an audio-visual medium. More generally, Gould & Clum found that videotape has a slightly stronger effectiveness than written materials. There is also a possibility that certain types of people benefit more from bibliotherapy than others, although both studies acknowledge the relative dearth of studies in this area, a notable exception being a study of mildly depressed students by Mahalik & Kivlighan (1988) showing some effect of personality.

A troubling finding in both Marrs and Gould & Clum's studies was that measured effectiveness of treatment was affected by two key experimental parameters. First, the type of dependent variable used was found to moderate the results. Marrs found that studies using non-standard scales and observed behaviour had larger effect sizes than those using physiological and self-reported behaviours. Second, the type of control group also moderated the results. Both Marrs and Gould & Clum found that studies with placebo control groups tend to show lower effect sizes (though still medium) as compared to no-treatment conditions.

2.2.2.3 Therapeutic Aspects of Self-Help Literature

In summary, although the evidence is somewhat equivocal, it appears that self-administered treatments do provide similar therapeutic benefits to those involving a therapist or counsellor. One reason for this may be that most empirical studies generally study cognitive or behavioural therapies, which are regarded as being less reliant on the personal qualities of a therapist. A more general account may be that the effectiveness of all psychotherapies does not lie in the expertise of the therapist but in the clients themselves. Bohart & Tallman (1996) have summarised this by stating “ultimately all therapy is self-help”.

2.2.3 Diaries as Therapy

Although little has been written about the use of diaries as a therapeutic medium, there is some evidence that the use of a number of diary techniques can be beneficial. To conclude this section on self-help, what follows is a brief review of the use of diaries as a therapeutic medium, with a particular eye on the methods used.

2.2.3.1 Use of Diaries

The use of a diary or personal journal is very common. People not only use them as a chronological record of events but for various therapeutic purposes. This folk psychological use of diaries as mediators of self-help has been studied by Rainer (1978). Rainer analysed the diaries of people across history and different cultures, looking for the devices that people use to express thoughts and feelings, and that help increase their understanding and reveal insights. It was found that diarists use four basic devices:

- Catharsis, i.e. the immediate expression of intense emotion, acting as a purgation for the writer
- Description, i.e. a narrative account of events, feelings, dreams, people, places, etc.
- Free-intuitive writing, i.e. a message from the inner consciousness using techniques such as free association, stream of consciousness and automatic writing
- Reflection, i.e. standing back in order to see connections and significances not noticed before.

Rainer also identified seven other techniques that are drawn upon when the four basic devices seem insufficient. These include lists (the enumeration of thoughts, feelings,

sense impressions or intuitions); portraits (descriptions of other people in order to learn what qualities the writer notices and values in others); maps of consciousness (free drawings and graphic images which can be interpreted later as a process of inner exploration); altered points of view (writing about the self in the third person or imagining how another person sees the writer); unsent letters (writing letters to others with no intention of sending them); and dialogues (a conversation carried on with the self to help gain insight into a person, event, or important subject matter).

2.2.3.2 The Intensive Journal

In contrast to Rainer's analytic study is that of Progoff (1975) who created a self-help therapy based on the use of a specially developed diary called the intensive journal. This aims to play an active role in reconstructing a person's life without imposing any external categories, interpretations or theories on the individual's experience. Specific procedures are provided which aim to give vitality to factors that are lying dormant in the depth of the self. The intensive journal comprises a number of sections. One is the dialogue dimension section that enables dialogues with persons, society, events and one's body. Another is the depth dimension section that encourages the logging of dreams, imagery and inner wisdom dialogues. A further section focuses on the life/time dimension, which involves capturing such things as the diarist's life history, current position, roads taken and not taken.

2.2.4 Summary of Self-Help Therapies

Research into the effectiveness of self-help literature generally suggests that certain problems do not require the direct involvement of a professional therapist or counsellor. However, there is also evidence that the direct involvement of a therapist is of benefit for certain people with certain problems, although which people and which problems is uncertain. There may be two reasons for this. First, it is the warmth and support of another person that provides the extra beneficial effects. Second, it is the more interaction-based and conditional treatments offered by a therapist that proves more effective than the use of self-help literature. Focusing on the latter possibility, perhaps a more active medium is required to facilitate the self-help. Use of a computer is a possibility here.

2.3 Computers in Psychotherapy

Computers have two main uses in the field of psychotherapy, use by the therapist and use by the client. The following sections review the use of computers by clinicians and by clients, including resistance to computer-assisted therapies and ethical issues.

2.3.1 Use of Computers by Therapists

Bloom (1992) has reviewed the history of computer-assisted psychological intervention since its inception in the mid-1960s. Bloom found that the computer is playing an increasingly important role in such diverse areas as personality and behavioural assessment, diagnostic interviewing, history taking, health education, mental health consultation and clinical training. In these areas, Bloom found the reliability, validity, and utility of the computer compares very favourably with that of a clinician. As well as traditional computer systems, knowledge-based systems are finding use as a support for clinicians. An example of this is DYSLEXPERT, a system that aids diagnosis of dyslexia (Blonk, Vandenbercken & Debruyne, 1996). Computer systems are also being used in knowledge management contexts to help psychiatrists in the collection, organisation, assessment, and exploration of complex data about their cases (Stinson & Horowitz, 1993). For example, computer-mediated concept mapping tools help to capture and represent autobiographical knowledge and are used to reflect upon personal histories (Plaisant, Shneiderman & Mushlin, 1998). Computers are also used for diagnostic interviewing and educational purposes (Plutchik & Karasu, 1991; McLemore & Fantuzzo, 1982).

2.3.2 Computer-Assisted Self-Help

Use of computers by clients has been explored within many of the main therapeutic approaches covered earlier, but with mixed results.

2.3.2.1 Computer-Administered Psychodynamic Therapy

As described previously, psychodynamic therapy relies on a conversational approach to treatment, and is based on some rather vague theoretical notions. It is not surprising then that the use of computers to emulate a psychodynamic therapist appears to be limited by the failure to fully explicate the rules governing a therapist's behaviour and by the continuing inability of computers to comprehend natural language (Bloom, 1992). That said, some very primitive programs, such as ELIZA (Weizenbaum, 1966;

Colby *et al.*, 1966) and PSYCHE (Balis Computing, 1984), have produced some surprising results. However, the general consensus is that the use of computerised psychotherapists is many years away. As well as technical difficulties, there are ethical issues involved. Indeed, Joseph Weizenbaum, a pioneer in this area, concluded that it would be immoral to substitute a computer for a human function that “involves interpersonal respect, understanding, and love” (Weizenbaum, 1976, p. 269).

2.3.2.2 Computer-Administered Cognitive and Behavioural Therapies

Computer-assisted psychotherapy programs have been most successfully implemented in the areas of cognitive and behavioural psychotherapy (Bloom, 1992; Selmi *et al.*, 1990). Evaluations of the use of the computer with psychiatric patients have found that even those who are quite disturbed can interact very successfully with computers, including many patients who are unable to interact with mental health personnel (Burda *et al.*, 1991). Studies with severely impaired patients have shown that not only can cognitive improvement result, but other effects occur such as a boosting of self-esteem and confidence to try other novel tasks and training (Burda *et al.*, 1995).

Kirkby and Lambert (1996) carried out a critical analysis of computer-administered treatments in psychiatry, focusing on the results of outcome studies, the range of approaches under investigation, and advantages and disadvantages of this treatment approach. They found that computer-administered treatments are as effective as human therapists for circumscribed, structured cognitive and behavioural interventions, and are acceptable to patients. They concluded that computer-administered treatments will become commonplace, but will require thorough evaluation of benefits, risks and costs to determine their proper role in relation to the alternative treatments available.

2.3.2.3 Computer-Administered Personal Construct Therapy

Mildred Shaw (1979) used a ‘conversational heuristics’ approach to human-computer interaction in order to provide a self-help system based on Personal Construct Psychology. A family of six computer programs was used to elicit personal constructs from people whilst they ‘interacted’ with a computer. Results indicated that computer analyses helped the person to understand more about themselves and their relationships with other perspectives of the world. The conclusion was that with such help, a person can come to see their modelling processes more clearly and be able to

change their cognitive models.

2.3.2.4 Use of Knowledge-Based Systems by Clients

The use of knowledge-based systems by clients is rare. However, those systems that have been developed show promise. An example of this is Sexpert, a system developed for use by couples with sexual problems (Binik *et al.*, 1988). Sexpert combines the capacity for intelligent therapeutic dialogue with the presentation of individualised therapeutic interventions. Results showed that couples engaged with Sexpert, and thought that dialogues with the system were logical, appropriate and intelligent. The main problem was with people's sensitivity to the wording of comments, although this indicated that people took the comments seriously and personally. Another knowledge-based system for use by clients was developed to help smoking cessation (Velicer *et al.*, 1993). This system is based on the Transtheoretical model of behavioural change (to be covered later). The system used client information to produce unique, matched information and interventions. Assessment results indicated that a knowledge-based systems approach could provide a cost effective, viable, and effective means of intervening in specific problem behaviour areas.

2.3.3 Resistance to Computers

If computers show such promise in providing treatments, why are they not used more frequently? Numerous research studies have found the reason for this to be resistance from clinicians rather than from patients (Bloom, 1992). A number of explanations for this have been reported, such as fear and avoidance of computers by clinicians, expectations that clients would resist the use of computer-administered therapies, devaluation of clinical judgement and danger of dehumanisation.

Ford (1993) has reviewed the literature on client acceptance of computers with a number of interesting findings. First, computerised assessment instruments have been readily accepted by various populations, and have been preferred by some clients to paper-based methods. Second, it is generally found that clients using computer-assisted therapy express positive attitudes to this form of treatment (e.g. Binik *et al.*, 1988; Burda *et al.*, 1991). Third, clients express virtually equal preference for computer-assisted and human-conducted therapy sessions when asked to make comparisons. Fourth, computer anxiety is reduced and computer attitudes are improved as a result of computer training. Ford also reports that the majority of

reluctant clients become converts after some basic computer training and guided positive interaction with the computer.

This evidence adds considerable weight to the notion that computers offer an effective alternative to the more expensive treatments involving a therapist. One caution, however, is that there may be possible gender differences in acceptance of computer-based treatments. Wagman (1988) reports that male students have more favourable attitudes to computer-assisted therapy, whereas females showed greater improvement as a result of human-administered counselling.

2.3.4 The Ethics of Computer-Assisted Therapy

Ford (1993) has discussed the ethical and professional issues associated with computer-assisted therapy. First, in any self-help program, there are no support systems if therapy has negative effects for the individual. Second, in marketing self-help programs, authors, publishers, advertisers and distributors may make unsubstantiated claims for their product. Third, many lay persons attribute greater veracity to information conveyed by computers than other media. Indeed, computer-naïve clients can ascribe magical qualities to computer output. Fourth, software may create problems of confidentiality when access to personal information is not restricted.

2.3.5 Summary of Computers in Psychotherapy

Computers have a wide range of uses in psychotherapy. Therapists can be supported when acquiring and managing client data and can be helped to make clinical decisions. Many studies have shown that computer-assisted therapies are acceptable to clients and are as effective as therapist-assisted approaches. Computers have a number of additional advantages over a therapist: they are potentially much cheaper to use, they do not judge and they do not form inappropriate and maladaptive relationships with clients. Use of computers by clients has also been found to increase autonomy and boost self-esteem. However, there are some ethical problems such as lack of support if things go wrong and issues of data protection. Also, female clients may respond less well to computer-assisted therapies than male clients.

2.4 Help in Non-Clinical Contexts

So far in this chapter, the focus has been on therapeutic treatments for people with

particular problems. The emphasis of the Personal Knowledge Methodology, however, is to find ways of helping people more generally. Hence, the emphasis will now shift to cover psychological theories that have more general applications to direct help involving personal knowledge. The areas to be covered are decision-making, behavioural change, creativity and learning.

2.4.1 Decision-Making

Psychologists have collected much evidence that people are poor at making certain decisions. By understanding the way people make decisions, a number of methods have been developed to aid the decision-maker. The benefits for people in making better life decisions are potentially huge. As a start, the traditional and most rigorous area of research, that of Subjective Expected Utility Theory, will be reviewed.

2.4.1.1 Subjective Expected Utility Theory

Subjective Expected Utility Theory (SEU) provides a normative theory of decision-making under uncertainty, i.e. it purports to identify the optimum action that a person should choose. Use is made of a tabular representation called a payoff matrix, which contains four elements. First, a number of clearly defined possible actions (e.g. go for a picnic). Second, a number of events associated with these possible actions, (e.g. it rains). Third, a subjective assessment of the probability of each event occurring (e.g. 50% chance of rain). Fourth, a quantified rating (called the expected utility) for each action-event pairing (e.g. a rainy picnic scores 10 out of 100). Simple formulas, based on a number of decision-making axioms, are then used to provide the optimal action to take (Rowe, Wright & Ayton, 1997).

Evidence from many laboratory-based experiments has shown that people fail to make the decisions prescribed by SEU. To alleviate this apparent problem, a field called Decision Analysis was developed. By the mid-1980s, Decision Analysis was being widely used to aid business and government decision-making, especially in the USA (Wright, 1984). However, some leading researchers have argued that the application of SEU as a decision aid is flawed due to a number of problems (Slovic, Fischhoff & Lichtenstein, 1977). First, there is a problem in structuring the situation of the real world into the clearly defined actions, events and utilities needed for SEU. If the structuring is wrong, then the subsequent assessments of utilities and probabilities may be inappropriate and the SEU calculations may be invalid. Indeed, the structuring of

decisions is often flawed given researchers know “next to nothing about eliciting the structure of problems from decision-makers” (Fischhoff, 1984). A second problem with decision analysis, is the difficulty of estimating probabilities and utilities. Although a number of methods have been devised to elicit the subjective probabilities and utilities required for an SEU analysis, testing has revealed inconsistencies between methods and a lack of reliability of single methods (Wright, 1984). Assessments of subjective assessments have shown these to be subject to a number of heuristics and biases (Kahneman, Slovic & Tversky, 1982). A final problem with SEU is that the theory is largely based on evidence from laboratory-based experiments that rely on relatively simple gambling situations having outcomes that are of little or no importance to the subject. There is evidence that the results of such a decision-making paradigm tend to be artefacts of contrived situations (Schwarz, 1994). To examine this, the following two sections look at a number of theories that attempt to describe actual decision-making, rather than compare it to normative models.

2.4.1.2 Conflict Theory of Decision Making

The real decisions of life often involve many important factors overlooked or ignored by laboratory-based decision theorists. Examples of such factors are time pressures, ill-structured problems, uncertain and incomplete information, shifting goals, action-feedback loops, high stakes, multiple players and context effects (Lipshitz, 1993).

One of the earliest theories that aimed to reflect actual decision-making is the Conflict Theory of Decision Making (Janis and Mann, 1977). The underlying perspective here is that research should examine the nature of decisions in significant life situations such as whether to get married, take a new job or sign a business contract. In decisions such as these, it is found that decision-makers are not rational calculators but are beset by conflict, doubts and worry, and often seek relief by procrastinating, rationalising, or denying responsibility.

The Conflict Model of Decision Making identifies five main types, or stages, of decisional behaviour, called coping patterns. Four of these result in incomplete search appraisal and contingency planning. It is only the fifth coping pattern (called vigilance) that results in a thorough consideration of alternative courses of action, an evaluation of costs and risks and a search for relevant information. Hence, it is only vigilance that is the one most likely to result in good decision-making.

To help people adopt a vigilant coping pattern, Janis and Mann make use of a technique called the decisional balance sheet. This enables the user to consider various pros and cons for a particular course of action: possible gains/losses for self; possible gains/losses for significant others; self-approval/self-disapproval; and approval/disapproval from significant others.

2.4.1.3 Decision-Making in Realistic Settings

A number of other theories have been developed to account for decision-making in realistic settings, however no unified theory has yet been proposed. In reviewing nine of the most prominent models, Lipshitz (1993) identified the following six common themes:

1. Real-world decisions are made in a variety of ways
2. Situation-assessment is a critical element in decision-making
3. Decision-makers often use mental imagery
4. Understanding the context surrounding the decision process is essential
5. Decision-making is dynamic, i.e. it does not consist of discrete isolated events or processes
6. Models of decision-making must derive from an analysis of how decision-makers actually function, not how they ought to function.

An example of a recent theory and method along these lines is Naturalistic Decision Making (Klein, 1995). The emphasis here is on the acquisition and modelling of the way experts assess the context and situation of a decision, help being provided using a knowledge-based systems approach.

2.4.2 Theories of Behavioural Change

A problem with focusing on decision-making alone is that there is often a gap to be crossed between one's decision to act in a certain way and actually performing the action. Theories of behavioural change seek to address this issue. Three of the most prominent are the Theory of Planned Behaviour, the Health Belief Model and The Transtheoretical Model. As will be seen, the first two assume no real gap between the decision to act and performance of the action. As such, they bare a close resemblance to theories of decision-making, particularly normative models. The third theory is quite different since it explicitly accounts for the stages between decision-making and

performing an action.

2.4.2.1 Theory of Planned Behaviour

The Theory of Planned Behaviour (Ajzen and Madden, 1986) is a development of another influential theory, the Theory of Reasoned Action (Fishbein, 1980). Both theories were derived from Subjective Expected Utility theory and rest on the assumption that people's intentions are the best predictors of how they behave. They attempt to explain and predict behaviour based on models specifying the causal relationships between a person's beliefs, attitudes, intentions and behaviour. According to the Theory of Planned Behaviour, intentions to behave depend on three factors. The first factor is the attitude of the decision-maker regarding the behaviour, which is based on beliefs about the outcome of the behaviour and evaluations regarding the outcome. The second factor is the subjective norm concerning the behaviour, which is based on the decision-maker's beliefs about other people's opinions and the decision-maker's motivation to comply with other people's opinions. The third factor is the perceived control the decision-maker believes he/she has over the target behaviour.

Assessments of the theory typically use questionnaire ratings to gather the data required. Evidence from numerous studies indicates that the theory accounts for around 25% of the variance in behaviour (Sheppard, Hartwick & Warshaw, 1988). However, there are many criticisms of the theory, such as how an intention is translated into action, the over-complexity with which it models decision-making and its lack of consideration of other factors such as prior experience and past history of performing related behaviours (Sutton, 1997).

2.4.2.2 Health Belief Model

The Health Belief Model (Becker, 1979) is the most widely researched and accepted theory within Health Psychology to explain and predict people's health-related behaviours, e.g. quitting smoking and safe sex behaviours (Sarafino, 1990). According to this model, the likelihood that a person performs a health-related action (i.e. takes preventive action against a health problem) depends on the outcomes of two assessments. One assessment is a cost-benefit analysis of performing the action (e.g. smoking is enjoyable and helps me stay slim, but is bad for my health). The second assessment is the perceived threat of the illness or injury (e.g. smoking has a small

chance of giving me lung cancer). This assessment is influenced by such factors as perceived seriousness of the health problem, perceived susceptibility to the health problem, and cues to action (e.g. advertisements and advice from others).

Although much research shows general support for the Health Belief Model, the vast majority does so in a piecemeal manner using multiple regression analyses rather than testing the causal nature of the model (Strecher & Rosenstock, 1997).

2.4.2.3 *Transtheoretical Model*

The Transtheoretical Model of change (Prochaska & DiClemente, 1992) is based on various studies of problem behaviours, notably smoking cessation. Results from cross-sectional and longitudinal studies indicate that smokers move through a series of stages in their efforts to quit smoking. These have been generalised and developed to give five possible stages of behavioural change. The first stage is *precontemplation* in which the person is not considering a change to a particular behaviour. Second is *contemplation* in which the person is seriously thinking about changing behaviour. Third is *preparation* in which the person is seriously considering and ready to change. Fourth is *action* in which the person is actively doing things to change or modify behaviour. The final stage is *maintenance* in which the person continues to maintain behavioural change until it becomes permanent.

In addition to these stages, the model proposes a number of processes of change. These are activities that people engage in to move from stage to stage. Examples include consciousness raising (increasing information about oneself and the problem), self re-evaluation (thinking how one feels and thinks about oneself with respect to the problem) and counter-conditioning (substituting alternatives for problem behaviours).

The Transtheoretical Model has most commonly been used to study health-related behaviours, including smoking, alcohol abuse, and health promotion behaviour with some use within interventions (Velicer *et al.*, 1993). However, evidence does not demonstrate a simple linear progression through the stages and the model is probably best thought of as a prescriptive model of ideal change (Sutton, 1997).

2.4.3 **Creative Thinking**

Another way to help people is to aid them to become more creative in their ideas and problem-solving. The research literature into creativity comprises three main parts.

First, studies identifying factors that separate very creative people, such as great scientists, from seemingly less creative people. Second, literature proposing and assessing various training programmes, especially within educational settings. Third, studies concerning techniques aimed at facilitating more creativity and innovation, primarily within organisational settings. The following sections take a brief look at each of these three areas, with an emphasis on the second and third.

2.4.3.1 Creativity and Discovery in Science

Literature on scientific creativity has examined both cognitive factors as well as factors associated with biography and personality (Vernon, 1970). Within the cognitive work, a number of authors have noted the major role played by imagery in major scientific breakthroughs (Roskos-Ewolden *et al.*, 1993). Use of analogies has also been highlighted as playing an important role in the creation of new theoretical hypotheses in science (Clement, 1988). As will be seen shortly, imagery and analogies are key concepts when training and facilitating people to be more creative.

2.4.3.2 Training People to be more Creative

A number of methods have been developed to train people to become more creative and innovative in their thinking, the majority focusing on creativity and innovation within scientific education and organisational settings. Rather than fostering any major changes to people's cognitive abilities, the training programmes mainly focus on training people in the operation of a number of creativity-facilitation techniques.

According to Treffinger and Gowan (1971), there are around 50 different approaches to training creativity. These fall into two categories: short-term procedures administered in one or two brief lessons, and extended programs administered in a series of lessons. Examples of short-term procedures include attribute listing, idea matrix, syntectic thinking, creativity toolbox, bridge building, idea production, and transformations. In assessing the evidence for the effectiveness of such techniques, Cropley (1992) concludes that short-term training procedures have little effect on general creative skills, attitudes, values, self-image and motivation, and has noted that such techniques can in fact have a detrimental effect. For example, instead of becoming more creative by offering ideas more freely using brainstorming, people can simply become less critical.

If short-term programmes seem unpromising, what of extended programs? Mansfield, Busse and Krepelka (1978) have assessed the effectiveness of five of the most popular extended programmes: the Productive Thinking Program, the Purdue Creative Thinking Program, the Myers-Torrance Workbooks, the Parnes Program, and the Khatena Training Method. According to this review, the latter two programmes have the most convincing evidence. Briefly, the Parnes Program uses a wide-range of techniques, brainstorming being a primary one. The aim here is to generate as many ideas as possible no matter how wild or impractical they may seem. Following this, is a stage of evaluation and criticism. The Khatena Training Method provides instruction and practice in five thinking strategies: breaking away from the obvious, transposing ideas, seeing analogies, restructuring information and synthesis of ideas. A number of other programmes have been used, but have little empirical evaluation. These include Syntectics, a method often used in industry that employs a variety of methods to facilitate two processes: making the strange familiar and making the familiar strange (Gordon, 1961).

Although there seems to be a very wide range of training techniques, a number of common elements can be identified. Cropley (1992) has identified four of these: formation of analogies, building up chains of ideas or associations, redefinition of the question or problem, and looking at existing information in new ways. In addition, Cropley has identified a number of attitudes and values within the individual that can block creativity. These include inability to 'let go', fear of letting the imagination loose, preference for analytical thinking, premature closure, persistence of set, inability to handle ideas, anxiety and excessive emphasis on verbal expression. To overcome the latter, a wide range of representations other than the purely verbal are encouraged.

2.4.3.3 Facilitating Creativity and Innovation

Smith (1998) has identified 172 methods to help people generate new ideas, and has explored the active elements within each method. The result is a list of 50 devices that comprise three types: strategies, tactics and enablers. Strategies are the most common device, most referring to identifiable mental activities. Examples include strategies for analysing, searching, imagining, habit-breaking and relationship-seeking.

A major interest recently has been in developing software tools that can enable

creativity and innovation, especially within organisations (Quinn, Baruch and Zien, 1996). Many of these tools draw upon techniques used to train or enable creativity previously mentioned, such as brainstorming (Gallupe *et al.*, 1992), syntectics (Siau, 1996) and analogies and metaphors (Bond and Otterson, 1998; Goel, 1997). Many tools have been developed to help capture and organise ideas using network diagrams such as concept maps (Twidale, Rodden and Sommerville, 1994).

2.4.4 Learning

Many of the techniques and tools used to aid creativity are also used to facilitate learning and memory. The educational uses of various diagrams such as trees, semantic networks and concept maps, have been well documented as providing both important information on a student's knowledge of a subject and as a valuable learning aid for the student (Jonassen *et al.*, 1993). Rogers (1998) has discussed the importance of knowledge tools, such as concept mapping, to enable both learning and innovative thinking. Building on the work of Novak and colleagues in education (Novak & Gowin, 1984), Rogers argues that in the knowledge era the problem for businesses is to help employees build good cognitive models that facilitate meaningful learning in the workplace.

Jonassen, Beissner and Yacci (1993) present a range of techniques for representing, conveying and acquiring structural knowledge. The concept of structural knowledge has its roots in such psychological theories as schema theory and semantic networks. The importance of considering structural knowledge stems from a number of ideas: structure is inherent in all knowledge; learning consists of building new knowledge structures; memory structures reflect the world; structural knowledge is essential to recall, comprehension and problem solving; expert's structural knowledge differs from that of novices (Chi, Feltovich and Glaser, 1986). The use of structured representations for intervention is illustrated in the use of concept maps to teach health professionals (Caelli, 1998).

A particular type of structural knowledge technique is mind mapping, a self-help method that aims to facilitate knowledge identification, summarisation and reflection (Buzan, 1989). A mind map is a diagram of connected nodes, each node representing an important concept relevant to the issue at hand. The diagram is constructed from a central node and spiders outwards as key themes are explored. Use of both colour and

pictorial images are encouraged to highlight and personalise nodes.

Computer-based techniques have also been used to aid people's thinking. For example, Weiner and Weiner (1996) have developed a knowledge-based system for teaching the ability to think scientifically, and Aw (1997) has developed a computer program to aid people in the management and processing of the vast amounts of information required of thinking processes.

2.5 Summary and Conclusions

This chapter has covered many theories and methods associated with the provision of help via a direct route. To conclude the chapter, this section summarises the material covered and draws some general conclusions. The structure follows that of the research aims described in chapter 1, so that the relevance of what has been covered to the present project is highlighted.

2.5.1 Research Aims Associated with Personal Knowledge Techniques

2.5.1.1 Which techniques are most suitable as Personal Knowledge Techniques?

This chapter has described a large range of possible techniques that can be considered as candidates for inclusion in the Personal Knowledge Methodology and as contributions to the design of the set of techniques and tools under development.

Evidence of the use of ELIZA and similar systems indicates that people may benefit from interaction with a software tool based on relatively crude language understanding capabilities. Such a technique may be of use in the Personal Knowledge Methodology as a brainstorming tool for the user, and as a starting protocol for more structured techniques, much as interview protocols are the starting point for many of the knowledge acquisition techniques described in the next chapter.

A number of very useful ideas for the present research are found in the literature on diaries. In particular, Rainer (1978) notes a number of devices that diarists find therapeutic, such as making lists, describing other people, writing about the self in the third person, unsent letters and imaginary dialogues.

In addition, a number of ideas for possible representational formats have been found. The payoff matrix of Subjective Expected Utility Theory may be a useful way in which a person could represent the knowledge motivating a decision. Another

approach is found in the Conflict Theory of Decision Making which uses a balance sheet of pros and cons based on a number of generic considerations, e.g. possible gains and losses for self and significant other. Similar methods are used in the Theory of Reasoned Action and the Health Belief Model, which also use a cost-benefit approach but include quantified expectations. The Transtheoretical Model provides a procedural approach to behavioural change, which suggests that a representation of more dynamic, rather than just static, knowledge is required. That is, generic considerations involved in a cost-benefit analysis may alter over the course of a decision. If so, this would require a different type of representation, possibly some mix of a flow chart and decision tree.

In addition, a major part of many types of therapy is the revelation and interpretation of key events in a person's past, and how these impact on present-day thoughts, feelings and behaviours. In this light, establishing models of dynamic processes is also an important aim. The need to develop techniques that aim to elicit and reveal subconscious thoughts is also a key driver in the search for Personal Knowledge Techniques.

2.5.1.2 Is a person helped by having his/her personal knowledge increased?

It is apparent from the literature covered in this chapter that many approaches have personal knowledge as a core concept. This is most noticeable in the psychodynamic and humanistic approaches to therapy and in techniques to aid decision-making and behavioural change. Increasing personal knowledge does seem to be an active ingredient of many approaches, although some approaches (notably behavioural therapies) are more focused on people's lower level cognitive mechanisms.

2.5.1.3 Can a person operate the techniques on his/her own?

Evidence from self-help and computer-assisted therapies show that non-experts can operate techniques and software for their benefit. The practical and ethical problems of not being able to easily monitor the use of self-help literature is overcome by the Personal Knowledge Methodology since it can be used to constantly acquire knowledge on the use and reactions of users to the techniques being used and information being presented.

2.5.1.4 Are there any differential effects in the use and usefulness of the techniques associated with demographic details?

Research indicates that women are the primary users of self-help books. In addition, there is some evidence that female users of self-help methods may have a different set of requirements to male users. Hence, it may be the case that different techniques and tools are needed to account for these gender differences. Alternatively, the same techniques and generic models may cover use by both genders but be populated with different content. There is also evidence of possible gender differences in people's use and reaction to computer-based techniques. Hence, careful consideration of gender differences should be made when developing new techniques both in their use and perceived usefulness.

A further methodological consideration stems from the evidence for a possible differential effectiveness of bibliotherapy for people with different personality traits. This may mean that certain people benefit more from the techniques being developed in the current project. This could be explored by examining self-reported effectiveness with various personality scales. However, results would have to be treated with caution since self-reported effectiveness may not accurately represent the actual effect upon the person. Indeed, reporting inaccuracy may itself correlate with personality type.

2.5.2 Research Aims Associated with Personal Knowledge Methodology

2.5.2.1 How useful might the methodology be to the person using it?

Studies of the effectiveness and use of self-help books, bibliotherapy, diaries and computer-assisted therapy strongly indicate that the direct involvement of a therapist is unrelated to treatment effectiveness for many types of problems. Hence, it seems that the self-help aspect of the methodology would provide help to those using it. But how might these people be helped? The chapter has covered a large variety of ways of providing help with many differences. However, a number of common themes have become apparent. First, many therapies and help programmes aim to increase understanding of self and others, which often involves revelation of insights and 'unconscious' thoughts. This can be achieved using methods such as open conversations, probing questions, word association, triadic elicitation, concept mapping, reading information about generic behaviour patterns and keeping a diary log. Second, this understanding is analysed and challenged in some way to eliminate

or reconstruct maladaptive thoughts and feelings. This can be done with the help of a therapist, self-help material or behavioural assignments, and involve methods such as the analysis of critical events, the reconstruction of construct systems and creativity training. Third, people's general cognitive skills can be improved. This can be done by making people more aware of the biases that can operate, providing training programmes and giving them specific tools to use such as a mind map and decisional balance sheet. So how can the Personal Knowledge Methodology provide help on these three fronts? There are two ways. First, the Personal Knowledge Techniques can help elicit and structure knowledge by adopting many of the techniques mentioned above. These techniques can also include the types of methods used to aid decision-making, learning and creativity. Second, web-based information sources, ontologies and knowledge-based components working alongside adaptive and personalised software methods can provide interpretations, guided help and opportunities for challenge and self-reflection.

2.5.2.2 Will people want to use the methodology?

The popularity of self-help books certainly suggests that people are keen to find out more about themselves and solve certain perceived problems. Information concerning the ways in which people select and use self-help publications suggests that searching and selecting a source of knowledge increases a sense of empowerment and autonomy, and that what is right for one person may not be right for all people. Studies of bibliotherapy and computer-assisted therapies demonstrate that there is no more drop-out in these therapies than in therapist-assisted programs suggesting participants are motivated to continue (Gould & Clum, 1993). Analyses of the users of computer-assisted therapies show that they are engaged by the method, feel empowered and have increased self-esteem (Ford, 1993). Taken together, this all suggests that users would be motivated to use the Personal Knowledge Methodology, although there is some evidence that certain types of people may be more motivated than others (covered later).

2.5.2.3 What ontology should be used?

The variety of approaches to therapeutic help covered in the chapter has demonstrated the differing perspectives, concepts and terminology that are used to assess, treat and support people requiring help. However, a number of key concepts can be discerned

that cut across a number of the approaches. These key concepts may form the basis for an ontology for the Personal Knowledge Methodology. Eight key concepts are described below.

- **Psychological Processes:** There has been much mention in the chapter of psychological processes such as thinking and feeling, and to a lesser extent experiencing and learning. Thinking includes considering, evaluating, problem-solving, decision-making, identifying and comprehending. Feeling includes processes associated with moods, emotions, fears and sense impressions.
- **Results of the Psychological Processes:** Alongside psychological processes, most approaches make use of concepts that are either the result of psychological processes or are operated upon by psychological processes. One might roughly refer to these as thoughts. They include such things as subconscious thoughts, ideas, beliefs, attitudes, values, evaluations and assumptions. One might also include dreams in this category.
- **Resources for the Psychological Processes:** In addition to the results of psychological processes, many approaches make use of concepts that can be viewed as resources required for psychological processes to operate. These include mental images, analogies, imagination and memories.
- **Actions:** Many theories include the notions of actions, behaviours and activities.
- **Drivers:** Some approaches use terms referring to drivers of action and thinking, such as motivations, goals, intentions, wishes and wants.
- **Medical Terminology:** Since the chapter has covered many techniques used to help people with specific behavioural or emotional problems, it is not surprising that there has been much use of vocabulary borrowed from medicine. Hence, use of such terminology as patient, symptoms, treatment and therapy.
- **Dynamic Mechanisms:** A number of approaches have used concepts associated with change and dynamic mechanisms, such as stages, cycles of change, vicious cycles and feedback loops.
- **Skills:** Some approaches make use of notions such as skills and capabilities.

2.5.2.4 Can the methodology be computer-based?

Strong evidence for the use of a computer-based methodology has been found. In many studies, computer-assisted therapies have been found to be acceptable to clients and as effective as therapist-assisted approaches (*Ibid*). Use of computers by clients has also been found to increase autonomy and boost self-esteem. In addition, computers are potentially much cheaper to use than a therapist, do not judge and do not form inappropriate and maladaptive relationships with clients.

Research that has developed knowledge-based systems for use by clients has found them to be both engaging to the user and provide a cost-effective means of therapeutic intervention. Such systems can be used to create interactive questionnaires and provide specific, personalised advice and information.

A possible limitation of computer-based techniques is suggested by some of the ways people use diaries. Such methods as the immediate expression of emotions, free drawings and guided imagery imply that paper-based techniques will still be required under certain circumstances. There are also ethical considerations that require careful development of software (discussed later).

As well as direct use of computers by clients, computers also have many uses to aid therapists such as data collection, information management, health education and clinical training. In addition, knowledge-based systems can aid diagnosis and decision-making. The fact that some therapists are using computers to help in such activities indicates opportunities to help professionals as well as their clients. Evidence showing that knowledge-based systems are as effective as clinicians at treating certain problems indicates that the use of knowledge-based technology within the analytical parts of the Personal Knowledge Methodology could prove useful.

2.5.2.5 What is the best way to develop the methodology?

Some of the problems with self-help therapies may be apparent with the methodology under development. Possible problems include the inappropriate application of techniques and the risk of negative attributions towards self and others should things go wrong. The over-commercialisation of any technique, such as those being developed here, is also a problem. When developing computer-based techniques, certain ethical issues are of concern, such as the way certain people perceive information conveyed by computers as being more accurate than when presented using

other media. For these reasons, it is essential that development of the Personal Knowledge Methodology is undertaken in a careful and systematic way, with the participation of potential users and evaluations at every stage of development.

2.5.2.6 What metrics and assessment methods can be used to assess the effects and effectiveness of the methodology?

The seven dependent variables used by researchers into bibliotherapy provide a sub-set that could be used for evaluation purposes when developing new self-help techniques. According to the literature, self-reported measures (i.e. questionnaires) were used for almost half of all studies into bibliotherapy. Objective and quantitative metrics, such as physiological measures and academic achievement, were used in 20% of studies, but only if the area being investigated was of a specific type. Given the holistic approach taken in the Personal Knowledge Methodology, there is no specific focus on any single problem or concern. Hence, any single objective metric, such as weight loss or academic grades, is not likely to be relevant for general assessment purposes. Self-reported measures, on the other hand, offer more promise as evaluation mechanisms. These might consist of standard scales or non-standard scales created to evaluate participant's use of new techniques and tools. Should non-standard scales be used, care should be taken since these scales have been found to lead to larger effect sizes than those using physiological and self-reported behaviours. As such, any very positive results from the use of such scales would have to be treated with some caution, as these may not reflect people's true attitudes to the effectiveness of the methods under development, nor be accurate of the actual effects on the individual.

3 ACQUISITION AND ANALYSIS OF KNOWLEDGE

*If the human mind was simple enough to understand,
we'd be too simple to understand it.
(Emerson Pugh)*

This chapter covers a variety of methods used to acquire and analyse knowledge. To explore the research aims described at the end of chapter 1, a number of particular questions will be addressed: What knowledge acquisition techniques exist that could be candidates for use in the Personal Knowledge Methodology? How is personal knowledge acquired and analysed in the most effective way to aid research? What can be learnt from knowledge engineering and psychological research to aid development of Personal Knowledge Techniques?

To examine these questions, the chapter covers two areas. First, the principles and methods used by knowledge engineers to acquire and analyse expert knowledge are described. Second, methods used by social psychologists to acquire and analyse various aspects of personal knowledge are covered, with a particular emphasis on qualitative methods.

3.1 Knowledge Acquisition within Knowledge Engineering*

3.1.1 Knowledge Engineering

Knowledge engineering is a field within artificial intelligence that develops knowledge-based systems. Such systems are computer programs that contain large amounts of knowledge, rules and reasoning mechanisms to provide solutions to real-world problems. A major form of knowledge-based system is an expert system, one designed to mimic the reasoning processes of an expert practitioner (i.e. one having performed in a professional role for very many years). Typical examples of expert systems include diagnosis of bacterial infections (Shortliffe, 1976), advice on mineral exploration (Duda *et al.*, 1979) and assessment of electronic circuit designs (Steele *et al.*, 1989).

The early years of knowledge engineering were dogged by problems. Knowledge

* Much of the material in this section is based in the author's first-hand experience working as a Principal Knowledge Engineer for Epistemics.

engineers found that acquiring enough high-quality knowledge to build a robust and useful system was a very long and expensive activity. As such, knowledge acquisition was identified as the bottleneck in building an expert system (Hayes-Roth, Waterman and Lenat, 1983). This led to knowledge acquisition becoming a major research field within knowledge engineering. The aim of knowledge acquisition is to develop methods and tools that make the arduous task of capturing and validating an expert's knowledge as efficient and effective as possible. Experts tend to be important and busy people; hence it is vital that methods be used that minimise the time they spend off the job taking part in knowledge acquisition sessions.

3.1.1.1 Knowledge Acquisition Techniques

Many techniques have been developed to help elicit knowledge from an expert (Cooke, 1994; Shadbolt & Burton, 1995). The techniques include protocol-generation techniques (such as interviews and reporting techniques), contrived techniques (such as card sorting and constrained-processing tasks) and model-based techniques (such as laddering). Detailed information on these and the other main techniques is covered later in section 3.1.3.

Why have so many techniques? The answer lies in the fact that there are many different types of knowledge possessed by experts, and different techniques are required to access the different types of knowledge. This is referred to as the Differential Access Hypothesis (Berry and Broadbent, 1984), and has been shown experimentally to have some supporting evidence (Hoffman *et al.*, 1995). However, proving that certain techniques are always superior to others for eliciting certain types of knowledge is beset by difficulties. As such, proper empirical studies tend to be the exception rather than the rule within knowledge engineering. The next section briefly covers the reasons for this.

3.1.1.2 Experimental Evaluation in Knowledge Engineering

Shadbolt, O'Hara and Crow (1999) have identified a number of problems in evaluating knowledge acquisition techniques and methodologies. First, there is the difficulty of involving a large enough sample of experts to give statistical significance. Second, there is the difficulty of assessing and validating the knowledge acquired given the general lack of "gold standards" to compare against. Third, there is the need to discover the range of tasks and domains for which tools and techniques are useful.

Fourth, there is the difficulty of isolating what added value a technique gives when each technique may need to work alongside other techniques.

Because of such difficulties, Shadbolt *et al* (ibid) have noted the lack of rigorous evaluation in the development and assessment of knowledge acquisition techniques, and have made the plea that more experimental evaluation be performed, especially during the development of new techniques. In light of this, it may be the case that practices used in the psychological approach to personal knowledge might provide useful input to knowledge engineering to help make it more rigorous and scientific.

3.1.1.3 Recent Developments in Knowledge Engineering

A number of recent developments in knowledge engineering are continuing to improve the efficiency of the knowledge acquisition process. Four of these developments are examined below.

First, methodologies have been introduced that provide frameworks and generic knowledge to help guide knowledge engineering activities and ensure the development of each expert system is performed in an efficient manner. As a project proceeds, CommonKADS follows a spiral approach to system development (Boehm, 1988) such that phases of reviewing, risk assessment, planning and monitoring are visited and re-visited. This provides for rapid prototyping of the system, such that risk is managed and there is more flexibility in dealing with uncertainty and change.

A second important development is the creation and use of ontologies (Noy and Hafner, 1997). Ontologies are formalised representations of the knowledge in a domain taken from a particular perspective or conceptualisation. The main use of an ontology is to share and communicate knowledge, both between people and between computer systems (Uschold & Gruninger, 1996). Ontologies act as skeletal frameworks that define what knowledge is required, how it can be modelled and the ways it can be acquired.

A third development has been an increasing use of software tools to aid the acquisition process. Software packages, such as PCPACK (Goodall, 1996), contain a number of tools to help the knowledge engineer analyse, structure and store the knowledge required. Software tools can also enforce good knowledge engineering discipline on the user, so that even novice practitioners can be aided to perform knowledge

acquisition projects (Shadbolt & Milton, 1999).

A fourth recent development is the use of knowledge engineering principles and techniques in contexts other than the development of expert systems. A notable use of the technology in another field is as an aid to knowledge management within organisational contexts (Wielinga, Sandberg & Schreiber 1997). Knowledge management is a strategy whereby the knowledge within an organisation is treated as a key asset to be managed in the most effective way possible (Davenport & Prussak, 1998). This approach has been a major influence in the past few years as companies recognise the vital need to manage their knowledge assets (Smith & Farquhar, 2000). A number of principles and techniques from knowledge engineering have been successfully transferred to aid in knowledge management initiatives, such as the construction of web sites for company intranet systems (Milton *et al.*, 1999). This is an important precedent for the aim of this thesis to apply practices from knowledge engineering to the realm of personal knowledge.

3.1.2 Knowledge Types and Knowledge Models

A number of principles underlie the techniques used to acquire and analyse knowledge within knowledge engineering. Amongst the most important principles are those associated with the different types knowledge that can be discerned and the different ways knowledge can be represented. The following two sections cover these two aspects.

3.1.2.1 Types of knowledge

Philosophers have been thinking about knowledge for thousands of years. Part of their endeavour has been the identification of various types of knowledge and classification systems. One well-known distinction is between declarative knowledge (knowledge of facts) and procedural knowledge (knowledge of how to do things), or what the philosopher Gilbert Ryle called "knowing that" and "knowing how" (Ryle, 1949). Within knowledge engineering, these two types are often referred to as object knowledge and process or task knowledge.

Another well-known classification of knowledge is that of tacit knowledge (cannot be articulated easily) and explicit knowledge (can be articulated easily). This is particularly important for knowledge engineers, as special techniques have to be used

with an expert to try to elicit tacit knowledge, which is the hardest and often the most valuable knowledge to acquire (Shadbolt & Burton, 1995).

A further way of classifying knowledge is to what extent it is generic (applies across many situations) or specific (applies to one or a few situations). Developing ways in which specific knowledge can be made more generic, and generic knowledge can be made more specific, has been a major effort in knowledge engineering.

The field of logic has also inspired important knowledge types, notably concepts, attributes, values and relationships. Brief definitions of these are as follows:

- Concepts are the things that constitute a domain, e.g. physical objects, ideas, people and organisations. Each concept is described by its relationships to other concepts in the domain (e.g. in a hierarchy) and by its attributes and values. From a grammatical perspective, concepts are usually equivalent to nouns.
- Attributes are the generic properties, qualities or features belonging to a class of concepts, e.g. weight, cost, age and ability.
- Values are the specific qualities of a concept such as its actual weight or age. Values are associated with a particular attribute and can be numerical (e.g. 120Kg, 6 years old) or categorical (e.g. heavy, young). From a grammatical perspective, values are equivalent to adjectives.
- Relationships represent the way knowledge objects (such as concepts and tasks) are related to one another. Important examples include *is a* to show classification, *part of* to show composition, and those used in various knowledge models such as a process map or state transition network (described later). Relationships are often represented as arrows on diagrams. From a grammatical perspective, relationships are usually equivalent to passive verbs.

There are other types of knowledge, some of which will be mentioned later, but those covered above are usually seen as the most fundamental and important.

3.1.2.2 Ways of representing knowledge

An important aspect of knowledge acquisition is the use of knowledge modelling as a way of structuring projects, acquiring and validating knowledge and storing knowledge for future use. Knowledge models are structured representations of

knowledge using symbols to represent pieces of knowledge and relationships between them. This includes symbolic character-based languages, such as logic; diagrammatic representations, such as networks; tabular representations, such as matrices; and structured text, such as hypertext. The generation and modification of a knowledge model is an essential aspect of knowledge acquisition, as the model helps to clarify the language being used and quickly convey information for validation and modification where necessary.

Knowledge engineers use various types of knowledge models when eliciting knowledge from experts. A taxonomy showing the types of knowledge models that are used is shown in Figure 3. A brief description of each of these is described follows.

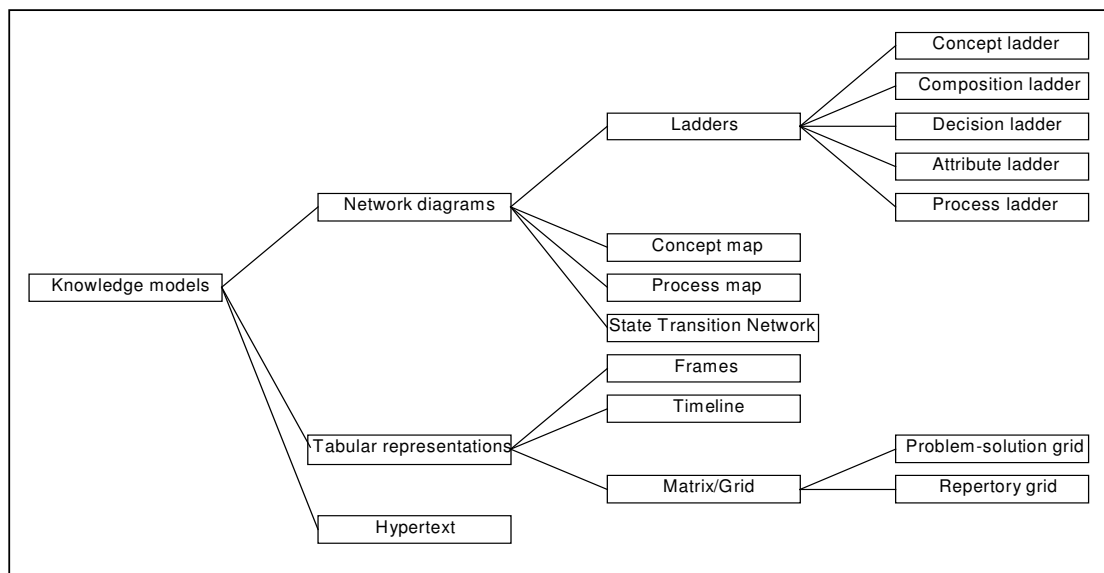


Figure 3. Taxonomy of Knowledge Models

Network Diagrams

Network diagrams show nodes connected by arrows. Depending on the type of network diagram, the nodes might represent any type of concept, attribute, value or task, and the arrows between the nodes any type of relationship. Examples of network diagrams include ladders, concept maps, process maps and state transition networks. Ladders are hierarchical (tree-like) network diagrams. Some important types of ladders are as follows.

- **Concept ladder:** This ladder shows concepts and instances and the classes and sub-classes to which they belong. All relationships in the ladder are the *is a* relationship, e.g. car is a vehicle. A concept ladder is more commonly known

as a taxonomy and is vital to representing knowledge in almost all domains. An example of a concept ladder was shown previously in Figure 3.

- **Composition ladder:** This ladder shows the way a concept is composed of its constituent parts. All relationships in the ladder are the *part of* relationship, e.g. wheel is part of car. A composition ladder is a useful way of understanding complex entities such as machines, organisations and documents.
- **Decision ladder:** This ladder shows the alternative courses of action for a particular decision. It also shows the pros and cons for each course of action, and possibly the assumptions for each pro and con. A decision ladder is a useful way of representing detailed process knowledge.
- **Attribute ladder:** This ladder shows attributes and values. All the adjectival values relevant to an attribute are shown as sub-nodes, but numerical values are not usually shown. For example, the attribute *colour* would have as sub-nodes those colours appropriate in the domain as values, e.g. *red*, *blue*, *green*. An attribute ladder is a useful way of representing knowledge of all the properties that can be associated with concepts in a domain. An example of an attribute ladder is shown in Figure 4.

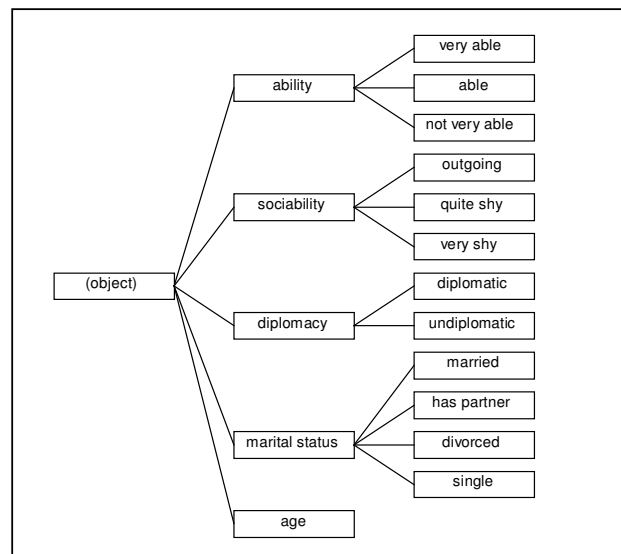


Figure 4. Example of an attribute ladder

- **Process ladder:** This ladder shows processes (tasks, activities) and the sub-processes (sub-tasks, sub-activities) of which they are composed. All relationships are the *part of* relationship, e.g. boil the kettle *is part of* make the tea. A process

ladder is a useful way of representing process knowledge.

A second type of network diagram is a concept map. This type of diagram shows concepts as nodes and the relationships between them as labelled arrows. Any types of concepts and relationships can be used. The concept map is very similar to a semantic network used in cognitive psychology.

A third important type of network diagram is a process map. This type of diagram shows the inputs, outputs, resources, roles and decisions associated with each process or task in a domain. The process map is an excellent way of representing information of how and when processes, tasks and activities are performed. An example of a process map is shown on Figure 5.

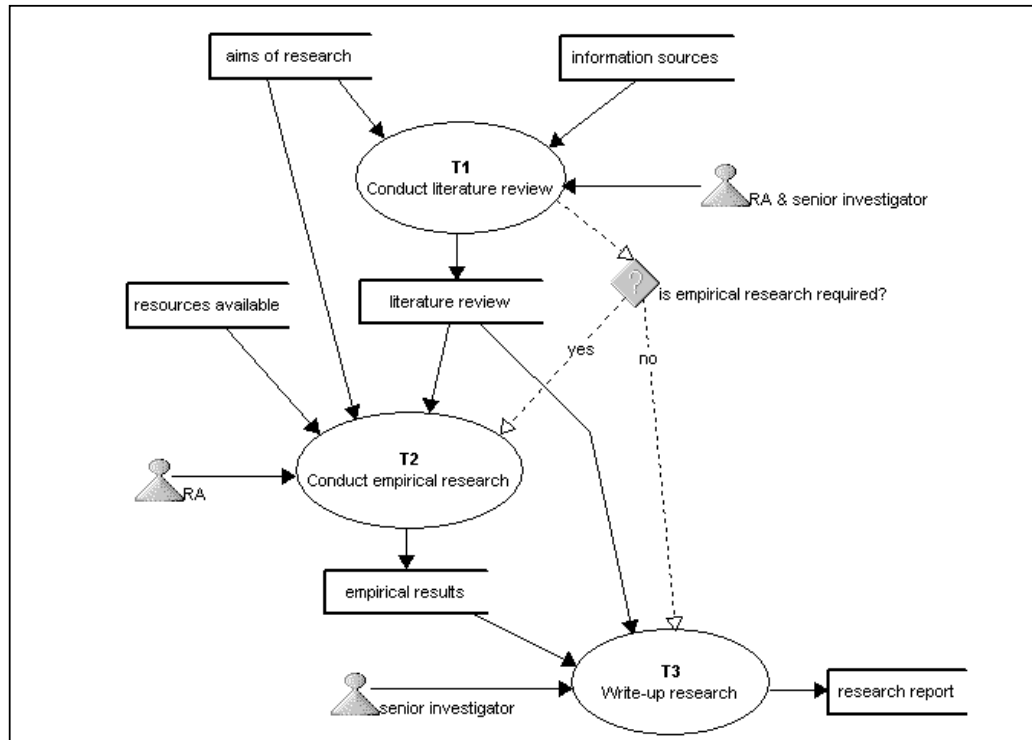


Figure 5. Example of a process map (produced using the PCPACK Control Editor tool)

A fourth important type of network diagram is the state transition network. This type of diagram comprises two elements: (1) nodes that represent the states that a concept can be in, and (2) arrows between the nodes showing all the events and processes/tasks that can cause transitions from one state to another. An example of a state transition network for a telephone is shown in Figure 6.

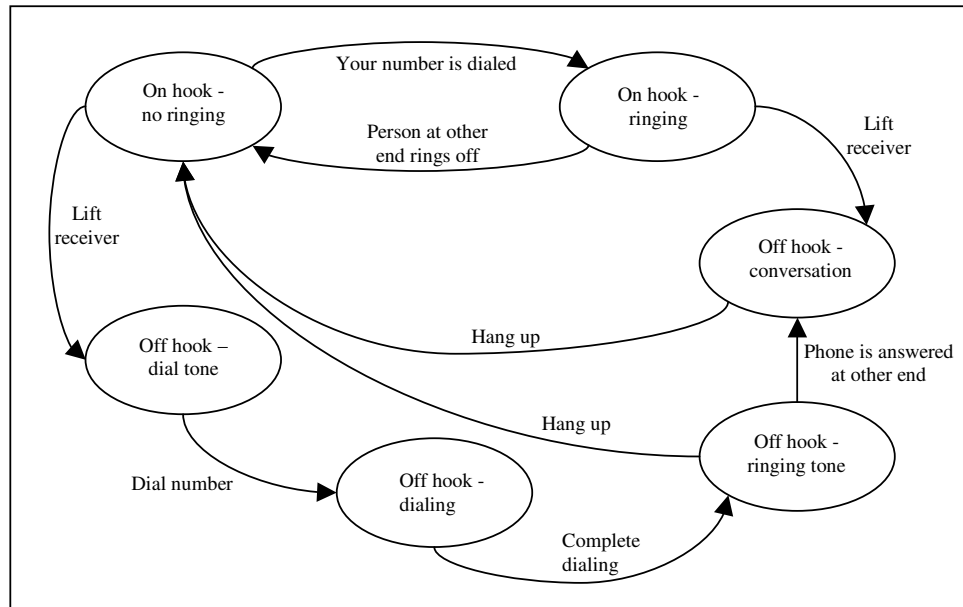


Figure 6. Example of a state transition network

Tabular Representations

Tabular representations make use of tables or grids. Three important types are frames, timelines and matrices/grids. Frames are a way of representing knowledge in which each concept in a domain is described by a group of attributes and values using a matrix representation. The left-hand column represents the attributes associated with the concept and the right-hand column represents the appropriate values. When the concept is a class, typical (default) values are entered in the right-hand column. An example of a frame is shown in table 2 for the concept *PhD thesis*.

PhD thesis	
Number of pages	300 pages
Difficulty to write	Difficult
Length of time to write	1200 hours
Length of time to read	8 hours
Rigour of format	Quite rigorous

Table 2. Example of a frame

A timeline is a type of tabular representation that shows time along the horizontal axis and such things as processes, tasks or project phases along the vertical axis. It is very useful for representing time-based process or role knowledge.

A matrix (aka grid) is a type of tabular representation that comprises a 2-dimensional grid with filled-in grid cells. One example is a problem-solution matrix that shows the

problems that can arise in a particular part of a domain as the rows in the matrix and possible solutions as the columns. Ticks, crosses or comments in the matrix cells indicate which solution is applicable to which problem. Another important type of matrix used by knowledge engineers is a focus grid, described later in this chapter.

Hypertext

A more recent form of knowledge model is the use of hypertext and web pages. Here relationships between concepts, or other types of knowledge, are represented by hyperlinks. This affords the use of structured text by making use of templates, i.e. generic headings. Different templates can be created for different knowledge types. For example, the template for a task would include such headings as description, goal, inputs, outputs, resources and typical problems.

3.1.3 Knowledge Acquisition Techniques

As described earlier, a number of techniques are used to elicit knowledge from experts. Lack of space does not allow detailed descriptions of all the techniques used. A comprehensive description of techniques can be found in Cooke (1994) that includes techniques for eliciting knowledge from experts as well as various data search and data mining techniques. Focusing on techniques used with experts, two classes of techniques can be discerned: natural techniques and contrived techniques (Shadbolt & Burton, 1995). Natural techniques are those that the expert is familiar with as part of their area of expertise, and include interviews and on-the-job observation techniques. Contrived techniques have been developed in order to capture various types of knowledge that are either inefficient or impossible to acquire by using natural techniques. These contrived techniques generally involve special ways of representing knowledge and/or special tasks that the expert is set (Hoffman *et al.*, 1995). The following sections give a brief overview of the major techniques used for acquiring, analysing and modelling knowledge.

3.1.3.1 Protocol-Generation Techniques

The aim of these techniques is to produce a protocol, i.e. a record of behaviour, whether in audio, video or electronic media. Audio recording is the usual method, which is then transcribed to produce a transcript.

Various types of interviews can be used to produce a transcript. **Unstructured**

interviews have a rough agenda but no pre-defined structure, so that the expert and knowledge engineer are free to explore the domain. This is an inefficient way of gathering detailed knowledge, but can prove useful as an initial interview when little is known of the domain. It also acts as an ice-breaker to establish a rapport between the expert and knowledge engineer. A **semi-structured interview** combines a highly structured agenda with the flexibility to ask subsequent questions. The questions for a semi-structured interview are ideally constructed some time before the interview and are sent to the expert so he/she can start to prepare responses. For an interview lasting 1 hour, around 10-15 questions might be asked. This allows time in between the set questions for the knowledge engineer to ask supplementary questions to clarify points and ask for more detail where necessary. This is often the preferred style of interview as it helps to focus the expert on the key questions and helps avoid them giving unnecessary information. Another form of interview is the **structured interview**. This allows no flexibility on the part of the knowledge engineer whose questions are all pre-established. As such, structured interviews often involve filling-in a matrix or other diagrammatic notation.

Another family of techniques that produce protocols are **think aloud problem-solving** (Belkin, Brooks & Daniels, 1987). These techniques generate protocols by having the expert provide a running commentary on a typical task used in the domain. The basic technique here is the self-report, in which the expert provides a running commentary of their thought processes as they solve a problem. Experimental evidence has shown that self-reports can access cognitive processes that cannot be fully recalled without bias and distortion if explained after the task has been completed (Ericsson & Simon, 1980). A problem with the self-report technique is that of cognitive overload, i.e. the mental effort required by the expert to provide the commentary interrupts and affects their performance of the task. This is especially true in dynamic domains where time is critical. One way around this is to use an off-line reporting technique. Here the expert is shown a protocol of their task behaviour, typically a video, and asked to provide a running commentary on what they were thinking and doing. An advantage of this is that the video can be paused or run at slow speed to allow time for full explanation. Variants of these reporting techniques involve a second expert commenting on another expert's performance.

Observational techniques are another way of generating protocols. Simply observing and making notes as the expert performs their daily activities can be useful, although a time-consuming process. Videotaping their task performance can be useful especially if combined with retrospective reporting techniques. On the whole, though, simple observation techniques are rarely used, as they are an inefficient means of capturing the required knowledge.

3.1.3.2 Protocol Analysis Techniques

Protocol analysis involves the identification of basic knowledge objects within a protocol, usually a transcript. For most projects, this makes use of categories of fundamental knowledge such as concepts, attributes, values, tasks and relationships. So, for example, an interview transcript would be analysed by highlighting all the concepts that are relevant to the project. This would be repeated for all the relevant attributes, values, tasks and relationships. In some cases, more detailed categories will be used for the identification depending on the requirements of the project. For instance, if the transcript concerns the task of diagnosis, then such categories as symptoms, hypotheses and diagnostic techniques would be used for the analysis. Such categories may be taken from generic ontologies and problem-solving models.

3.1.3.3 Laddering Techniques

These are techniques that involve the creation, reviewing and modification of ladders (i.e. hierarchies). Here the expert and knowledge engineer both refer to a ladder presented on paper or a computer screen, and add, delete, rename or re-classify nodes as appropriate. The knowledge engineer can make use of a set of generic questions to prompt the expert to elaborate the ladder (Corbridge *et al.*, 1994). Various forms of ladder can be used. A **concept ladder** is particularly important since the way an expert categorises concepts into classes is an important key to understanding the way the domain knowledge is conceptualised. Laddering using an **attribute ladder** is another very useful technique. By reviewing and appending such a ladder, the knowledge engineer can validate and help elicit knowledge of the properties of concepts. Hierarchies with other relationships can also be used, such as **composition ladders** and **process ladders** described earlier. Validation of the knowledge represented in a ladder with another expert is often very quick and efficient.

3.1.3.4 Sorting Techniques

Sorting techniques are a well-known method for capturing the way experts compare and order concepts, and can lead to the revelation of knowledge about classes, properties and priorities (Rugg & McGeorge, 1997). The simplest form is **card sorting**. Here the expert is given a number of cards each displaying the name of a concept. The expert has the task of repeatedly sorting the cards into piles such that the cards in each pile have something in common. For example, an expert in astronomy might sort cards showing the names of planets into those that are very large, those that of medium size and those that are relatively small. By naming each pile, the expert gives information on the attributes and values they use to denote the properties of concepts. Variants of this involve sorting objects or photographs rather than cards in domains where simple textual descriptors are not easy to use.

A technique often used in conjunction with sorting techniques is **triadic elicitation**. This technique prompts the expert to generate new attributes. This involves asking the expert what is similar and different about three randomly chosen concepts, i.e. in what way are two of them similar and different from the other. This is a way of eliciting attributes that are not immediately and easily articulated by the expert.

3.1.3.5 Matrix-based techniques

These techniques involve the construction and filling-in of grids indicating such things as problems encountered against possible solutions. The use of **frames** can also be adopted, although this would typically be used for validating previously acquired knowledge rather than for eliciting knowledge from scratch.

3.1.3.6 Repertory Grid Technique

The repertory grid technique has been mentioned at various parts of this thesis since it is used in many fields for eliciting and analysing knowledge and for self-help and counselling purposes. The technique is essentially matrix-based although it is more complex than simply filling-in a matrix of elements. When used in knowledge engineering (Boose, 1988), the technique usually involves the following four main stages.

1. In stage 1 the concepts (called elements) are selected for the grid. For the technique to be successful and not take too much time to operate, the number

chosen should be no less than about 7 and no more than about 15. A set of about the same number of attributes (called constructs) is also required. These should be such that the values can be rated on a continuous scale. The attributes can be taken from knowledge previously elicited or generated during the session using triadic elicitation.

2. Stage 2 involves the rating of each concept against each attribute. A numerical scale is often used, say 1 - 9. For instance, if the concepts are planets in the solar system, each might be rated on its distance from the sun (1 meaning close to the sun, 9 meaning far away), and so on through the other attributes.
3. In stage 3, the ratings are applied to a statistical calculation called cluster analysis to create a focus grid. These calculations ensure that concepts with similar scores are grouped together in the focus grid. Similarly, attributes that have similar scores across the concepts are grouped together in the focus grid. An example of a focus grid for planets of the solar system is shown in Figure 7. The structures to the bottom and to the right of the grid are dendrograms that indicate the strength of correlations. For instance, the lower dendrogram shows Neptune and Uranus as being very similar planets, and the right-hand dendrogram indicates a correlation between size and lack of density.

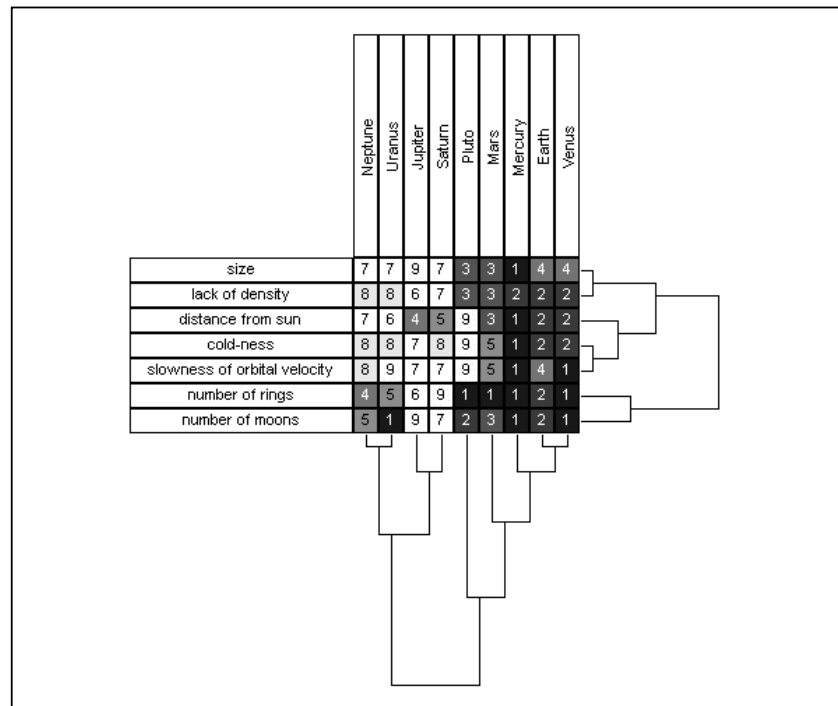


Figure 7. Example of a focus grid used in the repertory grid technique

4. In stage 4, the knowledge engineer walks the expert through the focus grid gaining feedback and prompting for knowledge concerning the groupings and correlations shown. If appropriate, extra concepts or attributes are added and then rated to provide a larger and more representative grid. In this way the technique can be used to uncover hidden correlations and causal connections.

3.1.3.7 Limited-Information and Constrained-Processing Tasks

Limited-information and constrained-processing tasks are techniques that either limit the time and/or information available to the expert when performing tasks that would normally require a lot of time and information to perform. This provides a quick and efficient way of establishing the key tasks and information used (Hoffman, 1987). An interesting variant of this is the **twenty-questions technique** (Grover, 1983). Here the aim is for the expert is to guess something that the knowledge engineer is thinking about (as in the parlour game of ‘animal, vegetable and mineral’). The expert is allowed to ask questions of the knowledge engineer who is only allowed to respond yes or no. As the expert asks each question, the knowledge engineer notes this down. The questions asked and the order in which they are asked give important knowledge such as key properties or categories in a prioritised order.

3.1.3.8 Network-Based Techniques

These techniques include the generation and use of network diagrams, such as concept maps, state transition networks and process maps (Berg-Cross & Price, 1989). As with laddering, the knowledge engineer elicits knowledge from the expert by mutual reference to a diagram on paper or computer screen. Use of **concept maps** has been strongly advocated as a comprehensive technique for eliciting many types of knowledge (Zaff, McNeese & Snyder, 1993). Use of network diagrams has become a mainstream technique when acquiring knowledge to develop object-oriented software. For example, the industry standard Unified Modelling Language makes use of concept maps (combined with frames) for object knowledge, **state transition networks** for dynamic modelling, and **process maps** for functional modelling (Rumbaugh, Jacobson, & Booch, 1999). As with laddering, the presentation of knowledge in a network format makes validation very efficient. The ease with which people understand and relate to networks has been demonstrated with experimental evidence showing that people understand and apply knowledge more easily and readily if a

concept map (semantic network) notation is used rather than predicate logic (Nosek & Roth, 1990).

3.1.4 Comparison of Knowledge Acquisition Techniques

Figure 8 presents the various techniques described above and shows the types of knowledge they are mainly aimed at eliciting. The vertical axis on Figure 8 represents the dimension from object knowledge to process knowledge, and the horizontal axis represents the dimension from explicit knowledge to tacit knowledge.

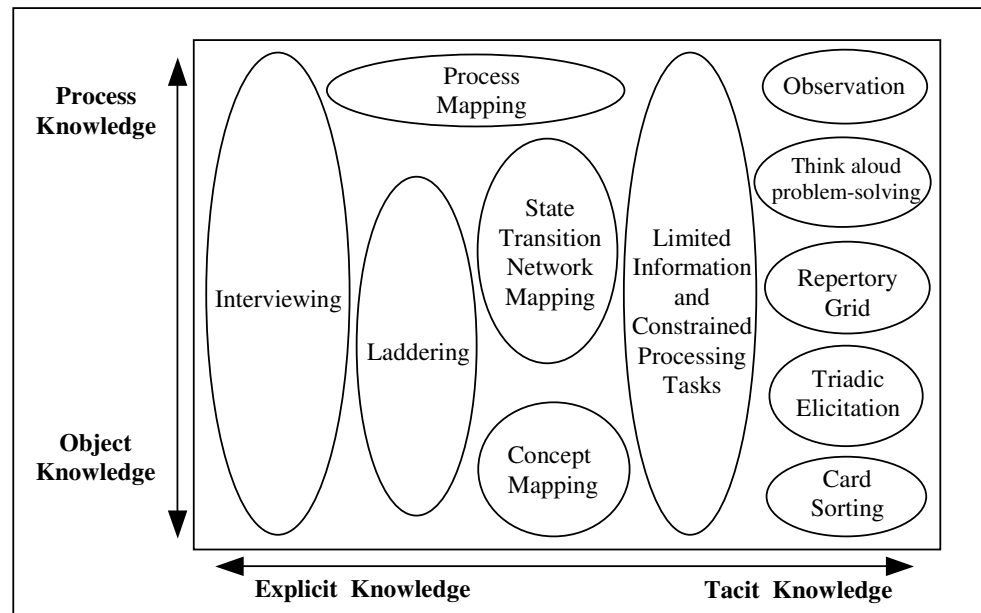


Figure 8. Diagram showing what knowledge can be elicited using various techniques

A number of issues involved in the empirical evaluation of knowledge acquisition techniques were discussed earlier. A major difficulty results from the fact that knowledge is not easy to quantify. Hence, multiple metrics are usually used in studies. Shadbolt, O'Hara and Crow (1999) describe three metrics:

1. Production rules: here the knowledge acquired is represented as rules of the form 'IF condition (AND condition AND...) THEN action'. Three metrics can be used from this, by counting the number of IF-clauses, the number of AND-clauses and the combined total of IF- and AND- clauses
2. Frames: here the knowledge acquired is represented as frames and the metrics used are the number of frames acquired together with the degree of inheritance
3. Semantic networks: here the knowledge acquired is represented using semantic

networks and the metrics used are the number of nodes and the number of relationships.

3.1.5 Typical Use of Knowledge Acquisition Techniques

How and when are the many techniques described above used in a knowledge acquisition project? To illustrate the general process, a simple method will be described. This method starts with the use of natural techniques, then moves to using more contrived techniques. It is summarised as follows.

1. Conduct an initial interview with the expert in order to (a) scope what knowledge is to be acquired, (b) determine what purpose the knowledge is to be put, (c) gain some understanding of key terminology, and (d) build a rapport with the expert. This interview (as with all session with experts) is recorded on either audiotape or videotape.
2. Transcribe the initial interview and analyse the resulting protocol. Create a concept ladder of the resulting knowledge to provide a broad representation of the knowledge in the domain. Use the ladder to produce a set of questions which cover the essential issues across the domain and which serve the goals of the knowledge acquisition project.
3. Conduct a semi-structured interview with the expert using the pre-prepared questions to provide structure and focus.
4. Transcribe the semi-structured interview and analyse the resulting protocol for the knowledge types present. Typically these would be concepts, attributes, values, relationships, tasks and rules.
5. Represent these knowledge elements using the most appropriate knowledge models, e.g. ladders, grids, network diagrams, hypertext, etc. In addition, document anecdotes, illustrations and explanations in a structured manner using hypertext and template headings.
6. Use the resulting knowledge models and structured text with contrived techniques such as laddering, think aloud problem-solving, twenty questions and repertory grid to allow the expert to modify and expand on the knowledge already captured.
7. Repeat the analysis, model building and acquisition sessions until the expert and

knowledge engineer are happy that the goals of the project have been realised.

8. Validate the knowledge acquired with other experts, and make modifications where necessary.

This is a very brief coverage of what happens. It does not assume any previous knowledge has been gathered, nor that any generic knowledge can be applied. In reality, the aim would be to re-use as much previously acquired knowledge as possible. Techniques have been developed to assist this, such as the use of ontologies (Noy and Hafner, 1997) and problem-solving models (Schreiber *et al.*, 2000). These provide generic knowledge to suggest ideas to the expert such as general classes of objects in the domain and general ways in which tasks are performed. This re-use of knowledge is the essence of making the knowledge acquisition process as efficient and effective as possible. This is an evolving process. Hence, as more knowledge is gathered and abstracted to produce generic knowledge, the whole process becomes more efficient. In practice, knowledge engineers often mix this theory-driven (top-down) approach with a data-driven (bottom-up) approach (discussed later).

3.1.6 Software-Assisted Knowledge Acquisition

A number of software tools are available to aid knowledge engineers in the acquisition, analysis and modelling of knowledge. The most comprehensive set of tools is PCPACK, a PC-based knowledge engineering workbench comprising an integrated set of software tools and representations. This has been found useful in a range of knowledge engineering projects (Montero & Scott, 1998; Zanconato & Davies, 1997). The inspiration for PCPACK lies in research performed on the ACKnowledge project (Shadbolt, Motta & Rouge, 1993) and later on the VITAL project (Motta *et al.*, 1996). Although PCPACK comprises twelve tools, including a tool to support a model-driven approach (O'Hara, Shadbolt & Van Heijst, 1998), a subset of these tools is predominantly used (Shadbolt & Milton, 1999). Six of the most useful for knowledge acquisition (four of which are referred to in chapters 4-7) are described in Appendix B.

3.2 Acquiring Knowledge in Social Psychology

This section addresses the methods used by psychologists and social scientists to acquire and analyse personal knowledge when testing and developing theories. The

emphasis is on the methods themselves and on the underlying paradigms and principles, rather than on a critical comparison or illustration of uses. Since Personal Knowledge Techniques are concerned with the acquisition and analysis of rich and holistic knowledge from each person, the main methods to be described are qualitative rather than quantitative. To start with, a brief outline of traditional, quantitative methods will be covered.

3.2.1 Traditional Approaches

Traditionally, psychologists acquire data about personal knowledge in two main ways: observation and self-report (Manstead & Semin, 1988). Brief descriptions of these are as follows.

3.2.1.1 Observation

Studies using observation collect data about people's behaviour, often their social interaction, from which might be inferred such things as attitudes and motivations. The participants are usually unaware that they are being observed since this would affect their behaviour. One variant is participant observation, which is used to investigate complex social situations. Here, the researcher poses as a member of a group to gain first-hand experience of the group's activities. These experiences are written-up in an ongoing diary that is later analysed. A more formal method is to observe people's behaviour in a situation from afar and record their actions and responses, for instance using photographs or video. These are analysed later, generally using pre-defined categories. An example of pre-defined categories is that of Interaction Process Analysis (Bales, 1950), which uses 12 categories of verbal behaviour to analyse interaction in small social groups.

3.2.1.2 Self-Report

Self-Report methods collect the responses of participants to questions concerning their beliefs, attitudes, behaviours, and so on. The questionnaire is the most obvious and common example. Open-ended questions allow participants to provide any response. This provides a rich source of data, but is time-consuming to analyse. Closed questions offer the participant a restricted set of answers or a scale on which a rating should be made. A variant of the simple questionnaire is to combine it with presentation of some experimental material such as a video or vignette. This is often

used for research into attitudes and attributions. An interview is another self-report method. This generally involves the interviewer asking questions from a questionnaire and noting down the responses. An advantage of this over a normal questionnaire is that the interviewer can clarify any questions that the interviewee may have difficulty understanding. However, this form of interview method is costly to administer and a poor interviewer can easily bias the respondent's answers by inadvertently hinting at desired or socially acceptable responses.

3.2.2 Social Cognition

Before moving on to look at qualitative methods in some detail, it is useful to include a short section on a major development in social psychology that has occurred since about the late 1980s. Before this time, social psychologists treated the study of attitudes and attributions as separate areas. With the advent of Social Cognition, the two fields became part of an integrated approach. The basis of Social Cognition is the schema, which has been defined as “a cognitive structure that represents knowledge about a concept or type of stimulus, including its attributes and the relations among those attributes” (Fiske and Taylor, 1991, p98). Schema are seen as an important means of describing a person's perspective on their world since they affect processes of attention, memory and social inference. Various types of schema have been investigated, such as person schema, self-schema, role schema, event schema (aka scripts) and causal schema. Much of the research into schema adheres to the positivist paradigm of laboratory-based experiments, such as memory tests. A typical procedure involves the participant being shown information as part of a supposed experiment. Some time later, the participant is given a surprise recall task. The amount and way in which the participant recalls the information previously presented indicates how they perceived, used and stored schema relevant to the information presented.

Interest in Social Cognition research is primarily based in the USA. It has been European social psychologists that have been at the forefront of new language-based approaches. These are discussed next, followed by a number of other qualitative approaches and methods.

3.2.3 The Turn to Discourse

The so-called ‘turn to discourse’ (Smith *et al.*, 1995) describes a number of

movements and approaches that can be considered to form a new paradigm in psychology. The key aspect of these approaches is their focus on the study of discourse, i.e. everyday use of language. Such ideas are not new. Indeed, Heider (1958) used a semantic analysis of language as the basis for his work in social psychology. In his words, “The fact that we are able to describe ourselves and other people in everyday language means that it embodies much of what we have called naïve psychology” (ibid., p7). In recent years, a number of new approaches have arisen that return to this language-based view.

One of these approaches is Ethogenics, which had its genesis in Harré & Secord’s (1972) influential critique of social and personality psychology. The Ethogenic approach is based on the idea that the analysis of human action should include studies of both human behaviour and the way in which people account for their behaviour. That is, a person’s descriptions of his/her own and other’s behaviour should be taken as a serious contribution to the understanding of action and its genesis. Harré has developed this approach into what he now calls Discursive Psychology (Harré, 1995).

Another way in which the 'turn to discourse' has influenced psychology is research into the uses of stories and narratives. This movement has been termed Narratology (Murray, 1995) and includes various ideas such as the influence of narrative literature on personality traits, psychological theories as narratives and self-narratives for therapeutic benefits.

A particularly strong adherent to a discourse-based approach is Jan Smedslund who has developed an approach called Psychologic (Smedslund, 1995). Smedslund argues that psychological theories are simply an explicit formulation of common-sense ideas already embedded in the natural language we all use. Because of this, he believes that researchers are unknowingly influenced by the conceptual or meaning relationships between words in the language. Psychologic is an attempt to systematise and make precise the psychological framework embedded in ordinary language. It does this by means of a number of axioms, definitions and propositions based on language itself rather than any empirical material.

Traditional areas of social psychology have also been influenced by the increased focus on language and discourse. For instance, a discursive approach to attribution theory has examined how people use everyday explanations of actions to satisfy and

promote their goals and interests (Edwards and Potter, 1993).

A more language-centred approach has also fuelled criticism against mainstream social psychology. As Schwarz (1994) has stated:

On close inspection, it seems that much of what we consider to reflect biases in human judgement, artefacts in attitude measurement, and so on, may actually reflect researchers' ignorance regarding the conversational context of human judgement, rather than serious shortcomings on the side of our subjects. (Schwarz, 1994, p123).

It should be noted that the 'turn to discourse' need not be directly concerned with the use and influence of language itself. As Harré points out, so-called Discursive Psychology, is a broader term for "the various kinds of things we might do that fall under the general prescription of being both intentional and normatively constrained" (Harré, 1995, p144).

3.2.4 Grounded Theory

Grounded Theory has its roots in Sociology, particularly its long tradition of ethnographic fieldwork and case studies (Charmaz, 1995). It was developed from work by Glaser and Strauss in the 1960s as a response to the increasing use of quantitative methods in Sociology. Glaser and Strauss (1967) challenged this movement with a strong defence of qualitative methods. They believed:-

- Qualitative research is not just a precursor to more 'rigorous' quantitative methods
- Qualitative research does not just produce descriptive case-studies, but can contribute to theory development
- Qualitative methods need not be impressionistic and unsystematic
- Data collection and analysis need not be separate activities
- There need not be an arbitrary division of theory and research

Grounded Theory provides a set of strategies for conducting rigorous qualitative research. A fundamental premise is that key issues emerge from the data, rather than being forced into preconceived categories, i.e. it is a data-driven approach. There is an openness and flexibility, such that research is never completely planned, but is adapted to follow interesting and relevant material. There is thus a cycle of data collection and analysis. It is only after a reasonably complete theory has been developed, that a thorough review of the relevant research literature is made.

It is interesting to note the similarity between grounded theory and the data-driven

approach to knowledge acquisition. Both approaches build rich descriptions of knowledge using few, if any, pre-defined categories or theories by intensive elicitation and analysis of data from a few people (Pidgeon, Turner, & Blockley, 1991).

3.2.5 Autobiographical Research

De Waele & Harré (1979) describe a psychological method based on autobiography. Writing the autobiography is a collaborative process undertaken by both the subject and the investigators, and which relies on a mutually respectful relationship. This involves a continuous process of negotiation and reconstruction. The validity and value of the resulting document is not dependent on its objectivity, but on the view it gives of the attitudes and interpretations of the participant. Hence, as the autobiography develops, the researchers learn how the subject conceives of situations, understands predicaments and solves problems. The autobiographical method aims to allow the investigator to learn about the dynamics and organisation of personality, and allows the participant to learn more about themselves.

By using intensive case studies on convicted prisoners, De Waele & Harré have developed a comprehensive questionnaire to elicit life histories. This is referred to as the biographical inventory and runs to over 600 pages of open-ended questions. There are three sections to this questionnaire. First is the Microsociological Framework that includes questions on the time perspective, social ecology and socio-economic living conditions. Questions on the time perspective cover each part of the life course with such topics as the typical day, the person's wishes, significant others and attitudes. Questions on social ecology include descriptions of activities, locations, roles, successes and failures. Questions on socio-economic living conditions explore hierarchies, artefacts, income and expenditure. The second part of the questionnaire includes questions on family and groups, values, norms, expectations, roles, and the institutional situation. The third part covers self-description, interpretations, interests, occupations, leisure activities, goals, aspirations and conflicts.

3.2.6 Life Story Research

In a similar vein to autobiographical research, life story research (Plummer, 1995) is another approach that aims to investigate the subjective meaning of lives as they are told in the narratives of participants. Three major methods are used (1) simply

encouraging the participant to write their life history, (2) tape-recording and transcribing interviews with the participant, and (3) a triangulation methods of informal chatting and participant observation. There are no formal methods of coding and analysing data, although care is always taken to ensure the minimum of contamination from the researcher. As with virtually all qualitative studies, theories and hypotheses are presented in a textual form with numerous quotes and references to the raw data.

3.2.7 Co-operative Inquiry

Co-operative inquiry (Reason & Heron, 1995) challenges the traditional methods of the social sciences that treat subjects as passive objects of observation. Underpinning co-operative inquiry is the idea that people's intentions and intelligent choices are the causes of their behaviour. As such, if the behaviour of those being researched is directed and determined by the researcher, then they are not being present as persons. Hence, Reason and Heron argue that research should only be performed with persons if what they do and what they experience as part of the research are to some significant degree directed by them. So persons can only properly study other persons when they are in an active relationship with each other, where the behaviour being researched is self-generated by the researchers in a context of co-operation.

3.2.8 Descriptive Psychology

Descriptive Psychology started life in the mid-1960's as an attempt to create a coherent science of human behaviour. Although largely the work of one man, Peter Ossorio, its concepts and methodologies have influenced a small community of psychologists, computer scientists, linguists and theologians (Davis, 1981). One of the main elements of Descriptive Psychology is the provision of formal representations of possible behaviours so that understanding and prediction of what might happen can be made a more complete and less arbitrary task. There is also a concern for the formulation of the relationship between language and behaviour, and the invention of a number of conceptual-notational devices.

The concept of behaviour as intentional acts is also central. Ossorio has developed the Intentional Action Formulation, a parametric analysis of behaviour intended to identify and discriminate between behaviours. This provides a means of describing any

behaviour along ten dimensions, which include intentions, motivations, knowledge, know how, personal characteristics and achievements (Ossorio, 1981). A number of operators can act on this formulation in order to distinguish different types of behavioural description. Twelve behavioural descriptions are identified, such as descriptions of social practice, activities, cause-effect and achievements.

3.2.9 Problems with Qualitative Methods

As indicated in the previous few sections, there is a wide range of qualitative research methods increasingly being used in certain areas of psychology due to the rich and context sensitive nature of the research data. However, there are also general criticisms of qualitative methods. The criticisms, many of which were noted by Miles (1979), include the following:

- *little attention on intervention*: many qualitative research studies focus on theory building and say little about the uses of theories within intervention programmes.
- *time and effort*: qualitative approaches tend to be very expensive in resources, and stressful to the researcher.
- *experimenter effects (actual &/or perceived)*: although new qualitative approaches try to protect against self-deception and the development of ‘invalid’ and ‘unreliable’ conclusions, findings can still be open to criticisms of their rigour, reliability and validity.
- *skill and experience*: to work methodically and efficiently, with as little bias as possible, requires a great deal of skill and experience from the qualitative researcher who often works alone due to the intensive nature of the research.
- *mono-methodological*: research studies tend to use and promote the use of one particular method or technique rather than promote a triangulation or multi-methodological approach.
- *unfocused and may re-invent the wheel*: by their very nature, many qualitative approaches can be rather unfocused in their objectives and may lead to findings that seem either quite obvious or have been found previously.

3.2.10 New Developments and Possibilities

A number of developments and new techniques have been proposed to deal with the

problems described above. These include summaries and coding schemes (Huberman & Miles, 1994), software for data analysis (Weitzman & Miles, 1995) and the use of structured representations for data collection, analysis and theory building. The latter area is of particular interest since it makes use of a number of techniques also used by knowledge engineers when modelling the knowledge of experts. A number of structured methods used for qualitative research are outlined below.

3.2.10.1 Repertory grids

Use of the Repertory Grid technique for psychological purposes is very similar to its use in knowledge engineering described earlier. The technique has been used in a wide range of fields to acquire knowledge of a person's constructs, i.e. the dimensions on which they view their world. Use has been made in family therapy (Gale & Barker, 1987), psychiatry (Leitner, 1981), business (Daniels *et al.*, 1995), education (Derry & Potts, 1998), medicine (Large and Strong, 1997), psychological research (Collett, 1979) and tourism (Mansfield & Ginosa, 1994).

Within psychology and psychotherapy, a typical focus grid would have a horizontal axis showing various people, real or hypothetical. For example, significant others in the persons life would be included as well as various aspects of the person, such as *me at school, the ideal me, me as other's see me, a bad teacher*. The vertical axis of the grid presents the constructs (i.e. attributes) with which the participant views such people. Invariably these would be traits, such as *confidence* and *shyness*. These would usually be elicited from scratch using triadic elicitation rather than selected from attributes previously acquired or from generic attributes. When completed the focus grid is used to explore what has been found, and add or subtract people and/or traits to arrive at a stable and representative grid.

The grid can be used in a number of ways, allowing both within-subjects or across-subjects designs (the latter producing sociogrids). An example of a within-subject design is that of Smith (1990) who used repertory grids longitudinally to capture the changing attitudes of pregnant women to their pregnancy. This allowed the knowledge to be gathered for theoretical purposes, but Smith also noted that participants were helped by the method in their attitudes to the pregnancy.

3.2.10.2 *Q sorting*

Q sorting is a technique employed in a qualitative approach known as Q methodology but which can also be used in a range of mainstream approaches (Stainton Rogers, 1995). There are three main phases to the technique. First, a large collection of items is gathered from as many sources as possible. Typically, each item is a statement relating to a particular subject matter. The set of items thus represents a large range of opinions and perspectives on the subject matter. Each of the items is written on a separate card as in the card sorting technique of knowledge engineering. Second, a number of participants, selected for their range of opinions or allegiances, each sort the cards based on how much they agree or disagree with each item. This sorting makes use of a matrix to be filled-in which provides a quasi-normal distribution. Third, the sorting data is subjected to a factor analysis statistical procedure, which produces a number of factors that group items together. The factors are also related to groups of participants so that certain attitudes can be related to demographic variables.

3.2.10.3 *Grammars of Action*

One of the main influences of linguistics on social psychology has been the methods used by linguists to study language, i.e. the use of grammars. The idea here is that just as linguists have developed grammatical rules to account for the structure of a sentence, so the behavioural researcher can look for grammars of action to account for behavioural sequences (Clarke, 1983). For this to operate, the analogy is made between the grammatical elements of a sentence and the distinct actions in a behavioural sequence. This approach has been used in a number of fields, including animal behaviour (e.g. Dawkins, 1976) and business processes (Malone *et al.*, 1997).

There are three parts to the development of a grammar of action. First, data collection, i.e. acquiring representations of a behavioural sequence. Second, parsing, i.e. dividing the sequence into distinct behaviours and categorising them using a coding scheme. Finally, a statistical technique called sequence analysis is used to find temporal patterns that can be described using a grammar. The relations between events can also be represented diagrammatically using event structures that show the potential consequences and prerequisites of events (Heise, 1989). The use of state transition networks can also be used to display sequential information of this kind (Clarke & Crossland, 1985).

3.2.10.4 Knowledge-based approaches

Yuen & Richards (1994) describe a method to perform automatic data analysis and theory construction based on the use of Artificial Intelligence and knowledge-based systems approaches. This method combines the use of grounded theory for data collection with fuzzy set theory and semantic networks. The method makes use of software that takes as input textual data collected using a grounded theory approach which has been marked-up by the researcher. This marking-up will consist of various core categories and relationships between core categories. The software analyses the occurrences of the categories and relationships and produces a semantic network. Based on the semantic network, a category-relation diagram is also produced which shows the strength of correlations both spatially and as labels on relationship links. The category-relation diagram thus represents a theory of how the core categories relate to one another. The types of relationship used include those defined by the users (e.g. *has*, *affect*) and primitive ones such as *part-of*, *member-of*, *instance-of*, *depend-on* and *kind-of*.

3.2.10.5 Logic

When describing and theorising about social behaviour, Fischer & Finkelstein (1991) argue that the social knowledge possessed by people is perhaps the most difficult aspect to observe, record and represent in a coherent manner. They advise that social knowledge should be represented in a highly formal manner to help overcome problems during data collection, analysis and modelling. Fischer and Finkelstein make use of a formal notation called Modal Action Logic for describing situations in terms of both structural relationships and the effects of actions by agents. Axioms are used which can represent the rules of social behaviour such as obligations and permissions, and how actions alter pre-conditions into post-conditions. An advantage of this knowledge-based approach is that computers can be used to scan the analytical models to help identify contradictions and conflicts, and to derive statements from the model and its definitions.

3.2.10.6 Qualitative Software and Other Possibilities

Other possibilities to improve upon existing qualitative methods can be identified. Integration of structured representations for data collection is an attractive notion since single methods can rarely access the broad knowledge that people possess and act

upon. Another possibility is more use of software tools (Fielding & Lee, 1998). Although software is increasingly used for data analysis, there is little use of software for the collection of data that still tends to be via interviews. Software might also be used for automatic collation and analysis of data. Pfaffenberger (1988) has discussed the possible uses of knowledge-based systems to provide sophisticated models of social behaviour. Manipulation of such models with the help of participants could help to validate knowledge structures and rules already acquired, and prompt for corrections and additions. In addition, intelligent software might be used to automatically encode and search for certain types of data and data patterns. Hypertext has been proposed as an important step forward in presenting, searching and accessing material for researchers (Cordingley, 1991). This allows complex links between data to be represented and provides flexible navigation structures.

3.3 Summary and Conclusions

To conclude the chapter, this section summarises the material covered and makes some general conclusions. As in the final section of the previous chapter, the structure follows that of the research aims described in chapter 1, so that the relevance of what has been covered to the present project is highlighted.

3.3.1 Research Aims Associated with Personal Knowledge Techniques

3.3.1.1 Which techniques are most suitable as Personal Knowledge Techniques?

A prime method used in both knowledge engineering and psychological research involves questions and answers. Interviews are the most obvious example here, with the semi-structured variety being most favoured in knowledge engineering. Questionnaires are a mainstay of traditional psychological research but are rarely used in knowledge engineering and qualitative research as the information gathered is either of a relatively shallow nature or can be rather ambiguous.

Event-based techniques are widely used in both knowledge engineering and psychological research. The events of interest can vary greatly in the specificity and level of detail involved. At one extreme are the very low-level details of interpersonal interactions. These are often studied using observation techniques and analysed using event categories or sequence analysis. At a higher level are the ways in which people perform tasks such as problem-solving. Knowledge engineers make use of think aloud

problem-solving and process mapping to acquire such task-based knowledge. At a much higher level of detail are the events that make up a person's life history. Qualitative techniques used for this can be found in autobiographical and life story research, such as the writing and re-writing of an autobiography.

Sorting and rating tasks are another common technique. These involve acquiring knowledge of attitudes, opinions and the properties and classes of concepts in a domain. Questionnaires using rating scales are often used in traditional psychological approaches but suffer from the problems noted earlier. The repertory grid technique makes use of ratings, but does so using personalised elements and constructs and involves the participant in the analysis and interpretation of the statistical results. The Q sorting technique of qualitative research is used to examine opinions and attitudes in great depth. The card sorting technique of knowledge engineering is used to examine classes and properties (attributes and values) of concepts.

Techniques involving the construction and modification of knowledge models and structures are much used in knowledge engineering but rarely used in psychological research. An obvious exception to the latter is the use of the focus grid in the repertory grid to prompt discussion. Knowledge engineers use various forms of hierarchical diagrams, concept maps, state transition networks and process maps to help elicit and validate knowledge with experts.

Contrived techniques are sometimes used by knowledge engineers, but are infrequently used by psychologists. Such techniques as constrained problem-solving, twenty questions and triadic elicitation can provide an efficient means of accessing the key properties or information in a domain.

3.3.1.2 Can a person operate the techniques on his/her own?

There are recent moves in knowledge engineering to provide software-assisted methods to allow experts to elicit and model their own knowledge. However, this is still in its infancy and most knowledge elicitation is performed with the expert and knowledge engineer co-operating to make use of various techniques. Many of the techniques involving knowledge models (such as ladders, concept maps and grids) are relatively easy to learn and apply and in practice experts can directly model their knowledge with the knowledge engineer providing guidance and prompts. The use of software, such as PCPACK, to support these activities ensures the expert does not

stray from good knowledge engineering practices. This is achieved by restricting the user in what can be represented and how it can be represented, such as limiting the ways in which certain types of knowledge are associated with other types of knowledge.

3.3.2 Research Aims Associated with Personal Knowledge Methodology

3.3.2.1 *How useful might the methodology be to the person using it?*

How useful might the Personal Knowledge Methodology be for psychological research purposes? As a start, it is hoped that the design of the methodology will address a number of the problems with many existing qualitative methods. Table 3 summarises some of the major problems and provides solutions that the Personal Knowledge Methodology aims at providing.

Problems	Solutions
Focus on pure research with little attention to application and intervention	Tight loop of intervention, evaluation, assessment and theory building
Time and effort required from the researcher	Participants pre-code data and computers allow many cases
Experimenter bias (actual and perceived)	Participants pre-code data and provide ongoing validation
Mono-methodological, unfocused and reinvents wheel	Integrated set of various methods, and use of generic knowledge

Table 3: Summary of problems with qualitative methods and possible solutions

As shown in Table 3, there are five key aspects of the Personal Knowledge Methodology: (1) a tight loop of theorising and intervention, (2) participants pre-coding data, (3) computers allowing many cases, (4) an integrated set of various methods, and (5) use of generic knowledge. What has been found in this chapter to support these?

(1) *A tight loop of intervention, evaluation, assessment and theory building.* This idea of looping, when building knowledge-based systems and theories, has appeared in a number of methods. Knowledge engineering methods are a prime example, where knowledge previously acquired and analysed is shown back to the expert to validate, amend and append where necessary. Hence, there is the need for a range of good knowledge models to enable this to be an efficient process and not open to

problems of ambiguity and lack of clarity. Iteration has been seen in a number of qualitative methods. For instance, grounded theory uses cycles of data collection and analysis, and autobiographical methods repeatedly present and re-write information previously collected.

- (2) *Participants pre-coding data.* Very few current approaches allow the participant to code their own data. However, the more recent qualitative approaches do seem to be moving in this direction, as they adopt more structured representations of knowledge and allow participants to co-operate with data analysis.
- (3) *Computers allowing many cases.* Use of computers promise benefits by supporting the acquisition and analysis of knowledge. Although this would allow many more cases to be dealt with, there has been little exploration of the widespread adoption of computerised techniques in this way for qualitative research.
- (4) *An integrated set of various methods.* The Differential Access Hypothesis of knowledge engineering states that different knowledge elicitation techniques are needed to elicit different types of knowledge from an expert. Although evidence for this hypothesis tends to be anecdotal rather than from controlled studies, the majority of knowledge engineers believe the effectiveness and efficiency of different techniques does depend on the type of knowledge being elicited. Since personal knowledge comprises different types of knowledge, such as attitudes, attributions, episodic memories and various schema, this supports the requirement for a range of techniques to be used.
- (5) *Use of generic knowledge.* The use of generic knowledge to provide categories for coding is a mainstay of a number of analytical approaches, such as Interactional Process Analysis and the Intentional Action Formulation of Descriptive Psychology. In a similar vein, the various types of schema used in Social Cognition provide a high-level classification framework. As will be covered later when reviewing the ontological elements covered in this chapter, there are many categories and frameworks that act to guide the acquisition and analysis of personal knowledge. On the other hand, there are qualitative approaches, notably grounded theory, that strongly discourage the use of any predefined categories or generic knowledge. This suggests that there may be occasions in operating the Personal Knowledge Methodology when generic knowledge is used and occasions

when it is not used. There is no real indication from the approaches covered in this chapter when these occasions should be, and this remains a key research question.

3.3.2.2 What ontology should be used?

Key ontological elements used in knowledge engineering include concepts, attributes, values, tasks, relationships and rules.

Traditional psychological research involving personal knowledge makes frequent use of notions such as attitudes and attributions, as well as basic processes such as attention, learning, memory and social interaction. The central element of Social Cognition is the schema that provides an ontological framework to examine and describe people (self and others), roles, events and causes.

A fundamental aspect of some qualitative approaches, notably grounded theory, is that there are no explicit ontological primitives in place prior to the research. However, other qualitative approaches do use ontological primitives, many of which take actions, events and behaviours as the central focus. Approaches that adopt a grammatical approach use notions such as actions, events, behaviours, accounts, systems, sequences, consequences and prerequisites. The biographical inventory of autobiographical research includes a wealth of ontological elements. These include those associated with the time course, significant others, wishes, attitudes, artefacts, socio-economic factors, norms, expectations, roles, institutions, interpretations, occupations, interests, leisure activities, goals, aspirations and conflicts. Descriptive psychology provides one of the most formal ontological frameworks found in qualitative approaches, using events and behaviours as the central focus. Ontological elements include activities, intentions, motivations, knowledge, know how, personal characteristics, achievements, social practice, and cause-effect. Another approach based around action and behaviour is Modal Action Logic that uses notions such as rules, obligations, permissions, pre-conditions and post-conditions. In contrast to these event-based ontologies, the repertory grid method makes use of two object-based primitives: elements and constructs (equivalent to concepts and attributes, respectively, of knowledge engineering).

3.3.2.3 Can the methodology be computer-based?

The increasing use of computers has been stressed throughout the chapter. Use of

software tools to support knowledge engineering activities has been a major thrust over recent years. Large projects are underway to develop intelligent systems based on large ontologies that can act as advanced web-based knowledge systems and that have the potential to elicit knowledge directly from experts.

Use of software tools to aid qualitative research is primarily in the area of analysis. The main use of software is in relatively simple applications that simulate and improve the efficiency of traditional paper-based methods. At a more sophisticated level, there are some moves to model social behaviour using knowledge-based systems to test the theories and gain feedback from participants. There has been little impact in providing tools to automatically analyse data and help develop theories. However, there are some moves in this direction, such as the use of fuzzy logic and semantic networks to create and display putative theories.

3.3.2.4 What is the best way to develop the methodology?

Very little has been said in this chapter concerning the ways in which new methodologies and techniques ought to be developed. This reflects a general dearth in the literature on this important matter. However, a number of issues have arisen that point to directions and considerations for the development of the Personal Knowledge Methodology.

Domains within knowledge engineering tend to be very problem-focused in nature. As such, many of the techniques and tools have been developed to deal with relatively structured knowledge domains, clear-cut goals and decisions. It may be the case that many of the techniques have to be modified substantially in order to fit the more ill-structured nature of people's lives. That said, the apparent successes of Social Cognition and Personal Construct Psychology rest on relatively simple conceptualisations of people's knowledge using schema and constructs. This implies the generic nature of the techniques, tools and modelling methods of knowledge engineering may not need substantial modification. However, this remains an important research issue. As such, a key consideration in developing the new methodology is to draw on techniques and uses of techniques that come from knowledge engineering but that also extend into other knowledge-based and allied approaches. A further consideration is to carefully assess techniques, in terms of their efficacy at acquiring knowledge, at helping people and their acceptability to users.

Another important issue that has occurred a number of times so far is whether to use a top-down (theory-driven or model-driven) approach or a bottom-up (data-driven) approach. The strengths and weaknesses of these approaches rest on a choice between (1) having a pre-existing theory (classification framework, ontology) to guide and focus the research, or (2) having no preconceived notions and identifying concepts, connections and theories from the raw data. The latter notion is epitomised in the grounded theory approach, but is called into question by those such as Smedslund (1995) who see language as containing inherent categories and conceptualisations from which the researchers cannot divorce themselves. The important issue for the present purposes is that a decision must be taken of how much of an ontology is in place when starting the development of the new methodology. Following the lead of knowledge engineering, perhaps a very abstract ontology could be in place which would not unduly guide the participants nor the analysis, but which can help provide some structure and focus. Use of such high-level categories as concepts, attributes, values, tasks and relationships would seem to be a fair compromise between a strong top-down approach and a strong bottom-up approach (as covered in the next chapter).

A final point is the interesting view of co-operative inquiry that holds that participants should be actively involved in shaping the research. This is an attractive notion and is consistent with the aim of the Personal Knowledge Methodology to have a tight loop of acquisition, analysis and intervention. However, this rather flexible and exploratory approach must be balanced by the need to critically assess the techniques under scrutiny that requires a more rigid and traditional empirical approach.

3.3.2.5 What metrics and assessment methods can be used to assess the effects and effectiveness of the methodology?

A major problem in assessing the efficacy and efficiency of different knowledge acquisition techniques is the fact that knowledge is not easy to quantify. Hence, studies in knowledge engineering use a number of criteria to assess the effectiveness of approaches and techniques. If the knowledge acquired can be represented as rules, then the number of IF-clauses, the number of AND-clauses and the combined total of IF- and AND- clauses can be counted. If the knowledge is represented as frames, then the number of frames acquired and the degree of inheritance can be counted. If the knowledge is represented using semantic networks, then number of nodes and the

number of relationships can be counted. However, even when such quantified metrics can be used, studies still suffer from problems associated with the quantity of experts, the ‘gold standards’ to compare results against, the range of tasks and domains to cover, and the possible synergistic effects of multiple techniques.

The empirical evaluation of psychological research methods and approaches is very seldom if at all performed. Indeed, any study that employed research methods to assess research methods is immediately in danger of problems of recursion, in that the methods employed for evaluation would themselves be open to criticisms. This echoes the ideas of the philosopher of science Thomas Kuhn concerning science as a whole. Kuhn (1970) argues that different scientific paradigms are ‘incommensurable’, i.e. there is no common body of neutral observations that can be used to decide between competing theories. Since most research methods pay little attention to practical applications, there is no way of testing approaches pragmatically (as was the case in the last chapter). Hence, arguments for one approach or method over another generally involves a mixture of common-sense appeals, listing the many pitfalls of competing methods and justification based on philosophical ideas.

4 RESEARCH DESIGN

*Nothing has really happened until it has been recorded.
(Virginia Woolf)*

This chapter is pivotal to the thesis, as it transforms the ideas and background information contained in the previous three chapters into the requirements for the empirical study described in the following four chapters. To do this a number of issues are covered concerning the choice of techniques. These include the number of techniques to assess, the types of techniques to assess and the detailed method to follow for each technique. In addition, a number of issues are covered concerning the way the techniques should be assessed. These include the selection of participants to involve, the assessment measures to use and the methods of analysis to employ.

To address these issues and create a detailed design for the empirical study, eight interrelated tasks were performed. The first section of this chapter describes the first seven of these tasks that led up to and included the pilot study. The second section of the chapter describes the task that produced the finalised design for the main study, and the third section describes the finalised research design.

4.1 Creating the Research Design

In creating a detailed design for the empirical study, the issues considered and decisions made involved a reasonably complex process. In particular, there was a relatively involved interplay between the tasks performed and the way information was used and produced. To clarify this, the task diagram shown in Figure 9 has been included. This diagram shows tasks as oval shapes and information as rectangular shapes. As shown in the diagram, the tasks performed were as follows.

- Consider overall method of assessment (see section 4.1.1)
- Assess available resources (see section 4.1.2)
- Select participants (see section 4.1.3)
- Collate techniques (see section 4.1.4)
- Identify criteria for technique selection (see section 4.1.5)
- Select initial set of techniques to assess (see section 4.1.6)
- Define initial method for each technique (see section 4.1.7)
- Perform pilot assessment (see section 4.1.8)

- Produce design for main study (see section 4.2)

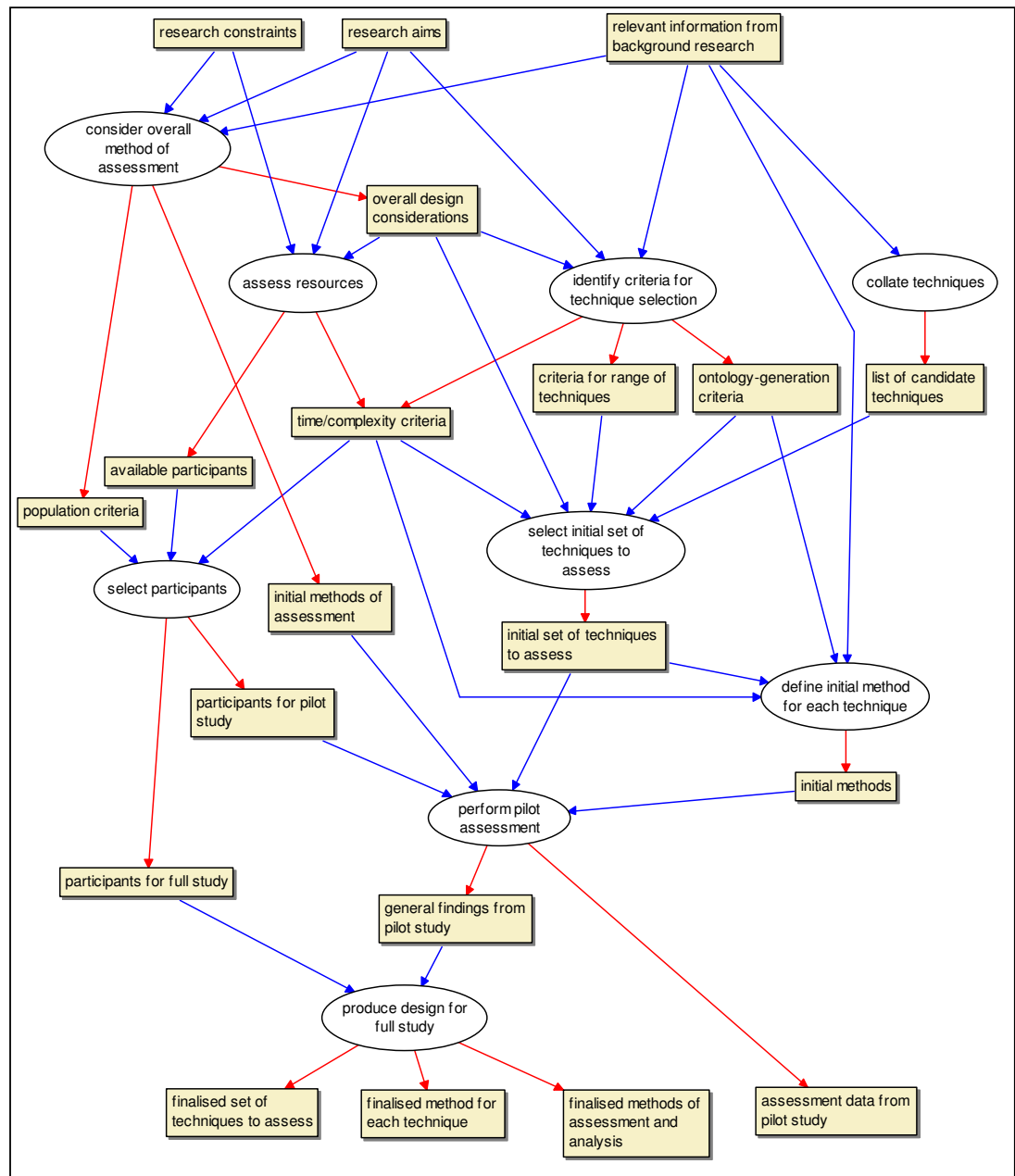


Figure 9: Tasks performed to produce the detailed design for the empirical studies

4.1.1 Consider Overall Method of Assessment

Using the relevant background literature, the research aims and the research constraints, this task produced overall design considerations, initial methods of assessment and population criteria.

4.1.1.1 Overall Design Considerations

As covered in the first chapter, the use of a purely quantitative or purely qualitative

approach in research studies carries a number of inherent problems. To counteract this, a fundamental notion behind the Personal Knowledge Methodology is the use of multiple methods. Hence, an overall design consideration for the empirical assessment was to make use of both a quantitative and qualitative approach.

It was made clear in the conclusions to chapter 2 that the development of the Personal Knowledge Methodology needs to be performed in a careful way to mitigate the risk of producing techniques that can be inappropriately applied by users. Hence, the development should involve the participation of potential users in a spirit of co-operative enquiry. In addition, it was decided that the self-help aspect of the Personal Knowledge Methodology should be de-emphasised. Instead, the researcher would be present at all sessions to explain and operate the techniques with the participants. In this way, the researcher would perform as a knowledge engineer does in a standard knowledge acquisition session of a knowledge engineering project. Hence, each session would be a one-to-one session between the researcher and the participant. It was decided that that only one knowledge technique would be used per session to avoid the participant becoming confused.

Although the Personal Knowledge Methodology involves the user interacting with computer-based techniques, it was decided that due to constraints on the research time and resources, no specialised software would be written. Hence, the emphasis would be on testing either paper-based techniques or those already supported by software (i.e. the PCPACK suite of knowledge acquisition and analysis tools).

The Personal Knowledge Methodology plays two roles in the empirical study. Firstly, it is under direct scrutiny because of the primary aim to assess various candidates for Personal Knowledge Techniques. Secondly, the Personal Knowledge Methodology forms a framework for carrying out the study. A key aspect of the Personal Knowledge Methodology is a cyclical approach, i.e. a cycle of designing techniques, use of techniques, gathering and analysis of structured knowledge, leading to a revision in the techniques to be used. Adopting this framework, the study should follow such a cyclical approach. By considering the resources available for the study, it was decided that two cycles could be completed. The first cycle would be exploratory in nature, hence would be referred to as the pilot study. This study would follow a qualitative approach and involve a spirit of co-operative enquiry. The emphasis would be on a

provisional assessment of a number of possible Personal Knowledge Techniques in a 'safe' environment where techniques can be altered in an evolving process without the constraints of a rigorous quantitative study. In contrast, the second cycle would follow a mixed approach of both qualitative and quantitative assessment. This would follow a rigorous experimental design with a random presentation of a fixed set of techniques. This will be referred to as the main study.

4.1.1.2 Initial Methods of Assessment

What assessment methods should be used during the pilot study? Since the pilot study is to be purely qualitative, it was decided to use an open-ended questionnaire. Analysis of the responses would be qualitative, hence would identify key terms and themes used by the participants. A questionnaire would be used to capture the participant's opinions of each technique. It was decided to keep this simple, with no use of particular ontological terms. Hence, the questions asked were made as neutral as possible. The questions asked referred to the technique being used. For example, the questionnaire used for the interview technique was as follows.

1. What were your general impressions of the interview? (2-3 adjectives, please)
2. What was good (if anything) about the interview?
3. What was poor about the interview? How can this be rectified?
4. Did any of the questions, or topics covered, make you think about things you hadn't (consciously) thought of before? Did any come close to helping promote a greater understanding of yourself? (Which ones and how?)
5. How willing would you be to take part in a further interview and feedback session?

4.1.1.3 Population Criteria

If people are to be treated as experts at being lay psychologists, then presumably people vary in their expertise, both generally and in specific areas, and in their ability to articulate that knowledge. In choosing participants, as in knowledge engineering, one needs to identify people who have a great deal of expertise, are capable of articulating much of their knowledge and are interested and available to take part in knowledge acquisition sessions. In the case of knowledge engineering, this is usually a reasonably uncomplicated matter. For the present research, identifying such people is

much less clear. Possibilities are people who are successful, stable, experienced, analytical (of self and others) and articulate.

Basing an expert system on one expert is rarely a good idea, unless this person is regarded as the world's best expert. A small number of experts, something like three or four, are generally used. Any more becomes too expensive in time, and can lead to diminishing returns. Validation of expert knowledge comes from comparing and contrasting the expertise captured across the various experts.

4.1.2 Assess Available Resources

Using the research aims, the research constraints and overall design considerations this task produced time/complexity criteria and available participants.

4.1.2.1 Time/Complexity Criteria

Based on the time available for the empirical studies, it was decided that 6-9 months of elapsed time should be allocated to the pilot study, and 9-12 months to the main study. These periods would include time between each session to transcribe and analyse the knowledge acquired from previous sessions and prepare for the next session. Since the pilot study was to be exploratory in nature, it was thought that the time between sessions should be longer than in the main study, since the methods for analyses and preparation used in the main study would already be in place. Due to the main study having a longer overall time and the need for less analysis and preparation time between sessions, it was decided that the main study should have about three times the sessions as in the pilot study. Hence, it was decided that around 20-30 sessions should take place during the pilot study and about 70-80 sessions should take place during the main study. This would result in about 100 hours of empirical data which is consistent with a research study of this nature.

4.1.2.2 Available Participants

For the assessment of techniques to use both a between-participants and within-participants design, each participant needed to be visited a number of times over a period of a number of months. Due to a lack of funds, it was required that participants should not be geographically distant from the place at which the research was based so that large travel expenses were not incurred. Hence, the easiest and least costly population of participants to select from were those at the university at which the

research was based. Undergraduates were discounted as their life experience was expected to be lower in number and more homogeneous than the average adult. Hence, postgraduates and staff were considered. However, it was thought that using a purely university-based population was likely to result in a particular emphasis in the knowledge acquired, hence a more representative pool of participants was also required. Employees of a large industrial organisation were considered an attractive possibility since they were likely to be relatively representative of the population as a whole, available over a lengthy period and could be contacted easily. In addition, the sessions could be arranged to take place in a private and confidential manner. It was, therefore, decided that university-based post-graduates would participate in the pilot study and employees of an industrial organisation would participate in the main study.

4.1.3 Select Participants

Using the population criteria and available participants, this task identified the participants for the pilot study and the participants for the main study.

4.1.3.1 Participants for the Pilot Study

The university-based participants for the pilot study were selected using a set of criteria derived from knowledge engineering practice and the need to involve the participants in co-operative enquiry. Nine people were selected using the following four criteria:-

1. Likely to be available for a number of sessions over a 9 month period
2. Known to the researcher to be open, honest and verbally expressive
3. Thought by the researcher to be someone who would not react negatively to the interview sessions
4. Known to have some interest in psychological matters and have an awareness of the problems of interviewing (e.g. biases of memory, experimenter effects, etc.)
5. Thought by the researcher to be someone who could provide useful feedback concerning the study in the spirit of co-operative inquiry

Of the nine people approached, eight agreed to participate in the study. All were female, post-graduate students in the general area of the social sciences (e.g. psychology, health and law). The age of the participants ranged from 21 years to 41 years, the average being 27.9 years. One participant was married with children, one

was divorced with children, and five had previously lived with a partner, one being an unmarried mother.

4.1.3.2 Participants for the Main Study

The pilot study used a group of psychologically literate people, all at post-graduate level and all females. This was a useful population for the pilot study so as to produce a 'safe' environment to help develop the initial methods used. Thus, changes could be made as each participant was seen without worrying about introducing experimental confounds, and to gain some confidence that Personal Knowledge Techniques could be useful. For the main study, a much more representative section of the general population was required and a rigorous, experimental design should be used. Based on the available resources and the need to investigate a broader population of participants, the choice was made to involve employees of a large industrial organisation.

The number of employees to involve was determined by two opposing factors associated with the need to mix a quantitative-like and qualitative-like feel for the study. First, having enough people to ensure a good spread of demographics and enough assessment data for quantitative analyses to be applied. Second, not having so many participants that there would be not enough time to assess each technique with everyone and not enough time for a full analysis of the resulting data. As a compromise, the figure chosen was that 10 participants should be involved. The spread in demographics for these participants aimed to satisfy the following criteria:-

- 6 male and 4 female participants. This slight imbalance was chosen since the pilot study had involved all females, and also to reflect the gender profile of employees at the company since most are male.
- A range of ages from early twenties to late fifties.
- A range of educational background, from those with few formal qualifications to those with graduate-level qualifications
- A range of areas in which the employee worked, including those working in technology, manufacturing, design, training and human resources groups
- A range of employee roles, including those with no supervision responsibilities, those in technical jobs, those in people-facing jobs, and those in middle and upper management
- A range in the number of years the employee had worked for the company

Using contacts made when gaining acceptance from the company to involve their employees, a short-list of names was supplied with data on the demographics listed

above. A pseudo-random selection was made, ensuring the resulting pool of participants fitted the demographic criteria described above.

Of the ten people approached, all ten agreed to participate in the study. As required, six were male and four were female. All were white-collar (non-manual) workers, since the participation of manual workers was felt to be problematical by the contacts in the company. The job positions of the ten participants included two secretaries, an engineer, an engineering specialist, a project manager, a senior HR (Human Resources) officer and a senior training manager. The academic qualifications ranged from those with no A-levels to those with university degrees. The age of the participants ranged from 26 years to 59 years, the average being 38.6 years. Six of the participants were married with children, one was widowed with children, one was engaged, and two were single with no partner. The number of years employed at the company ranged from 3 years to 30 years, the average being 13.7 years.

4.1.4 Collate Techniques from Background Literature

Using the relevant background literature, this task produced a list of candidate techniques to be assessed.

In chapter 2, the following techniques were identified:-

- A software conversation tool (such as an updated ELIZA) to be used as a brainstorming tool and as a starting protocol for more structured techniques
- Diary techniques, such as making lists, describing other people, writing about the self in the third person, unsent letters and imaginary dialogues.
- Techniques to aid decision-making such the payoff matrix, balance sheet of pros and cons, a cost-benefit approach that includes quantified expectations.
- Techniques that take a procedural approach to behavioural change, possibly some mix of a flow chart and decision tree.
- Techniques that aim to reveal and interpret key events in a person's past, and how these impact on present-day thoughts, feelings and behaviours.
- Techniques that can help elicit and reveal subconscious thoughts and feelings.
- Techniques that help people to be more creative, such as brainstorming, use of imagery, use of analogies, restructuring information, transposing ideas, syntectics, and redefining the problem.
- Techniques using structured knowledge models to help people learn and be more creative, such as concept maps and mind maps.

In chapter 3, the following techniques were identified:-

- Interviews, especially the semi-structured interview, and questionnaires.
- Event-based techniques such as (1) observation techniques and analysis using event categories or sequence analysis, (2) think aloud problem-solving and process mapping, and (3) autobiographical and life story research, such as the writing and re-writing of an autobiography.
- Sorting and rating tasks, such as card sorting, Q sorting, questionnaires using rating scales and the repertory grid technique.
- Techniques involving the construction and modification of knowledge models and structures, such as the use of various forms of ladders (e.g. concept tree, decision tree) concept maps, state transition networks and process maps.
- Contrived techniques, such as constrained problem-solving, twenty questions and triadic elicitation.

Combining and classifying the techniques from chapter 2 and 3 at a higher-level resulted in the following five categories being identified.

- Question-based techniques: These involve one person providing responses to a set of questions. They include interviews, personality tests and twenty-questions techniques.
- Attribute-based techniques: These involve the elicitation and capture of the attributes and/or values of various concepts. They include sorting techniques (e.g. card sorting and Q sorting), repertory grid and triadic elicitation techniques.
- Network-based techniques: These involve the creation and modification of network diagrams, such as ladders, concept maps, process maps, mind maps and state transition networks.
- Matrix-based techniques: These involve the creation and filling-in of a matrix. They include the use of a payoff matrix, a balance sheet of pros and cons, a focus grid and frames.
- Other techniques: These involve a variety of minor techniques, which include various diary techniques and creativity techniques.

4.1.5 Identify Criteria for Technique Selection

This task made use of the overall research aims discussed in chapter 1, the relevant background literature covered in chapters 2 and 3 and the overall design considerations described above. This resulted in the creation of three selection criteria: range criteria, ontology-generation criteria and time/complexity criteria.

4.1.5.1 Range criteria

Range criteria relate to the range of techniques to be assessed. Three criteria were established. First, a good spread of techniques is required to provide an appropriate assessment of the applicability and efficacy of potential knowledge techniques for the Personal Knowledge Methodology. Hence, representation from each of the major

classes of techniques was required. Techniques based on structured representations, such as a ladder, network and matrix, have featured strongly when reviewing the background material in the previous two chapters. Hence, a reasonable proportion of the techniques assessed should be based on structured representations. The second criterion established was that the techniques selected should cover most key areas of personal knowledge. Hence, there should be at least one technique to capture knowledge of the following: basic concepts (e.g. people and places), attitudes, behaviours, emotions, goals, events and attributes (e.g. traits, constructs and attributes of events). The third criterion was that some computer-assisted techniques be selected. There were two reasons for this: (i) so computer-assisted techniques could be compared to purely verbal and paper-based techniques, and (ii) as an initial assessment of the computer-assisted aspect of the Personal Knowledge Methodology.

4.1.5.2 Ontology-Generation Criteria

Ontology-generation criteria relate to the research aim of providing an ontology of personal knowledge to provide an overall guiding framework for the use of Personal Knowledge Techniques. The essence of an ontology is that it should be a complete and formalised representation of the knowledge in a domain. Many different ontologies can be constructed for a particular domain depending on the particular use or uses that the ontology is to be put. Thus, in constructing an ontology, the key driver is the way the domain is to be conceptualised from a pragmatic perspective.

As discussed in the previous two chapters, there are two opposing ways in which this could be achieved. One can be classed as top-down, the other as bottom-up. The top-down approach means starting with a provisional idea of the contents and structure of the ontology, then testing and amending this using data from the empirical studies. The bottom-up approach means starting with a blank sheet of paper and constructing the ontology from the raw data provided in the studies. There are distinct parallels between the top-down and bottom-up methods and the quantitative and qualitative methods used in psychology. Advantages and disadvantages are also very similar.

The major advantage of the top-down approach is that what is being tested is plain at the outset and revisions are clearly based in the empirical data. However, there are serious disadvantages with this approach. First, there is the problem of generating an initial ontology given the vast amount of literature, including different perspectives

and differing terminology. Second, the initial ontology may be inappropriate and thus revision of it may require a large effort. Third, the ontology might so dominate the collection and analyses of empirical data that serious biases are introduced.

The major advantage of the bottom-up approach is that it is not coloured by any pre-existing ontology. The disadvantages, however, are the possible subjective interpretation of the data to arrive at the ontology and the distortion that can result in over-emphasis on the population being assessed.

Given the disadvantages listed above, neither a pure top-down nor pure bottom-up approach would be applicable for the present purposes. Indeed, neither would be practical. A purely top-down approach would seriously hamper the assessment of each technique and oppose the aim of providing an element of co-operative enquiry. A purely bottom-up approach is impossible since each candidate technique already has a set of underlying ontological elements.

It is clear from this, that a partly top-down and partly bottom-up approach is required to generate the ontology. An initial skeletal ontology will be provided by the techniques chosen. For instance, the questions in an interview have to cover certain topic areas, thus steering the participant to answer from a particular ontological perspective. Network-based techniques are even more loaded with ontological primitives, given any network diagram must have certain classes of nodes and links with which to operate. Hence, care should be taken when deciding on a technique and the way it is employed to ensure it does not force the participant to use too much of a predefined ontology.

4.1.5.3 Time/Complexity Criteria

The time/complexity criteria are related to the time required to operate and assess each technique and the complexity involved in learning and using the technique. For a fair assessment of the selected techniques an essential requirement is that they are roughly equivalent in the amount of time needed in preparation for a session, during a session and after a session for analysis. For instance, it would be unfair to compare a technique that only took 15 minutes with the participant to one that took 2 hours. Obviously such factors as the amount of time needed to acquire knowledge and possible effects of drifting attention and boredom impinge on differences in length of time. In a similar vein, the complexity of the selected techniques should be roughly

equivalent. A technique that is easy to understand and use cannot be assessed on equal terms with one that is very difficult to understand and use. Not only is relative time a key criterion, but so is absolute time. A very short session, say 15 minutes, would give very little time to explore the use of a technique. On the other hand, a very long session, say 3 hours, may result in the participant losing attention. Additionally, a long session, if deemed unproductive by the participant, may lead to a feeling that the session has been a waste of their time, thus losing motivation to take part in subsequent sessions. Hence, the decision was made to select techniques that could be operated in a session of about 1-hour in length.

4.1.6 Select Initial Set of Techniques to Assess

Using the list of candidate techniques, overall design considerations, range criteria, time/complexity criteria and ontology-generation criteria, this task produced an initial set of techniques to assess in the pilot study. Based on the resource constraints and range criteria, it was decided that about 10 techniques would represent a good spread across the high-level categories listed above.

Four criteria for selection described previously are:

1. Capability at acquiring knowledge: the technique should be used to acquire knowledge preferably structured knowledge, or have a potential to do this.
2. Capability at providing self-help: the technique should be used to facilitate self-help, or to have a potential to do this.
3. Suitability for a 1-hour session: the technique should be able to be fully explained and implemented with a participant in a session lasting no less than 45 minutes and no more than 75 minutes.
4. There should be at least one technique that can acquire knowledge from the main types of personal knowledge: concepts, attitudes, behaviours, emotions, goals, events and attributes.

Table 4 shows the techniques considered for selection with ratings and comments for each using the four criteria listed above.

Class of Techniques	Technique	Capability at acquiring knowledge	Capability at providing self-help	Suitability for a 1-hour session	Type of knowledge addressed
Question-based	Semi-structured interview	High	Medium	Good	All types
	Personality tests	Medium	High	Medium	Traits
	Twenty questions	High	Low	Medium	Attributes
Attribute-based	Card sorting	High	Low	Good	Attributes/Classes
	Q sorting	High	Low	Poor	Attributes/Classes
	Repertory grid	High	High	Medium	Attributes/Classes
	Triadic elicitation	High	Medium	Poor	Attributes
Network-based	Laddering	High	Low	Good	Classes
	Process mapping	High	Medium	Good	All types
	Event mapping	High	Medium	Good	Events/Actions
	State transition network	High	Low	Good	States
	Decision trees	High	Medium	Medium	Decisions
Matrix-based	Payoff matrix	Medium	Medium	Good	Decisions
	Decisional balance sheet	Medium	Medium	Good	Decisions
Others	Diary techniques	High	Medium	Medium	Events/Feelings
	Creativity techniques	Low	Medium	Poor	Decisions

Table 4: Comparison of candidate techniques using the four selection criteria

Any potential personal knowledge technique must be effective at acquiring knowledge. Hence, any technique that is not rated ‘high’ on the capability to acquire knowledge is eliminated. Thus, **personality tests**, **payoff matrix**, **decisional balance sheet**, and **creativity techniques** are eliminated. Any potential personal knowledge technique must also be effective at providing self-help. However, this is a difficult aspect to assess for techniques that have not been used directly for this purpose. Hence, those techniques scoring ‘low’ for this capability will not be immediately eliminated. That said, **Q sorting** not only scores ‘low’ for the capability for self-help but also scores ‘poor’ for its suitability for a 1-hour session, hence is eliminated.

A further means of selection are the three range criteria described in section 4.1.5.1 concerning the type of knowledge that the technique can acquire. First, what technique should be selected to capture attributes? Clearly **repertory grids** are an important technique in this area and have a track record of both capturing knowledge and providing help. **Card sorting**, on the other hand, is good for capturing detailed information on classes and attributes, but has no record of helping people. The kind of detailed information that card sorting can elicit has not been seen in any of the help techniques described in chapter 2, hence it was decided to eliminate card sorting, but

include repertory grids. A similar argument can be made when comparing the two question-based techniques of **semi-structured interview** and **twenty questions**. Once again, interviews appear in both chapter 2 and 3, but twenty questions has neither a track record nor a potential for providing self-help. Hence, the twenty questions technique was eliminated, and the semi-structured interview included.

Triadic elicitation is a very useful technique for eliciting attributes and can access tacit knowledge. However, it was not deemed sensible to have a whole 1-hour session of triadic elicitation as it is generally very mentally demanding and could become very monotonous for the participant. It was decided that rather than eliminate this technique, it should be used in conjunction with the repertory grid technique, which it often is in practice.

As discussed in the section on range criteria (section 4.1.5.1), there should be a reasonable proportion of techniques based on structured representations. From Table 4, it is clear that **concept mapping**, **process mapping** and **decision trees** score well, hence should be selected. **Laddering** is not thought to have such a good capability at providing self-help as no technique in chapter 2 has the look or feel of laddering. However, it is a standard technique for knowledge engineering, hence it was decided to select laddering but to do so only in a limited way (i.e. to spend about 10 minutes on it at the start of another session). The use of **state transition networks** has no track record of providing help. However, it is the only technique that might directly capture knowledge of behavioural and emotional states. Since the need to address knowledge of behaviour and emotions was part of the range criteria, it was decided to include the state transition network technique. Other types of knowledge not specifically addressed by the techniques included so far, are attitudes and goals. It was decided that special forms of **concept mapping** could be used to address these types of knowledge, i.e. a semantic network of attitudes and of life goals, respectively. Hence, it was decided to include these two types of concept mapping technique.

The inclusion of a **diary technique** was considered important. However, the operation of a diary technique as part of a 1-hour session with the participant was thought problematical as the creation of diary entries is generally a spontaneous, less time-intensive and privately performed activity. The use of a diary to re-read entries and review them in the light of an intervening time period was thought a possibility. It was

decided that the transcript of the semi-structured interview could be considered as a snap-shot of a person's thoughts and feelings at one time period. In this way, it could be shown to the person at a much later date (at least 9 months later) to gain their feedback on what they had said. This need not be part of a session with the researcher but could take place in the participant's spare time. Hence, it was decided to include this interview review as a representative of a diary technique.

In summary, the techniques selected for assessment in the pilot study were as follows.

- **Semi-structured interview:** Selected because it is representative of a questioning technique and can acquire a broad range of knowledge.
- **Laddering:** Selected because it is a standard knowledge engineering technique, but only to be assessed in a limited way because of a presumed low capability to facilitate self-help
- **Repertory Grid:** Selected because of its widespread use for acquiring knowledge and helping people, and representative of an attribute-based and matrix technique. Will incorporate triadic elicitation.
- **Process Mapping:** Selected because it is a structured technique that can elicit and capture event-based knowledge.
- **Decision Tree:** Selected because it is a structured technique that can elicit and capture knowledge of decisions.
- **Concept Map of Life Goals:** Selected because it is a structured technique that can elicit and capture knowledge of goals, aspirations and motivations.
- **Concept Map of Attitudes:** Selected because it is a structured technique that can elicit and capture knowledge of attitudes.
- **State Transition Network:** Selected because it is a structured technique that can elicit and capture behavioural and emotional knowledge.
- **Interview Review:** Selected because it is representative of a diary-based technique.

4.1.7 Define Initial Method for each Technique

Using the initial set of techniques just described together with relevant background literature, time/complexity criteria and ontology-generation criteria, this task produced initial methods for each technique for use in the pilot study. A brief account of each method used in the pilot study is given in Appendix C. Detailed accounts of those techniques used in the main study are given in the appropriate places in chapters 5-7.

4.1.8 Perform Pilot Assessment

Using the initial set of techniques to assess, the initial methods for each technique, the

pilot participants and initial methods of assessment, this task produced a number of general findings from the pilot study, and assessment data from the pilot study.

A brief description of these findings is outlined below, to indicate which techniques were selected and which were rejected for use in the main study. Full descriptions of the findings, where relevant, are included in the appropriate later chapters.

4.1.8.1 Interview - Findings from the Pilot Study

The semi-structured interview technique was very well received by participants. Words such as ‘interesting’, ‘thought-provoking’ and ‘enlightening’ appeared on a number of feedback questionnaires. Almost all the questions were found to initiate interesting responses and discussions, particularly those concerning parents and significant others. Some questions, however, were found to be a little confusing and ambiguous by some people, especially the question describing oneself as another person would. Such questions were re-worded as the pilot study progressed to ensure more clarity. More results can be found in chapter 5. Once transcribed, the interview transcript proved extremely useful in preparing for subsequent sessions using other techniques.

4.1.8.2 Laddering - Findings from the Pilot Study

Showing concept ladders to participants did not prove very useful or revealing. Some corrections were made to basic facts such as the names of people and places. However, the use of the technique to prompt for new knowledge by structuring categories was not deemed a success. Perhaps this was due to the lack of time spent on the technique (only about 10 minutes), or was due to not enough focus on the less factual categories such as attitudes and expectations. Although the concept ladder was not found to be very successful, use of the attribute ladder and event ladder were found useful as part of the repertory grid and event diagram techniques, respectively, as described below.

4.1.8.3 Repertory Grid - Findings from the Pilot Study

Participants reacted positively to the repertory grid sessions, with words such as ‘interesting’, ‘enjoyable’ and ‘enlightening’ appearing on the feedback questionnaires. However, it was also noted by some that the sessions were ‘quite long’ and ‘a bit repetitive’. The grids that worked best were those on self, people and events. With these grids, participants saw similarities between elements and similarities between

constructs. The grids on relationship and decisions did not work so well in this way. In particular, a grid involving both events and decisions proved confusing as different constructs were used for each.

4.1.8.4 Event Diagrams - Findings from the Pilot Study

The event diagram technique proved very useful in capturing aspects of key events in the participant's life. The representation used, adopted from a process mapping approach, was found to work very well and created clear diagrams. This diagrammatic format proved particularly good at prompting the participant to explore the way in which events had changed their mood, abilities, attitudes or life situation and how these had then enabled other events to occur.

4.1.8.5 Decision Tree - Findings from the Pilot Study

The decision tree technique was found to work well at exploring and capturing the elements that make up a key life decision. However, it was found to take only about 20 minutes to perform fully, hence for later sessions it was combined with the concept map of life goals described next.

4.1.8.6 Concept Map of Life Goals - Findings from the Pilot Study

Initially a concept map of life goals was constructed from scratch, and although it was found rather a struggle to elicit nodes from the participant, the result was comprehensive and thought useful by the participant. In later sessions, this technique was combined with the decision tree. In this way, the decision tree was used to capture elements around one key decision. The elements were then discussed as to their more general properties, which led to identification of a number of nodes that provided a good starting point for the concept map of life goals. This combined technique was judged a success and resulted in two clear, readable and useful diagrams.

4.1.8.7 Concept Map of Attitudes - Findings from the Pilot Study

The concept map of attitudes was found to be quite hard for the participant, as the diagram soon became quite complex and difficult to read. Many of the probe questions concerning second order attitudes (e.g. what is your attitude about your feelings towards your job) were not found to prompt the participant to reveal anything very interesting. In addition, the final diagram was very tangled and difficult to interpret. Altogether, the technique was not deemed a success.

4.1.8.8 State Transition Network - Findings from the Pilot Study

Producing a state transition diagram was found to be very smooth once a number of states had first been established. Prompt questions on what made the participant go from one state to another were found to capture and reveal useful insights. The result was a clear, readable diagram. The technique was deemed promising enough to include in the main study.

4.1.8.9 Interview Review - Findings from the Pilot Study

A number of participants were shown a transcript of the interview that had taken place about 9-12 months earlier. Feedback indicated that participants were reminded of how they had felt and how much things had changed in their life. A number were struck by how honest and open they had been during the initial interview, and some noted that it was interesting to see what had seemed important a number of months previously. The technique was found to be very promising.

4.1.8.10 Summary of Pilot Assessment of Techniques

In summary, the results of the pilot assessments indicated that the following 8 techniques showed promise as Personal Knowledge Techniques and should be assessed in the main study.

- **Semi-structured interview**, requiring some refinement of questions
- Repertory grid using aspects of the self and other people as elements (to be called the '**people grid**')
- Repertory grid using events and time periods in the person's life as elements (to be called the '**events/periods grid**')
- Event diagrams based upon a process mapping format from the PCPACK Control Editor tool (to be called the '**event diagram technique**')
- Use of a state transition network to elicit behaviours, moods and emotions (to be called the '**state diagram technique**')
- A combined technique of a decision tree followed by a concept map of life goals (to be called the '**aspirations technique**')
- **Interview review** using the transcript of the semi-structured interview

4.1.8.11 Assessment Methods - Findings from the Pilot Study

The open-ended questionnaires proved very useful in gaining feedback from the participants concerning each of the sessions. In total, 17 questionnaires were received from participants. Unfortunately, many questionnaires were not returned or were lost in the intervening time. This indicated that more rigour should be enforced when gaining feedback from each participant using the questionnaire.

When asked for 2 or 3 adjectives describing general impressions of the session, most participants entered 3 adjectives per questionnaire. From the questionnaires received, a total of 16 different adjectives were used to describe the relevant session. Table 5 shows those adjectives appearing more than once, together with the number of occurrences that appeared on the questionnaires. As shown in the table, the most popular impressions of the sessions as a whole were that they were “interesting” and “thought-provoking”. Other common descriptors used were “enlightening” and “insightful”. However, on the down side, some participants noted that a session was “difficult”, “demanding” or “tiring”. The most popular adjectives (interesting, thought-provoking, enlightening and difficult/demanding) were later used in the questions for the rating scales used in the main study.

Adjective	Number of responses
Interesting	7
Thought-provoking	5
Enlightening	3
Difficult/Demanding/Tiring	3
Challenging	2
Insightful	2
Personal	2
Fun/Enjoyable	2

Table 5. Adjectives used by the participants to describe the sessions in the pilot study

4.2 Design for the Main study

The pilot study was somewhat exploratory in nature and did not employ a firm structure nor any rigorous practices to assess the techniques employed. Rather, it focused on developing and evolving the techniques with the involvement and help of the participants. For a rigorous research design, it was required that the techniques being assessed are compared to a standard technique acting as a control.

4.2.1 Choice of Control Technique

The most obvious choice for a control technique is a personality type indicator, since these both map an aspect of a person's self-knowledge and can provide information that aims to increase self-awareness. The criteria used to select the control technique were as follows. Is the technique widely used? Has the technique a credible validity and reliability? Has the technique been shown to aid self-awareness? Can the technique be applied within a 1-hour time slot? Are any exorbitant costs involved, for example in training or copyright?

Four personality techniques were considered contenders based on their widespread use and credibility of validity and reliability: Myers-Briggs Type Indicator (Quenk, 2000), OPQ (Matthews *et al.*, 1990), 16PF (Cattell, 1981) and Keirsey Temperament Sorter (Keirsey & Bates, 1984). OPQ and 16PF can be eliminated since they are primarily personality scales used to provide a dependent variable in psychological studies, and are rarely used in self-awareness settings. The Myers-Briggs Type Indicator and the Keirsey Temperament Sorter are widely used to increase self-awareness.

The Myers-Briggs Type Indicator (MBTI) is the most widely used technique for personal development purposes in organisational contexts. The MBTI is a questionnaire-based method that categorises a person into one of 16 types based on their scores on 4 dimensions. The theoretical basis comes from Jungian psychoanalysis. The 4 dimensions are extroversion-introversion, feeling-thinking, judging-perception and intuition-sensing. Typical uses of the MBTI are for career counselling, team building and for general self-awareness. However, there are a number of drawbacks to the use of MBTI. First, the publishers control its use and only those attending a training course are allowed to administer MBTI without breaking copyright laws (the cost of this course is currently over £1000, and was outside the budget of this research). Second, MBTI workshops typically take 3 hours excluding time to complete the questionnaire. During the workshop the theory behind the MBTI is fully explained, and participants self-report their type before results of their questionnaire are given to them. Any discrepancies of their self-reported type and questionnaire type are then explored, as are the ways in which the person can change from category to category depending on what role they are in.

The Keirsey Temperament Sorter is very similar to the MBTI, and was developed by

two experts in the use of MBTI (Keirsey & Bates, 1984). On the surface, it is virtually identical to MBTI, categorising people into 16 types based on Jungian theory. Indeed, the 4 dimensions used to produce the 16 types are almost identical to the MBTI. The Keirsey Temperament Sorter can be considered a cut-down version of the MBTI, aimed more at self-help rather than a stricter measure of personality type. However, it has been shown to correlate significantly with the MBTI such that the same underlying constructs are being measured (Tucker & Gillespie, 1993). A major advantage is that it is freely available, being accessible over the internet. For these reasons, the Keirsey Temperament Sorter was selected as the control technique.

4.2.2 Overall Method for the Main Study

4.2.2.1 Session Plan

A plan for the sessions was developed so that all ten participants would be seen on eight occasions. The first session for all participants was the semi-structured interview technique. Excluding the interview review technique, the remaining six techniques were randomly assigned so that each participant assessed them in a different sequence. At the end of the first session, and the subsequent six sessions, the participant was given a questionnaire to complete (the ‘post-session questionnaire’), as shown in Appendix D. This questionnaire captured the participant’s opinions of the session. Participants were given the option to complete the questionnaire at the time or to take it away and complete it at their leisure then post it on.

Following the seventh session with each participant, the interview review technique was assessed. For this, each participant was sent a copy of the transcript from the semi-structured interview along with an instruction sheet on how to perform the interview review. This instruction sheet is shown in Appendix E.

The final session with each participant (the ‘feedback session’) comprised a review of all the techniques and of the study as a whole. This session used the agenda and materials shown in Appendix F.

All the sessions were tape-recorded. The first session (the semi-structured interview) and the final session (the feedback session) were transcribed in full. The other sessions were selectively transcribed dependent on the analysis required.

4.2.2.2 Tasks Performed for Each Participant

The tasks performed by the researcher for each participant in the main study are shown in Figure 10 (overleaf). This figure is in the form of a task diagram showing tasks as oval shapes, the information used and produced for/during sessions as shaded boxes and the tools used as clear boxes. A brief summary of this procedure follows.

As shown in the diagram, the semi-structured interview was followed by the transcription and analysis of the tape-recording. The analysis used the PCPACK Protocol Editor tool (see Appendix B) to identify the concepts, attributes, values and events. Using this information, the PCPACK Laddering tool was used to produce a concept ladder, an attribute ladder and event ladder.

The concept ladder was not used in any session, but proved useful in constructing the ontology and preparing for the repertory grid sessions. The attribute ladder was used during the people grid session. The event ladder was used during the event diagram session. The event diagram session also used provisional event diagrams created in and the PCPACK Control Editor tool. These were produced before the session using information taken from the interview transcript.

Each of the sessions produced a post-session questionnaire and various diagrams or grids. This information was collated and sorted in preparation for the feedback session.

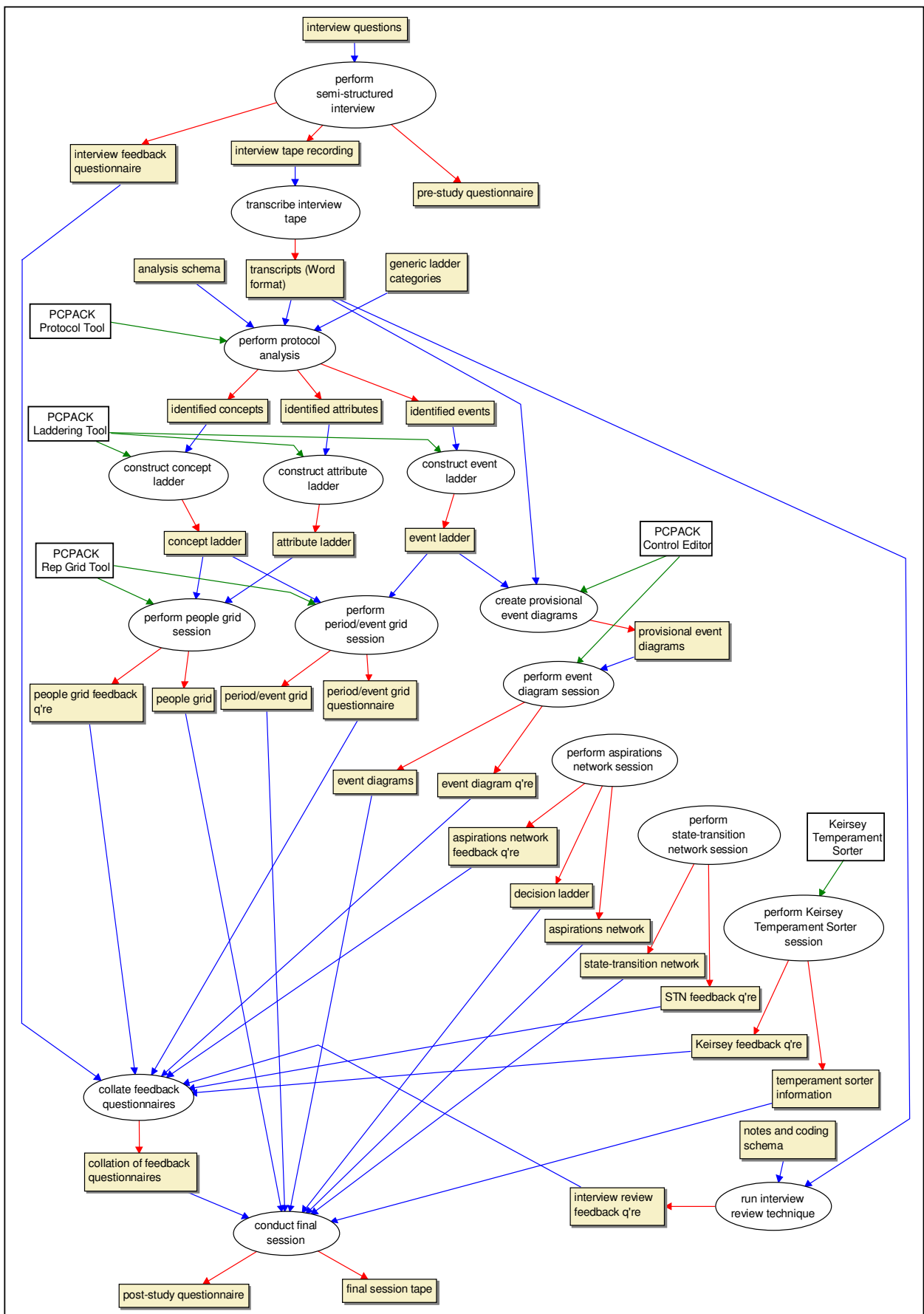


Figure 10: Task diagram showing the tasks performed for each participant in the main study

4.2.2.3 Analysis

Following the feedback session with each participant, a number of other tasks are conducted to analyse the ontological and assessment information collected:

- Use interview transcripts to segment interviews via questions into separate Word files for each question, then analyse the responses for general themes (using PCPACK Protocol Editor and Laddering tools)
- Perform analyses on the post-session questionnaires
- Analyse knowledge models and session transcripts to produce a generic ontology (using PCPACK Protocol Editor and Laddering tools)

4.3 Summary of the Research Design

Using the ideas presented in chapter 1, combined with the information found in the background material, and the work described in this chapter, the general research methodology can be summarised as follows.

The central aim is to develop a set of knowledge acquisition and modelling tools, simultaneously, on a fixed group of individuals, using a user-centred, spiral design approach. Evaluation will primarily use specially designed questionnaires to assess participants' attitudes to the techniques and the tools being developed. This overall approach is believed to be unique, since the development of knowledge acquisition techniques/tools is usually achieved in a piecemeal fashion (one or two at a time), on a varying group of experts, using relatively non-rigorous design and evaluation techniques. The research methodology will use co-operative enquiry and treat people as experts at being lay psychologists.

A combined top-down and bottom-up approach will be adopted. The top-down approach will draw upon relevant ideas and findings from a wide range of background material, especially techniques, tools and models from knowledge engineering. The bottom-up approach will be based on empirical data from a group of case studies. This will follow a basic knowledge acquisition method, starting with semi-structured interviews and moving on to more contrived techniques using some prototype computer-assisted techniques. The aim, then, will be to develop and assess the best set of techniques for use in the Personal Knowledge Methodology.

5 INTERVIEW-BASED TECHNIQUES

*I hate quotations. Tell me what you know.
(Ralph Waldo Emerson)*

This chapter covers the empirical work undertaken on two techniques based on an interview. The chapter is divided into two sections. The first section covers the use of a semi-structured interview technique to explore various aspects of the participant's personal knowledge, such as life events, traits, expectations, admired qualities and opinions. The second section covers the use of an interview review technique that provides the participant with an opportunity to read the transcript of the semi-structured interview (as described in the first part of the chapter) that took place many months previously. Each of these sections includes the method used to administer the techniques, the results obtained, a summary and discussion.

5.1 Semi- Structured Interview

5.1.1 Introduction

The interview technique, especially the semi-structured interview, is an essential technique for many knowledge acquisition methodologies. A semi-structured interview combines a highly structured agenda with the flexibility to ask subsequent questions. The questions for a semi-structured interview are ideally constructed some time before the interview and are sent to the expert so he/she can start to prepare responses. For an interview lasting 1 hour, around 10-15 questions would typically be asked. This allows time in between the prepared questions for the knowledge engineer to ask supplementary questions to clarify points and ask for more detail where necessary. An important aspect of the technique is that the interview is tape-recorded and later transcribed providing a protocol for detailed analysis. The way an interview is used as part of a knowledge acquisition project was covered previously in section 3.1.4. The results obtained for the semi-structured interview technique during the pilot study can be found in section 4.1.8.1.

5.1.1.1 Interview Design

In designing the questions for the interview, an exploration of two important issues was required, that of self-understanding and self-change. Hence, the main aim was to gain a good feel for how people view and talk about self-understanding and self-

change. This would provide the basis for later sessions that would use more contrived knowledge acquisition methods, such as repertory grid and concept mapping.

Two issues were key to the design of the interview:

1. The general research issues of self-understanding and self-change
2. The aim of developing various ways of representing people's knowledge, with which to both analyse the interviews and use in subsequent techniques.

To account for the first issue, it was decided to use the interview to elicit participant's views on self-understanding and self-change, i.e. how each comes about, what limitations there are on each of them, and how they interact. To account for the second issue, it was decided that the interview should elicit both event-based and belief-based knowledge. That is, to ask questions about events, opinions, attitudes, etc. For the repertory grid approach to be used, it was decided that a number of questions should focus on eliciting the traits that the participants use to describe and compare people (self and others).

The Biographical Inventory (De Waele & Harré, 1979) also influenced the design of the interview. This large-scale questionnaire details the issues that are associated with a person's life and contains the following parts:

- I. Microsociological framework
 1. Time Perspective
 2. Social ecology
 3. Socioeconomic living conditions
- II. Social psychological life-patterns
 1. Family and groups
 2. Cultural patterns of values, norms, expectations, and roles
 3. The institutional situation
- III. Individual characteristics: self and personality
 1. Self-description and interpretations
 2. Interests, occupational and leisure-time activities
 3. Goals, aspirations, and conflicts

It was decided that the three high-level categories of the Biographical Inventory would provide a good structure for the semi-structured interview. Hence, the interview should cover the same three main areas, i.e. life events, significant others, and self-knowledge.

Another influence on the interview design, was Self-Discrepancy theory (Higgins, 1987). This focuses on the differences between one's own views, and the views of

significant others, on three domains of the self: ‘actual self’, ‘ideal self’, and ‘ought self’. This perspective suggested that questions should be asked to elicit those qualities that the participant, and the participant’s significant others, would like the participant to have. A number of questions were included to cover this.

Since the effects, both positive and negative, of increased self-understanding are a key issue in this research, it was also decided to ask participants their opinions on the ways in which more self-knowledge might affect them.

Based on these influences and considerations, it was decided to structure the interview in the following way:

1. Life Events: Ask the participant to describe the major events of their life, and then describe in detail how specific events had changed them.
2. Significant Others and Personal Qualities: Ask the participant about the similarities between themselves and their parents, which people they admire and why, how they might change to have the admired qualities, the expectations their parents and close friends have of them, the expectations they have of themselves, and how they think people try to change each other.
3. Self-Knowledge: Ask the participant to describe themselves from another person’s perspective, the limits of self-knowledge, what they have discovered about themselves and how, and the ways in which knowing more about themselves might affect them.

In addition, the interview included a number of questions prior to these. These included asking the participant their attitude towards the study, how they were feeling, how much they had thought about the questions, whether they wanted any questions removing or re-wording, and whether they had any questions of the interviewee. Although this preamble gathered useful information, it was primarily aimed at easing the participant into the interview and making them feel comfortable and relaxed. This is an important first step in a semi-structured interview (Smith, 1995). The set of questions used in the interview is shown in Appendix G.

5.1.2 Method

5.1.2.1 Procedure

In recruiting participants, each was given a brief, verbal explanation of the research,

and asked if they would be interested in taking part. If interest was shown, the person was sent written information about the interview session, including instructions, a consent form, a list of the questions to be asked and contact numbers should any adverse effects occur. This material is shown in Appendix G.

After a week or two, the possible participants were asked if they would like to take part in the study. Of those that did, a time and place for the interview was agreed. All interviews took place privately in a place chosen by the participant. A number of different locations were used, e.g. a small office, a meeting room and the participant's home. At all times an informal atmosphere was maintained.

Before the interview the following points were stressed to the participant: the interview is strictly anonymous, and no one other than the researcher would know who took part; the participant should try to be as open and honest as possible; there are no right or wrong answers to the questions; the participant should indicate any question they are not happy about answering, and it would be passed over; the participant should feel free to discontinue his/her participation in the study or halt the interview at any stage.

The semi-structured interview, shown in Appendix G, was used. Supplementary questions were added to clarify and expand on the points raised. At times, prompts and suggestions were made by the researcher. All interviews were taped using a Sony recording walkman. For each interview, a single 90-minute audio cassette tape was used. This was used to impose a time limit on the interview; hence, if all questions had not been covered during the 90 minutes, the interview was halted, and these questions remained unasked.

At the end of the session, each participant was given the evaluation questionnaire shown in Appendix D. They were given the option of completing the questionnaire immediately (at the end of the interview session) or taking it away to fill-in over the next day or so. Participants were thanked for taking part and a brief explanation was made of what would happen next. Participants were not paid for taking part.

5.1.2.2 Content Analysis

All the interviews were tape-recorded and transcribed in full. This involved a straight transcription of all utterances, with added symbols to capture extra-linguistic information, i.e. long pauses, hesitation, interruptions, stressed words, changes of

subject matter, and emotion (e.g. laughter).

After all the interviews had been transcribed, analysis took place. In line with a Grounded Theory approach (Charmaz, 1995), no specific categories of knowledge were decided beforehand. Each question was analysed separately. First, the relevant sections from the separate transcripts were combined to produce documents containing all the responses to a particular question. These included segments of transcripts from participants in both the pilot study and the main study, such that in most cases, responses from 18 participants were included. Second, taking each question separately, the relevant document was entered into the PCPACK Protocol Editor tool. Using the highlighter pen function, all concepts of interest were marked. Care was taken to try to avoid identifying any categories of answers, but just to identify any relevant ideas and comments. Third, the PCPACK Laddering tool was used to group and classify concepts based on similarity. Nodes were added to create classes. For instance, all methods of change were grouped together under a new node called “methods of change”. The result was a taxonomic hierarchy of responses and types of responses. This analysis and laddering process was repeated for each question of the interview.

5.1.3 Results

This section is split into five parts. First, there is an analysis of the knowledge content captured during the session. Second, there is an analysis of the responses given to the open-ended questions on the feedback questionnaire. Third, there is an analysis of the scores given to the rating-scale questions on the feedback questionnaire. Fourth, there is an analysis of the verbal responses given during the feedback session that specifically addressed the interview technique. Fifth, there is a summary of each participant’s opinion of this technique.

5.1.3.1 Content Analysis

A brief summary of the responses to the semi-structured interview is as follows. A fuller analysis of the responses to each question is contained in Appendix H, which includes a number of quotes taken from the interview transcripts to illustrate the categories of responses. For brevity, the following summary does not include all of the questions asked.

Question: *I’d like you give me a very brief description of your life so far. Just the*

major events. **Responses:** The three most common categories of responses described events associated with (1) starting, ending or attending a place of education, (2) starting, ending or moving job, and (3) births.

Question: *I'd like you to choose one of these events, and describe how you think it may have changed you.* **Responses:** The three most common categories of responses described changes in (1) perspective, priorities and goals, (2) traits, and (3) attitudes to relationships.

Question: *During the time you've been working for this company, what events have shaped your career?* **Responses:** The three most common categories of responses described events associated with (1) change in job, (2) courses and qualifications, and (3) exposure to high-level management.

Question: *How do you think you are similar or different to your parents?* **Responses:** The three most common categories of responses described similarities and differences associated with (1) simple trait descriptions, (2) perspective on life, and (3) emotion-related aspects.

Question: *What effects generally do you think a person's parents have on them?* **Responses:** The three most common categories of responses described effects associated with (1) morals and values, (2) behaviours, and (3) attitudes and perspective.

Question: *What expectations do you think people have of you? (e.g. parents, partner, close friends, boss, work colleagues).* **Responses:** The two most common categories of responses relating to expectations from parents were associated with (1) success, and (2) feeling proud. The two most common categories of responses relating to expectations from partner and close friends were associated with (1) morality, and (2) being a source of knowledge and advice.

Question: *What expectations do you have of yourself?* **Responses:** The three most common categories of responses described expectations associated with (1) success in everything, (2) happiness, and (3) being honest, fair and nice.

Question: *What qualities do you admire in people?* **Responses:** The three most common categories of responses described qualities associated with (1) tenacity and ability to cope, (2) kindness, compassion and helpfulness, and (3) social and

relationship skills.

Question: *How do people try to change the people they know?* **Responses:** The two most common categories of responses described mechanisms associated with (1) verbal means (such as openly talking, shouting and cajoling), and (2) behavioural means (such as manoeuvring, being unpleasant, and leading by example).

Question: *I'd like you to think of yourself as if you were another person looking from outside at yourself. What sort of person does this other person think you are?*

Responses: The three most common categories of responses described qualities associated with (1) helping and caring, (2) sociability, and (3) assertiveness.

Question: *Do you think there are things that no one can really know about themselves?* **Responses:** Most people were in agreement that there was knowledge that one can never really know about oneself. The three most common categories of responses were associated with (1) knowledge of the future, (2) knowledge of the past, and (3) how one is perceived by others.

Question: *During your life, what have you discovered about yourself? How did this happen?* **Responses:** The three most common categories of responses described discoveries associated with (1) personality traits, (2) behaviours, and (3) reactions. When describing the mechanisms of change, the three most common categories of responses were (1) conversations, (2) specific events or experiences, and (3) thinking.

5.1.3.2 Feedback questionnaire - Open-ended questions

Directly following the interview, each participant completed a feedback questionnaire containing four questions on their reactions to the use of the semi-structured interview technique. An analysis of the responses from the 18 questionnaires (from the pilot study and main study) is as follows.

What were your general impressions of the interview? (2-3 adjectives please)

From the 18 questionnaires received, a total of 42 entries were made to describe the general impressions of the interview session. The most popular impressions of the session were “interesting” used by 7 participants and “thought-provoking” used by 6 participants. “Challenging” was used by 4 participants, and “relaxed”, “enjoyable”/“fun” and “enlightening” were each used by 3 participants. Of the 42 entries, the majority gave a positive reaction to the session. 6 negative impressions

were made, which were “difficult”, “demanding”, “tiring”, “long”, “frightening” and “discomforting”.

What was good about the interview?

Analysis revealed 5 main categories of responses of what was good about the interview. First, 7 participants felt the session was good because it **provoked thought**, such as “it made me think in some depth about myself and my life” and “it made me think about the broader influences on me”. Second, 4 participants felt the session was good because it was **non-intrusive and non-judgmental**, such as “the interviewer wasn't too intrusive, didn't interrupt” and “the ability to express one's views without question or any future comeback”. Third, 4 participants felt the session was good because the **questions were available beforehand**, such as “it helped to have the questions in advance”. Fourth, 3 participants felt the session was good because it was **a learning experience**, such as “I saw a pattern I hadn't seen before” and “I found it very useful and interesting to reflect on issues such as how my parents have affected my life, what qualities are important to me, etc.”. Fifth, 3 participants felt the session was good because it was **relaxed**, such as “I felt relaxed throughout”.

What was poor about the interview?

Of the 18 questionnaires received, 10 participants made comments on what was poor about the interview. Analysis revealed 3 main categories of responses. First, 5 participants felt the session was poor because the questions **lacked clarity**, such as “it was difficult to know exactly what you were asking” and “difficulty in understanding the reason for some areas of discussion”. Second, 2 participants felt the session was poor because the questions were **repetitive**, such as “some questions seemed to repeat themselves”. Third, 2 participants felt the session was poor because it was **being taped**, such as “the fact it was being taped was a bit off-putting”.

Please describe anything in the interview that made you think about things you hadn't (consciously) thought before, or helped give you a greater understanding of yourself?

Of the 18 participants, 15 provided responses to this question. Analysis revealed three main categories of responses. First, 6 participants felt the session provided an opportunity for **more in-depth thought** on issues, such as “I had thought about most of the things before but not in so much depth perhaps” and “in the past I had vaguely

thought about them”. Second, 6 participants described **specific new thoughts** (see below). Third, 3 participants felt the session provided an opportunity to **articulate one’s thoughts**, such as “just talking openly to someone you haven’t met before helps the understanding” and “it wasn’t so much that they hadn’t occurred to me, more that I hadn’t had to articulate the thoughts before”.

Further analysis identified 4 main categories of interview questions that were particularly thought-provoking or revealing. First, questions associated with **parents**, such as “the question about my similarities and differences with my parents made me think about the reasons for my behaviour towards them”. Second, the question concerning **viewing oneself from another’s perspective**, such as “only one question was particularly thought-provoking from the point of view of having not really asked myself that particular question and that was the question asking me to consider myself from another person’s perspective”. Third, the question concerning **other’s expectations of oneself**, such as “I hadn’t considered people’s expectations of me before”. Fourth, the question concerning **influential life events**, such as “situations in my life that may have had an effect on the way I am”.

5.1.3.3 Feedback questionnaire – Rating scales

Directly following the interview session, each of the 10 participants in the main study completed a rating-scale questionnaire. The questionnaire contained 6 questions each with a Likert-type rating scale from 1 to 7 (see the second sheet of Appendix D).

The results of the questionnaire ratings were compared to explore any differences due to gender, age or qualifications. Table 6 shows average values and standard deviations (in brackets) for these demographic variables. As shown in the table, there were no clear differences in the scoring based on gender, age and qualifications. No statistics were performed due to the low number of participants involved.

Rating	All	Gender		Age		Qualifications	
		Male	Female	<40 yrs	>40 yrs	Non-Grad	Graduate
Interesting	6.00 (0.47)	6.00 (0.63)	6.00 (0.0)	6.00 (0.0)	6.00 (0.71)	6.00 (0.0)	6.00 (0.63)
Thought-provoking	5.80 (0.79)	5.67 (0.82)	6.00 (0.82)	6.00 (0.71)	5.60 (0.89)	6.00 (0.82)	5.67 (0.82)
Enlightening	4.30 (1.06)	4.00 (1.26)	4.75 (0.50)	4.80 (0.45)	3.80 (1.30)	4.50 (0.58)	4.17 (1.33)
Demanding / Difficult	3.70 (1.25)	3.83 (1.47)	3.50 (1.00)	3.20 (1.10)	4.20 (1.30)	4.25 (1.50)	3.33 (1.03)
Openness	5.80 (1.14)	5.83 (0.98)	5.75 (1.50)	5.80 (1.30)	5.80 (1.10)	5.50 (1.29)	6.00 (1.10)
Recommend'n	5.40 (1.17)	5.17 (1.33)	5.75 (0.96)	5.40 (0.55)	5.40 (1.67)	5.25 (1.71)	5.50 (0.84)

Table 6: Comparison of the means and SDs of the questionnaire ratings for the interview based on the gender, age and qualifications of the participants

Table 7 shows the mean and standard deviation of ratings for the interview as compared to those from the other techniques being assessed.

SUBJECT OF RATING	INTERVIEW		ALL OTHER TECHNIQUES	
	Mean	Std Dev.	Mean	Ave Std Dev.
INTERESTING	6.0	0.47	5.40	1.09
THOUGHT-PROVOKING	5.8	0.79	5.22	1.17
ENLIGHTENING	4.3	1.06	4.52	1.29
DEMANDING / DIFFICULT	3.7	1.25	3.59	1.30
OPENNESS	5.8	1.14	6.35	0.57
RECOMMENDATION	5.4	1.17	5.36	0.97

Table 7: The means and SDs of the questionnaire ratings for the interview compared to the means and SDs of the ratings for the other techniques being assessed

As shown in the table, the interview technique was generally rated as being more **interesting** and more **thought-provoking** than the other techniques.

5.1.3.4 Verbal feedback from the feedback session

After the completion of all the sessions that assessed each individual technique, a feedback session was held with each of the 10 participants in the main study to gain more feedback on the techniques as a whole. These sessions were held about 9 months after the initial interview had taken place. An analysis of the responses from the feedback sessions that specifically addressed the semi-structured interview technique is described below.

How beneficial was the session?

In general, all ten participants felt that the interview session that had taken place a number of months previously had been beneficial. Analysis revealed 4 categories of responses. First, five participants felt the session had been **revealing**, such as “I made links I hadn’t consciously thought before” and “I started to identify a few things I hadn’t realised about myself”. Second, three participants felt the session had allowed them to **examine and articulate** issues not normally talked about, such as “I said things I’d only thought about before and never said” and “it made you examine things you don’t normally do, such as behaviours and choices”. Fourth, one participant felt the session had been **interesting but not useful**, making the comment “it was interesting and thought-provoking but not enlightening or revealing”. Fourth, one participant felt the session had been very useful as **an ice-breaker** for the rest of the study.

Did any changes in thinking or behaviour result from the session?

Six participants felt that changes had resulted from the session. Three participants felt they had **thought more about certain things**, such as “made me think more about relationships in the workplace”, “I’m beginning to realise how important it is to think about the way you are” and “organising my thoughts more”. Two participants noted **small changes**, such as “a tweak in personality rather than major change” and “the act of recalling events from the past may subconsciously have affected me”. One participant noted a change in **behaviour**, making the comment “I might try and get out more and to travel a little bit more”.

What uses is the interview transcript to you?

Seven participants suggested personal uses of the interview. Analysis revealed three main categories of responses. First, 3 participants gave responses associated with the **benefits** of doing the interview (which overlapped with the question concerning the benefits already described), such as “it’s very useful as a feedback and counselling session”, “it allows you to take stock of yourself” and “it’s a better learning tool about yourself than psychometric tests and things like that”. Second, 2 participants gave responses concerned with **repeating the interview** at a later date and comparing the responses, such as “if we did it again, you might see quite a considerable difference”. Third, 2 participants gave responses concerning the use of the transcript in an

interview review, such as “I’d like to look back on it in a few years time”.

What uses is the interview transcript to other people?

Eight participants suggested uses of the interview transcript by other people. Four participants suggested a use in **aiding interpersonal understanding**, such as “if people understand what is happening in your life, and what is a high priority for you, they may better understand some of the decisions you make and then respect you for them more”. Four participants suggested **uses at work**, such as “repeating and comparing answers may be helpful from a personal development point of view” and “it would be useful for a mentor and employee development advisor”. Third, 2 participants suggested uses by **professionals**, such as “if they can decipher it, things like marketing” and “maybe it’s useful to somebody in HR”. Fourth, 2 participants suggested uses at home by **significant others**, such as “my partner read it and was very intrigued by it, and I was interested in how it agreed with what she thought about me”.

Would you like to see other people’s interview transcript?

The general opinion was that participant’s would be interested to see other’s people’s transcripts. They seemed to indicate that seeing other people’s transcripts would be more useful than other people seeing their transcript. Analysis revealed three other categories of responses. There were various descriptions on **whose transcript** they would like to see, such as “someone you can relate to - an acquaintance”, “if I knew them”, and “if they were happy to”. An important factor described was the need for **the right context and the need for trust**, such as “it depends on context – your views could be held against you at a later date” and “the key word is trust – you’d need a good relationship to share things”. Analysis of the benefits that could be gained revealed four categories. First, a benefit of **increased understanding**, such as “to improve understanding of their personality”. Second, a benefit of **seeing other’s difficulties**, such as “seeing the confusion, or the anxiety, or whatever, that lies behind the façade”. Third, a benefit of seeing the **difference between oneself and others**, such as “to see how their answers differed from mine”. Fourth, a benefit in **relationships**, such as “outside work, for relationship counselling”.

How could the interview technique be improved?

Nine participants made suggested improvements. Analysis revealed three main categories of responses. Four participants suggested improving the **questions**, such as “maybe change the direction of some of the questions” and “a good choice of questions, but incomplete”. Three participants emphasised the importance of the **context and purpose**, making comments such as “improvements would depend on the desired output” and “if I were to use it, it would have to be clear on the purpose and outcomes”. Two participants suggested changes to the **style and environment** of the interview, such as “the person interviewing is critical - the prompting and direction” and “moving the interview to different locations would have helped”.

5.1.3.5 General Opinions from Each Participant

To conclude this section of results, Table 8 presents the general opinions of each participant in the main study to the interview technique taken from various sources.

Par't	General impressions	Rank	How beneficial was the session
A	Interesting, Self-satisfying	1	Very useful. Forces you to talk and think about the issues. Knew most of it, so interesting & thought-provoking but not enlightening or revealing.
G	Structured, Relaxed	1	A vehicle for things floating to front of mind. Useful to identify events not thought were as important as they were.
H	It was long	2	I hadn't considered people's expectations of me before, so that provoked some thought, and it also provoked some discussion last night with my husband.
B	Very professional and also relaxed.	4	It made me realise I'd been a bit of a stick-in-the-mud, and that circumstances had just prevented things and there was nothing I could do about it.
D	Frightening, Interesting, Enjoyable	4	Very useful because it was a breaking the ice session. Need some context for the other techniques. Need to get used to the person and what they're trying to do.
E	Thought-provoking, Enjoyable	4	The questions on the sheet were good as were the other questions, which pushed things further and challenged what I thought.
I	Thought-provoking, Challenging	4	Made you talk about and think about things & examine things not normally do, e.g. behaviours and choices.
C	Challenging, Discomforting	6	The questions were ones you seldom think about or are asked about – offered almost a complete analysis. I made links not consciously thought before.
F	Relaxed. Interesting.	6	Started to identify a few things I hadn't realised about myself, and how lots of things were inter-linked.
J	Open, honest, natural	7	I'm used to this style, so I was comfortable and relaxed and could open up to a stranger. I said things I'd only thought about before and never said.

Table 8: General opinion and ranking from each participant in the main study to the semi-structured interview

The first column of Table 8 shows a code letter for the participants. The second column shows the entries made on the post-session questionnaire to the question "What were your general impressions of the session?". The third and fourth columns

display opinions taken from the feedback session. Column three shows how each participant ranked the interview technique compared to the other seven techniques. Column four shows representative verbal statements made by each participant to the question "How beneficial was the session, what was revealed, how was it revealed?".

5.1.4 Summary and Discussion

5.1.4.1 Summary of Results

Responses to the interview questions provided a multitude of response categories, the main ones being as follows. The main life events mentioned were associated with **starting, ending or attending a place of education**, whilst the main events described in detail as causing changes were associated with **relationships with significant others**. The main way in which such events caused changes was in terms of changes in **perspective, priorities and goals**. When the participants compared themselves to their parents, the main descriptors used were traits especially those associated with **quietness and sociability**. Most participants noted that parents have a large effect upon their children, the main way being in providing **morals and values**. The main expectations from parents were associated with the **success** of their child, whilst the main expectations from partner and close friends were associated with **morality**. The main expectations of oneself was to be **successful in everything one does**. The main quality admired in other people was their **tenacity and ability to cope**, and the main method of achieving a change to one's admired qualities was via **self-monitoring and self-control**. The main way in which people try to change other people was via **verbal means**. When describing oneself, the main category of responses was associated with being **helpful and caring**. The main discovery about oneself during one's life was associated with **personality traits**. Most participants were of the opinion that knowing more about oneself would be useful.

The 18 post-interview questionnaires (from both the pilot and main study) revealed that 7 participants described the session as being **interesting**, 6 participants described the session as **thought-provoking** and 4 participants described the session as **challenging**. Comments about what was good about the session included 7 participants who felt the session **provoked thought**. Comments about what was poor about the session included 5 participants who felt that some of the questions **lacked clarity**. 6 participants felt the session provided an **opportunity to think in more**

depth about issues, and a further 6 participants felt **particular new thoughts had been revealed**.

Ratings on the post-interview questionnaire revealed that there were no significant differences in the scoring based on gender, age and qualifications. Comparison between the ratings of all the techniques being assessed showed that participants felt they were less **open** during the interview when describing very personal matters than during the other techniques.

Results from the feedback session held a number of months after the interview session showed that 5 participants felt the session had been **revealing** and 3 participants felt the session had allowed them to **think about, examine and articulate** issues not normally talked about. Six participants felt that changes in thinking/behaviour had resulted from the session, three feeling that they had **thought more about certain things**. Seven participants made suggestions for personal uses of the interview technique, including 3 participants suggesting uses in helping **thinking more about things**. Suggestions for uses by other people included 4 participants suggesting use in **aiding understanding by others** and 4 participants suggesting uses in **various work situations**. Suggestions for possible improvements included 4 participants who suggested making improvements and additions to the **questions**, and 2 participants who suggested changes to the **style and environment** of the interview.

When ranking all the techniques being assessed (during the final feedback session), 3 participants placed the interview technique in their top three, and 3 participants placed the interview technique in their bottom three.

5.1.4.2 Discussion

The semi-structured interviews provided a large and rich source of personal knowledge. This knowledge can be viewed as operating at two levels. First, there is the level of personal knowledge concerning such aspects as life events, traits, behaviours, opinions, etc. Second, there is meta-knowledge, i.e. the knowledge participants have of their personal knowledge. The following two paragraphs examine each of these in turn.

Analysis of the personal knowledge produced numerous categories in various areas of knowledge (as covered in Appendix H). These categories have a number of uses. They

offer the basis for a lay psychological theory of personal knowledge. As such, they can be fed into the ontology required by the Personal Knowledge Methodology (to be described in chapter 8). Via this ontology, such categories could be used in future analyses of interview transcripts (possibly semi-automated). They can also be used as categories of answers for the participants to select from during the interview. In this way, the participants would be provided with a structured way of answering. Perhaps this could follow the kind of responses that participants were found to make to the questions in this study. In general, this included three aspects. First, there were responses that commented on the question, and any inherent assumptions that may be present. Second, there was the main theme of the response, such as might be selected from a list of ontological categories. Third, there were examples and anecdotes that illustrated the main response. In this way, a move might be made towards automation of the interview technique. This would also make the arduous task of transcribing and analysing the interviews less time-consuming and difficult. A major problem with the interview technique, compared to the types of technique to be covered in the following two chapters, is the time-consuming nature of the analysis.

At the level of meta-knowledge, a number of questions were included in the design of the interview to elicit this form of knowledge. Although opinions varied across the participants, a number of ideas emerged that have a direct influence on the development of the Personal Knowledge Methodology. First, most participants believed it is beneficial to learn more about oneself, with only a small number believing that this is not beneficial, and is perhaps detrimental. Obviously, people of the latter opinion would either not be interested in using the Personal Knowledge Methodology, or should be warned when using it of the problems that may occur. Opinions on such problems included becoming too analytical/concerned and revealing maladaptive thoughts. Second, various opinions on the ways in which more self-knowledge can be beneficial were captured. These included help in recognising and changing one's behaviour, dealing with difficulties, understanding other people, motivation and confidence. Perhaps advice could be included in the Personal Knowledge Methodology of what techniques might facilitate such benefits and what other means are available. Third, opinions on how people change were captured. These included verbal means (such as conversations), experiences (such as key events and other's behaviours), thinking and special courses/techniques. In various forms,

each of these ‘natural’ methods of change could be included in the Personal Knowledge Methodology. Fourth, opinions of what knowledge can be learned about oneself. These included discovering more about one’s personality traits, behaviours, reactions, likes/dislikes, needs, goals and abilities. Once again, such categories could be built into the Personal Knowledge Methodology to advise on which techniques facilitate the discovery of which types of knowledge. More detail and implications on these issues will be covered in chapter 9.

As well as providing knowledge at the two levels just discussed, the semi-structured interview provided an efficient way of leading into the other techniques to be covered in this and the following two chapters. Based on this evidence, and on the use of interviews in knowledge engineering, it seems clear that an interview technique would always be useful as the first technique to be used by a user of the Personal Knowledge Methodology.

A number of encouraging findings emerged from the post-session questionnaire and feedback session. Participants’ reactions to the interview were generally very positive in the post-session questionnaire, with a number describing the session as interesting and thought-provoking. A common reaction from participants was that it was useful to have the opportunity to talk about and examine things that are not normally talked about. In addition, a number of participants noted that new thoughts had been revealed. These positive reactions were reflected in the rankings made during the feedback session with 7 of the 10 participants in the main study placing the interview technique in their top 4 of the 8 techniques being assessed.

A number of problems and possible improvements to the semi-structured interview have been revealed. The main problem identified by the participants was a lack of clarity in some questions. The use of a more structured answering system and advice on what knowledge can be captured (as described above) could both be used to help clarify the questions and provide a context for their use. Some development in the wording of the questions took place from the pilot study to the main study. This evolving nature of the questions is an example of the wider mechanism in the Personal Knowledge Methodology to have constant feedback and improvements in the techniques.

As a final point, a wealth of personal knowledge was captured during the interviews

such that a complete analysis could cover the remainder of this thesis, and is thus beyond the scope of the present research aims. It would be very useful in the development of the Personal Knowledge Methodology that further analyses take place. This is especially true if the interview were to be automated. In this case, an analysis of the interviewer's utterances (further questions, prompts, clarifying comments, etc.) would be beneficial.

Further discussion and comparison to the other techniques will be covered in chapters 8 and 9.

5.2 Interview Review Technique

5.2.1 Introduction

The starting point for the interview review technique is the transcript of the semi-structured interview. Some time after the interview, the participant is given a copy of the transcript, asked to read it and provide feedback. This technique is not part of the usual repertoire of techniques used by knowledge engineers, but has its roots in the diary techniques used for therapeutic purposes (as described in section 2.2.3). During the pilot study of this research, the interview review technique was tested and found to provide good reactions from participants. More information on this can be found in Appendix C and section 4.1.8.9.

5.2.2 Materials

This technique requires three documents:

1. A copy of the transcript of the semi-structured interview that took place in the first session with the participant. This is printed on A4 paper, with enough room in the margin to allow comments to be made (about 3cm is appropriate). The questions and comments made by the interviewer during the session are shown in bold font to distinguish them from the responses made by the participant. For further clarity, lines are included to separate each question from the next.
2. A sheet of instructions detailing what the participant should do for the interview review. This instruction sheet is shown in Appendix E.
3. An assessment questionnaire of the type used at the end of each of the sessions that assessed a single technique comprising both open-ended and rating-scale items. This questionnaire is shown in Appendix D.

5.2.3 Method

About 2-3 weeks after the 7th session with the participant (i.e. the last which evaluated a single technique), the participant is contacted to arrange a feedback session that would gain feedback on all the techniques and the study as a whole. During this conversation (invariably by phone), the interview review technique is introduced in the following way.

1. Explain that the initial interview conducted in the first session has been transcribed in full and that if the participant agrees this transcript will be sent to the participant to assess the usefulness of reviewing an interview transcript.
2. Explain that along with the transcript there will be sent an instruction sheet and an assessment questionnaire of the same type as used in each previous session. The participant is then asked if they would be willing to perform this interview review.
3. If the participant agrees, explain that this should be completed by the date of the feedback session, and that the participant should bring the resulting documents to that session for collection.
4. The transcript, the instruction sheet (shown in Appendix E) and an assessment questionnaire (shown in Appendix D) are then posted to the participant.
5. A few days before the arranged date for the feedback session, the participant is contacted to check if they have completed the interview review technique and assessment. If not, then the participant is asked if they will have time before the feedback session to complete this. If not, then the date of the feedback session is re-arranged to a date when the participant will have had time to complete the interview review.

5.2.4 Results

This section is split into five parts. First, there is an analysis of the knowledge content captured during the interview review. Second, there is an analysis of the responses given to the open-ended questions on the feedback questionnaire. Third, there is an analysis of the scores given to the rating-scale questions on the feedback questionnaire. Fourth, there is an analysis of verbal responses given during the feedback session that specifically addressed the interview review. Fifth, there is a summary of each participant's opinion of the interview review technique.

5.2.4.1 Content Analysis

The number of symbols marked on the transcript by each participant ranged from 19 to 80, and averaged 50. Of the total number of symbols, 78.9% were ticks (denoting agreement), 7.8% were exclamation marks (denoting surprise), 7.1% were asterisks (denoting something revealing), 3.8% were a cross (denoting disagreement) and 2.4% were question marks (denoting lack of understanding). 4 of the participants ticked

almost every paragraph. 1 participant took the opportunity to write notes in the margin explaining the reasons for a number of the marked symbols. 4 of the participants took the opportunity to make corrections to the transcript, such as names and dates.

5.2.4.2 Feedback questionnaire - Open-ended questions

Directly following the interview review, each participant completed a feedback questionnaire containing four questions on their reactions to the use of this technique. An analysis of the responses is as follows.

What were your general impressions of the interview review? (2-3 adjectives please)

From the 14 questionnaires received (from the pilot study and main study), a total of 28 entries were made to describe the general impressions of the interview review. The most popular impression was “surprising”, used by 4 participants. “Interesting” and “enlightening”/“revealing” were each used by 3 participants. A number of other impressions were associated with reflection, such as “intriguing”, “thought-provoking”, “reflective”, “useful reassessment” and “memory jogger”. Although four people described what they read as surprising, two people described the opposite idea, i.e. “agreed with what I said” and “familiar (like meeting an old friend)”. Of the 28 entries, the vast majority gave a positive reaction to the interview review. Only 3 negative entries were made: “OK, not sure of the point”, “disappointing” and “time-consuming”.

What was good about the interview review?

Analysis revealed five categories of responses. First, 5 participants felt the technique was good because it **provoked thought and reflection**, such as “stimulated quite a bit of thought”, “presented an opportunity to re-calibrate the interview” and “it gave me time to reflect on my attitudes and feelings at the time”. Second, 4 participants felt the technique was good as a **reminder**, such as “good to be reminded of what I was thinking a year ago” and “reminded me of things I’m not doing any more that I should be doing”. Third, 4 participants felt the technique was good because it identified **changes**, such as “it was interesting to see how I’ve changed my views over the past few months” and “enabled me to see how I’ve moved on and grown since then”. Fourth, 2 participants felt the technique was good because it was **surprising**, such as “I was quite surprised by some things I said”. Fifth, 2 participants felt the technique

was good because it revealed how **incoherent** one can be, such as “realised how incoherent you sometimes are”.

What was poor about the interview review?

Of the 14 questionnaires received, 8 participants made comments on what was poor about the interview review. Analysis revealed two categories of responses. First, 3 participants felt the technique was poor because of **what the participant said during the interview**, such as “my replies were not clear cut, too flowery, and not very professional” and “at times my responses were embarrassingly inarticulate”. Second, 2 participants felt the technique was poor because of the **time required**, such as “relied on my own time - struggled to complete” and “it took me an hour”.

Please describe anything in the interview review that made you think about things you hadn’t (consciously) thought before, or helped give you a greater understanding of yourself?

Of the 14 questionnaires received, 12 participants responded to this question. Analysis revealed four main categories of the ways the interview review helped lead to a greater understanding. First, 6 participants felt the technique led to more understanding about **one’s personality and life**, such as “I didn’t really realise that I had such a negative attitude towards myself”, “reminded me who I used to be and who I want to be again”, and “what factors have influenced the decisions I’ve made and helped shape me to be the person I am today”. Second, 3 participants felt the technique **instigated analysis and motivation for understanding**, such as “it felt as if I could look at myself from another viewpoint or as someone else would see me” and “it made me want to understand more about myself”. Third, 3 participants gave various opinions of the **style and timing** of the interview review, such as “it was quite reassuring” and “would perhaps like to have done this in, say, 5 years”. Fourth, 2 participants felt the technique led to more understanding of how **time and circumstances changes a person**, such as “how you think about yourself is coloured by what you’re doing at the time” and “something that was at the forefront of my mind in February is now something that I had almost completely forgotten”.

5.2.4.3 Feedback questionnaire – Rating scales

After performing the interview review, each of the 10 participants in the main study completed a rating-scale questionnaire (see the second sheet in Appendix D). The

questionnaire included 6 ratings with Likert-type scales from 1 to 7.

The results of the questionnaire ratings were compared to explore any differences due to gender, age or qualifications. Table 9 shows average values and standard deviations (in brackets) for these demographic variables.

Rating	All	Gender		Age		Qualifications	
		Male	Female	<40 yrs	>40 yrs	Non-Grad	Graduate
Interesting	5.40 (1.35)	5.00 (1.55)	6.00 (0.82)	5.80 (0.84)	5.00 (1.73)	6.25 (0.50)	4.83 (1.47)
Thought-provoking	5.10 (1.52)	4.83 (1.72)	5.50 (1.29)	5.60 (1.14)	4.60 (1.81)	6.25 (0.96)	4.33 (1.37)
Enlightening	4.20 (1.23)	4.00 (1.26)	4.50 (1.29)	4.80 (1.30)	3.60 (0.89)	4.75 (0.96)	3.83 (1.33)
Demanding / Difficult	3.80 (1.87)	3.67 (1.86)	4.00 (2.16)	4.40 (2.07)	3.20 (1.64)	4.25 (1.71)	3.50 (2.07)
Openness	6.50 (0.53)	6.33 (0.52)	6.75 (0.50)	6.40 (0.55)	6.60 (0.55)	6.50 (0.58)	6.50 (0.55)
Recommend'n	5.40 (1.58)	5.17 (1.47)	5.75 (1.89)	5.6 (1.95)	5.20 (1.30)	6.50 (0.58)	4.67 (1.63)

Table 9: Comparison of the means and SDs of the questionnaire ratings for the interview review based on the gender, age and qualifications of the participants

As shown in the table, there is little difference in the scoring based on gender and age, although there are differences based on qualifications. Non-graduates tended to rate the interview review as being more **thought-provoking** (mean=6.25) than graduates (mean=4.33). In addition, non-graduates tended to rate the interview review as being more **recommended** to others (mean=6.50) than graduate participants (mean=4.67). No statistics were performed due to the low number of participants involved.

Table 10 shows the mean and standard deviation of ratings for the interview review as compared to those from the other techniques being assessed.

SUBJECT OF RATING	INTERVIEW REVIEW		ALL OTHER TECHNIQUES	
	Mean	Std Dev.	Mean	Ave Std Dev.
INTERESTING	5.4	1.28	5.48	0.97
THOUGHT-PROVOKING	5.1	1.45	5.28	1.07
ENLIGHTENING	4.2	1.17	4.52	1.28
DEMANDING / DIFFICULT	3.8	1.78	3.51	1.25
OPENNESS	6.5	0.50	6.25	0.66
RECOMMENDATION	5.4	1.50	5.31	0.95

Table 10: The means and SDs of the questionnaire ratings for the interview review compared to the means and SDs of the ratings for the other techniques being assessed

As shown in the table, the interview review technique generally gained similar ratings to the average of the other techniques for all items on the questionnaire.

5.2.4.4 Verbal feedback from feedback session

After the completion of all the sessions that assessed each individual technique, a feedback session was held with each of the 10 participants in the main study to gain more feedback on the techniques as a whole. An analysis of the responses that specifically addressed the interview review is described below.

How beneficial was the interview review?

Analysis revealed 3 categories of responses, 2 being positive and 1 negative. First, five participants felt reviewing the transcript was **useful**, such as, “I can see that I have changed and that I can continue to change” and “it provided an opportunity to reassess some of the things I’d said and to question whether the incidents did present the meaning you thought they had”. Second, four participants felt reviewing the transcript was **enjoyable and/or interesting**, but not that useful, with comments such as “it was certainly very interesting, but I’m not sure how beneficial it was” and “it was quite surprising to see what you say and how you say it”. Third, one participant felt that reviewing the transcript was **neither useful nor interesting**, making the comment “I felt I was doing it for your benefit not mine”.

Has the interview review led to any changes in thoughts or behaviours?

Six participants commented that no changes had resulted from the interview review. The four who described changes made comments such as “I hadn’t realised how much I’d changed before I read that”, “how I react with people and how I learn from them - try to be more tolerant with boring people” and “it shows how differently you can feel”.

What uses is the interview review to you?

Eight participants made suggested uses. Analysis revealed two categories of responses. First, three participants suggested use in showing **how much a person has changed**, such as “useful as a measure of how I had changed” and “it would let me analyse how I’d changed, and if I had changed, in what way”. Second, three participants suggested use in **reviewing the way you thought or responded**, such as “it gives you a chance to review the way you think” and “it allows you to question why I said that - if it was

as important as I had presented it”.

How could the interview review be improved?

Four participants made suggested improvements. Two participants felt that a **longer period** between the interview and the review would have been better. Two participants felt that the **marking scheme** could be improved, making the comments “I was thinking too much about marking – needed reading through once and going back to mark” and “rather than putting a star, put a little comment, to justify what you’ve done”. One participant suggested the review took too long and a shorter transcript would be preferable.

5.2.4.5 General Opinions from Each Participant

To conclude this section of results, Table 11 presents the general opinions of each participant in the main study to the interview review technique taken from various sources. The table is of the same format as Table 8 shown in section 5.1.3.5.

Par’t	General impressions	Rank	How beneficial was the technique
I	Surprising. Interesting. Revealing.	1	You rarely get the chance to see written down what you actually say. It was quite surprising to see what you say and how you say it.
J	Thought-provoking. Surprised at content. Enjoyable.	1	Scary, because of the period of time, so I could think “god, I really said that?”. You only learn from the interview when you review it.
H	Easy to follow	2	Useful because I can see that I have changed and that I can continue to change, and that I will continue to change, and I might as well change for the positive.
A	Agreed, interesting, surprised	5	Can pick up and analyse what you said. It’s very rare to see something written down that you’ve said.
C	Intriguing, Enlightening	5	It was certainly very interesting, but I’m not sure how beneficial it was. It would be useful if I had had a goal to change something about myself over the time period.
F	Time-consuming. Enlightening.	5	Looking back on it, it was quite interesting about how I felt, although most of the responses I’d agree with.
B	Quite good	7	What it does is brings it all together. It was useful, and I wasn’t surprised really at anything, even though it was quite a while after.
G	Useful reassessment. Memory jogger.	8	Opportunity to re-assess some of the things said & to question whether the incidents did present the meaning you thought they had, therefore more considered.
D	OK, not sure of the point	8	I felt I was doing it for your benefit not mine. I didn’t want to add or change anything.
E	Disappointing	8	Quite enjoyed doing it. It reinforced that I was open and honest with you.

Table 11: General opinion and ranking from each participant in the main study to the interview review

5.2.5 Summary and Discussion

5.2.5.1 Summary of Results

The number of symbols marked on the transcript by each participant in the main study ranged from 19 to 80, and averaged 50. Of the total number of symbols, the most common were ticks denoting agreement (78.9%), exclamation marks denoting surprise (7.8%) and asterisks denoting something revealing (7.1%).

The 14 post-interview questionnaires (from the pilot and main study) revealed that 4 participants found the interview review to be **surprising**, 3 participants found it to be **interesting**, and 3 participants found it to be **enlightening/revealing**. Comments about what was good about the interview review, included 5 participants who felt it **provoked thought and reflection**, 4 participants who felt it was good as a **reminder**, and 4 participants who felt it was good because it identified **changes**. Comments about what was poor about the interview review included 3 participants who felt it was poor because of **what the participant had said during the interview** and 2 participants who felt it **took too long to do**. 6 participants felt the interview review led to more understanding about **one's personality and life** and 3 participants felt it **instigated analysis and motivation for understanding**.

Ratings indicated that non-graduates felt the interview review was more thought-provoking than graduates. Comparison between the ratings of all the techniques being assessed showed that the interview review was rated as being close to the average of all the other techniques.

Results from the feedback session showed that 5 participants felt the interview review was **useful** and 4 participants felt it was **enjoyable/interesting but not that useful**.

Of the 10 participants in the main study, 4 participants felt that changes in thinking/behaviour had resulted from the review. 8 participants made suggestions for personal uses of the interview review technique, including 3 participants suggesting a use in showing **how much a person has changed**, and 3 participants suggesting a use in **reviewing the way you thought or responded**. Suggestions for possible improvements included 2 participants who felt that a **longer period** between the interview and the review would have been better and 2 participants who felt that the **marking scheme** could be improved.

When ranking all the techniques being assessed, 3 participants placed the interview review technique in their top three, and 4 participants placed the interview review technique in their bottom three.

5.2.5.2 Discussion

It is clear from a number of indicators that some participants found the interview review technique to rate relatively poorly compared the other techniques being assessed, whereas other participants found it to be one of the best. This difference of opinion is particularly well illustrated in the rankings made in the feedback session, in which 3 participants placed the interview review technique in their top two techniques and 4 participants placed it in their bottom two. Why should this be the case? Those participants who favoured this technique seemed to be those that (a) had changed in some ways over the months between the interview and the interview review, and/or (b) were surprised and enlightened by seeing what they had said some months earlier.

In addition, there was evidence that non-graduates rated the interview as being more thought-provoking than graduates. The reasons for this are unknown but may be due to non-graduates changing more over time, being less aware of how they respond verbally or having a less accurate memory what they had said during the interview. On the other hand, it may be due to graduates wanting to appear more consistent over time or wanting to appear less surprised by what they had said. Perhaps this finding is merely spurious due to the low numbers involved. The conclusion must be that more work needs to be undertaken with a larger sample of participants.

A number of problems and possible improvements to the interview review technique have been revealed. Some participants suggested a longer period is required between the interview and the review. This matches the reasons for the difference of opinions described above (i.e. lack of change over the period). Other participants suggested the marking scheme should be improved. The inclusion of comments capturing the participant's reactions to parts of the transcript would be a useful addition. If software is used, perhaps a simulated post-it note could be used to add comments.

Further discussion will be covered in chapters 8 and 9.

6 CATEGORY-BASED TECHNIQUES

Human beings have a remarkable propensity for lending themselves to classification somewhere within neatly labelled categories. Even the outrageous exceptions may be classified as outrageous exceptions!
(W. J. Reichmann)

This chapter is divided into three sections. The first section describes the assessment of a standard and often used repertory grid involving aspects of the person and significant others. This allows exploration of how the person has changed, how they change in different circumstances, how different people and aspects of themselves are similar and different, and how their social constructs correlate. The second section describes the assessment of a repertory grid involving life events and time periods. This allows exploration of the constructs with which a person views their life events and any patterns that emerge across the lifetime. The third section describes the assessment of the Keirsey temperament sorter, which is a personality test aimed at self-help and is being used as the control technique for the main study.

6.1 People Grid Technique

6.1.1 Introduction

The People Grid technique is a slight modification of the main way in which the repertory grid technique is used for psychological purposes. As discussed in chapter 2, the repertory grid technique has its roots in Personal Construct Psychology (see section 2.1.4.1). This approach is based on the idea that a person's psychological processes are driven by their personal constructs, i.e. the ways in which the individual views their personal social world and construes certain entities as being similar or different from each other. The therapeutic approach encourages the client to develop alternative construct systems through which to construe life events. The main method of achieving this uses the repertory grid, a technique that involves the construction of a grid of elements (e.g. people) against constructs (e.g. personality traits). The grid consists of numerical ratings of each element for each construct. There are many uses of repertory grids for psychological purposes as was covered in section 3.2.10.1. The way in which knowledge engineers use the repertory grid to acquire expert knowledge was described in section 3.1.3.6. This often makes use of special software, such as the Repertory Grid tool in PCPACK (see Appendix B). The results obtained for the

repertory grid technique during the pilot study can be found in section 4.1.8.3.

The following sections contain a description of the assessment of a repertory grid using (i) aspects of the participant (such as *me at 18*, *how others see me* and *the ideal me*) and significant others as elements, and (ii) personality traits as constructs. To save time and ensure a grid can be completed and discussed in the 1-hour time slot, the personality traits are selected by the participant from those mentioned during the semi-structured interview. This would normally be achieved using triadic elicitation (as discussed in section 2.1.4.1), but this takes too long for the number of elements required. In the descriptions that follow, the term ‘attribute’ is used instead of the term ‘construct’. This is to maintain consistency of terminology with the other techniques being assessed (as is commonplace in knowledge engineering).

6.1.2 Method

Prior to the session, the following steps are performed:-

1. Analyse the interview transcript to identify attributes and values. Values are adjectives used to describe people or aspects of people (e.g. admired qualities).
2. Use identified attributes and values to create a trait ladder as part of the attribute ladder. The trait ladder is a three-level hierarchy, the first level being the single node “traits”, the second being attributes, the third being the possible values for each of the attributes. The interview transcript typically contains many values but few attributes, hence many attributes are added to the ladder for the values identified in the interview, e.g. the attribute “intelligence” is added and associated with the value “intelligent”.
3. For those attributes identified in the interview, appropriate values are added. Where necessary, attributes that seem clearly to be synonyms or antonyms, are combined into one attribute. For example, if the values “quiet”, “very quiet”, “introverted” and “noisy” are all present, they would be combined under a main attribute heading “quietness”.
4. For each attribute, values are added, if appropriate, so that each attribute has a pair of poles, i.e. values that are at the extremes of a continuum. In most cases, the word “not” is inserted as a prefix to the identified values. For example, if the value “intelligent” is present, a “not intelligent” node is added under the “intelligence”

attribute.

5. The completed trait ladder is printed to provide material for the session. The attributes and values identified in the interview are marked using a highlighter pen.
6. An “aspects of self” node is added to the concept ladder in PCPACK. Under this node, as sub-concepts, are added concepts representing the participant at various ages of their life. The ages chosen are dependent on the current age of the participant. For example, for a 45-year-old person, the following concepts are used “me at 18”, “me at 25” and “me at 35”. A smaller or larger spread of ages is used for younger or older participants, respectively.
7. The following sub-concepts are also added under the “aspects of self” node: “me now at work”, “me now at home”, “the ideal me” and “how others see me”.
8. The Repertory Grid tool in PCPACK is set-up using information from the concept ladder and trait ladder. Using the concept ladder, the following concepts are added as elements: sub-concepts of the “aspects of self” node (i.e. the participant at various ages, “me now at work”, “me now at home”, “the ideal me” and “how others see me”). The following concepts are also added as elements: parents (e.g. “mum” and “dad”), other significant others (e.g. “wife”, “brother”), and supervisor at work (e.g. “boss”). In total, 11 or 12 elements are added.

During the session, the following steps are performed:-

1. The session is described to the participant.
2. The participant is given the trait ladder and asked to mark about 12 attributes that they feel are key attributes with which to compare the aspects of self and other people. A further request is to try to avoid choosing attributes that the participant feels are very similar to each other or are opposite in meaning.
3. The attributes selected by the participant are added as constructs to the Repertory Grid tool.
4. Explain to the participant that brief descriptions of the attributes are required, and to dictate a one or two sentence definition to the tape recorder for each of them.
5. Using the Repertory Grid tool, allow the participant to rate each element against each attribute using the numerical scale of 1 - 9. This is performed using the

“construct” view so that all the elements are rated on the first attribute, then all are rated on the second attribute, etc. This process is tape-recorded as is the rest of the session.

6. When all ratings have been made, the “focus” view in the Repertory Grid tool is invoked which shows the focus grid created using cluster analysis. These calculations ensure that concepts with similar scores are grouped together in the focus grid. Similarly, attributes that have similar scores across the concepts are grouped together in the focus grid.
7. The participant is then walked through the focus grid gaining feedback and prompting for knowledge concerning the groupings and correlations shown. First, the correlations and groupings between the elements (i.e. ‘people’) are explained and feedback is sought with such questions as “does that seem reasonable?”, “is that surprising to you?” and “is that something you had noticed before”. This process is repeated for the correlations and groupings of attributes (i.e. ‘traits’). If two or three attributes show a high correlation (have been given very similar scores across all the elements), then the mechanism of this is explored with questions such as “is it this one [pointing] that is causing this other one [pointing] or is it the other way around?” and “is there another factor that leads to both of them that is causing this similarity?”.
8. Based on the discussion and exploration, extra attributes are added if appropriate and then rated to provide a larger and more representative grid.
9. If there is an attribute that has no correlation to any other (i.e. shown at the very top or very bottom of the focus grid with a long dendrogram line), then it is explained that the reverse description may be similar to one of the other attributes. To test for this, the “swap poles” operation is invoked on the appropriate attribute, which inverts the ratings (e.g. 1’s become 9’s and 9’s become 1’s etc.). If a correlation occurs then this is explored and the relevant node is renamed as its antonym (e.g. ‘happiness’ is renamed ‘unhappiness’).

6.1.3 Results

This section is split into five parts. First, there is an analysis of the knowledge content captured during the session. Second, there is an analysis of the responses given to the

open-ended questions on the feedback questionnaire. Third, there is an analysis of the rating-scale questions on the feedback questionnaire. Fourth, there is an analysis of responses given during the feedback session that addressed the people grid. Fifth, there is a summary of each participant's opinion of this technique. The results shown are all taken from the main study that involved 10 participants.

6.1.3.1 Content Analysis

Basic Statistics

The number of elements (people) used by each participant ranged from 10 to 12, and averaged 11.0. The number of attributes (traits) used by each participant ranged from 9 to 19, and averaged 12.9. The number of correlations found for each participant (elements and attributes) ranged from 3 to 6, and averaged 4.3. An example of a typical grid produced during a session is shown on Figure 11.

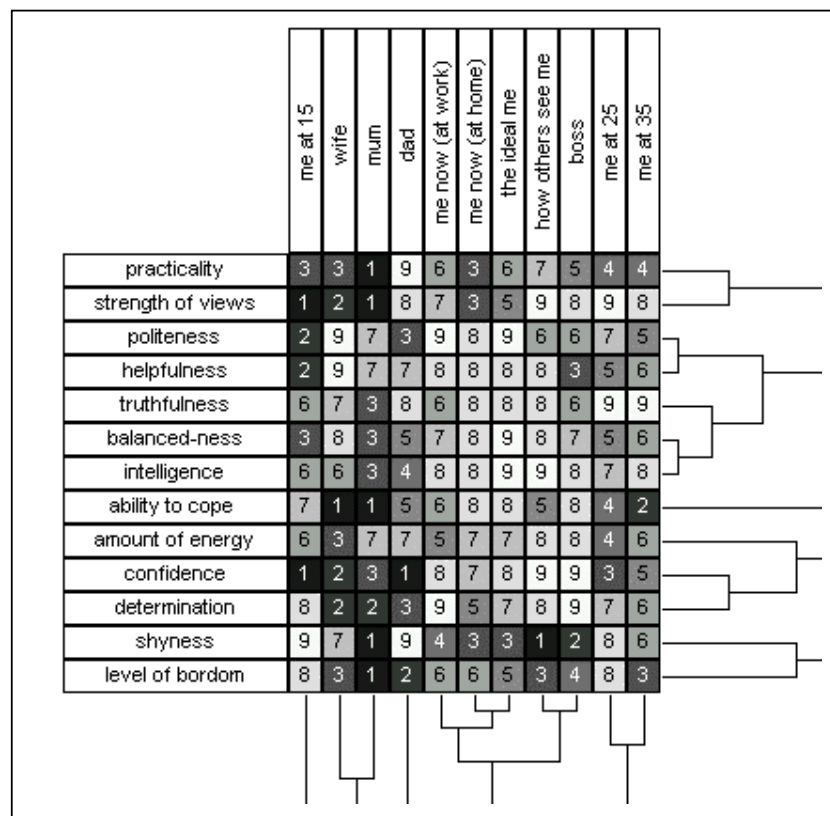


Figure 11: Example of a grid produced using the people grid technique

Grid Attributes

The 129 attributes were analysed for commonality. The most common attribute found was **honesty** with 6 participants using this in their grid. 3 participants used **confidence**

and a further 3 used **self-confidence**. 3 participants used **helpfulness**. Of the remaining attributes, 16 of them occurred twice. These included **intelligence** and **cleverness**, and **extroversion** and **shyness**.

Of the 129 attributes, 124 were classified into four main categories. These categories were named (1) **ambition and strength**, (2) **emotions and niceness**, (3) **social skills** and (4) **thinking**, and are described below.

The largest category comprised 31 attributes associated with **ambition and strength**. These were further classified into 6 subcategories and a miscellaneous category as shown in Table 12. In this table, the first column shows the category (a name given to summarise the class members), the second and third column show the synonyms and antonyms that form the category and the fourth column shows the number of participants who used an attribute in the category.

Category	Synonyms	Antonyms	No. of Participants
Confidence	confidence, self confidence, lack of embarrassment, level of ease with self, naturalness		6
Strength of views	strength of views, opinionated-ness, forthrightness, stubbornness	fairness	5
Determination	ambitiousness, competitiveness, determination, self-motivation, results orientation, competitive spirit	cautiousness	4
Resilience	ability to cope, resilience, strength		4
Assertiveness	assertiveness, arrogance, big headed-ness, dominance		3
Energy level	amount of energy, animated-ness, energy level, how hard works		3
Misc	lack of control over future, perfectionism, proactive-ness		3

Table 12: Attributes from the people grid associated with ambition and strength

The second largest category comprised 29 attributes associated with **emotions and niceness**. These were further classified into 5 subcategories as shown in Table 13. This table is of the same format as the previous table.

Category	Synonyms	Antonyms	No. of P's
Kindness	helpfulness, kindness, niceness, amount cares, understanding-ness, supportiveness	hardness, selfishness	7
Honesty	honesty, truthfulness, how much you're honest with yourself, integrity		7
Emotionality	sensitivity, tendency to work on emotions, moodiness, emotionality, emotional-ness, amount of up and downs, amount worries	amount of self-control, level-headed-ness, positive-ness	6
Placidity	laid-back-ness, placid-ness, patience	level of boredom	4
Perspective	balanced-ness, perspective, liberated-ness		2

Table 13: Attributes from the people grid associated with emotions and niceness

The third largest category comprised 21 attributes associated with **social skills**. These were further classified into 4 subcategories as shown in Table 14.

Category	Synonyms	Antonyms	No. of P's
Sociability	how much communicate, sociability, sociable-ness, openness, extroversion	shyness, quietness, reserved-ness	7
Ability at interpersonal skills	friendliness, getting on with people, ability at interpersonal skills, skill at listening, ability to communicate, politeness, un-abruptness	abruptness	6
Sense of humour	light-heartedness, sense of humour		3
Independence	dependence	independence	2

Table 14: Attributes from the people grid associated with social skills

The smallest category comprised 18 attributes associated with **thinking**. These were further classified into 5 subcategories as shown in Table 15.

Category	Synonyms	No. of P's
Cleverness	ability to think logically, amount respected for their knowledge, brightness, cleverness, intelligence, rational-ness	5
Amount of critical thinking	amount think through things, need to know all the facts, self-criticality	3
Reliability	conscientiousness, efficiency, professional-ness, reliability	3
Practicality	practicality, pragmatic-ness, technical-ness	3
Experience	experience, how much seems older	2

Table 15: Attributes from the people grid associated with thinking

Grid Correlations

43 correlations were found across the 10 grids produced. 34 of these (79.1%) were simple correlations between two elements or two attributes. The other 9 correlations

(20.9%) were like this but had another strong correlation between the pair that correlated and another element or attribute. Of the correlations found between elements (people) for the 10 grids, 4 of the grids had 2 simple correlations, 3 of the grids had a simple correlation and a multi-correlation, and 2 of the grids had 3 simple correlations. Of the correlations found between attributes (traits) for the 10 grids, 3 of the grids had 2 simple correlations, 3 of the grids had a simple correlation and a multi-correlation, and 3 of the grids had 3 simple correlations. Examples of simple correlations between attributes included *friendliness* and *self-confidence*, *efficiency* and *conscientiousness*, *intelligence* and *dominance*, and *confidence* and *positive-ness*.

6.1.3.2 Feedback questionnaire - Open-ended questions

Directly following the people grid session, each participant completed a feedback questionnaire containing four questions on their reactions to the session. An analysis of the responses is as follows.

What were your general impressions of the people grid session? (2-3 adjectives please)

From the 10 questionnaires received from the main study, a total of 17 entries were made to describe the general impressions of the people grid session. By far the most popular impression was “interesting” used by 7 participants. A number of impressions were associated with thinking and learning, such as “thought-provoking”, “learnt a lot about similarities” and “conclusions seemed realistic and could relate to them”. Of the 17 entries the vast majority were very positive, with only 2 being negative. These negative entries were “I felt that the selection of key descriptors was more difficult than I would have thought” and “sometimes didn’t agree with correlations”.

What was good about the people grid session?

Analysis revealed three main categories of responses of what was good about the people grid. First, 6 participants felt the people grid was good because it **provoked thinking**, such as “it made me think about different people in different ways”, “it made me think about how I see and have seen myself in the past” and “I had never thought about the comparisons like that before”. Second, 3 participants felt the people grid was good because it was **simple and easy**, such as “the simplicity of the approach” and “I felt comfortable with method”. Third, 2 participants felt the people grid was good because it was **revealing**, such as “it gives insight into where you first

see attributes that you admire in others”.

What was poor about the people grid session?

Of the 10 questionnaires received, 6 participants made comments on what was poor about the people grid. Analysis revealed two categories of responses. First, 3 participants felt the people grid was poor because of **difficulties in performing the ratings**, such as “some answers were ‘don’t know’ and it could not handle this” and “difficult to answer some of the questions when they related to how others may rate themselves”. Second, 3 participants felt the people grid was poor because of **difficulties with attributes**, such as “there is some similarity in attributes and often the converse aspect of an attribute is difficult to assess”

Please describe anything in the people grid session that made you think about things you hadn’t (consciously) thought before, or helped give you a greater understanding of yourself?

Analysis revealed three main categories of the ways the people grid helped lead to a greater understanding. First, 4 participants felt the people grid led to more understanding about **general comparisons between people**, such as “some interesting similarities which I hadn’t previously considered”, and “who I have grown more like (never really thought about it before) and who I have changed from”. Second, 4 participants felt the session led to more understanding about **attributes**, such as “how much I liked a secure lifestyle” and “relationships between descriptors”. Third, 3 participants felt the session led to more understanding about **specific comparisons between people**, such as “how much I was like my father i.e. placid” and “my view of J’s traits as an ‘ideal me’”.

6.1.3.3 Feedback questionnaire – Rating scales

After performing the people grid session, each of the 10 participants in the main study completed a rating-scale questionnaire (see the second sheet in Appendix D). The questionnaire included 6 ratings with Likert-type scales from 1 to 7.

The results of the questionnaire ratings were compared to explore any differences due to gender, age or qualifications. Table 16 shows average values and standard deviations (in brackets) for these demographic variables.

Rating	All	Gender		Age		Qualifications	
		Male	Female	<40 yrs	>40 yrs	Non-Grad	Graduate
Interesting	5.60 (0.97)	5.17 (0.98)	6.25 (0.50)	5.60 (0.89)	5.60 (1.14)	5.75 (1.26)	5.50 (0.84)
Thought-provoking	5.60 (1.17)	5.00 (1.10)	6.50 (0.58)	6.40 (0.55)	4.80 (1.10)	5.75 (1.26)	5.50 (1.22)
Enlightening	5.10 (1.37)	4.67 (1.36)	5.75 (1.26)	5.60 (1.14)	4.60 (1.52)	6.25 (0.50)	4.33 (1.21)
Demanding / Difficult	3.20 (1.40)	2.33 (0.52)	4.50 (1.29)	3.80 (1.64)	2.60 (0.89)	3.75 (1.71)	2.83 (1.17)
Openness	6.40 (0.52)	6.17 (0.41)	6.75 (0.50)	6.60 (0.55)	6.20 (0.45)	6.50 (0.58)	6.33 (0.52)
Recommend'n	5.50 (0.71)	5.17 (0.75)	6.00 (0.0)	5.80 (0.45)	5.20 (0.84)	5.75 (0.50)	5.33 (0.82)

Table 16. Comparison of the means and SDs of the questionnaire ratings for the people grid based on the gender, age and qualifications of the participants

As shown the table, there are some notable differences in the scoring based on gender and, to a lesser extent, age and qualifications. Females tended to rate the people grid as being more **interesting** (mean=6.25), more **thought-provoking** (mean=6.50), and more **recommended** (mean=6.00) than males (means=5.17, 5.00 and 5.17 respectively). Females also rated the people grid as being more **demanding/difficult** (mean= 4.50) than males (mean=2.33). Younger participants rated the people grid as being more **thought-provoking** (mean=6.40) than older participants (mean=4.80). Non-graduates rated the people grid as being more **enlightening** (mean=6.25) than graduates (mean=4.33). No statistical tests were performed due to the low number of participants involved.

Table 17 shows the mean and standard deviation of ratings for the people grid as compared to those from the other techniques being assessed.

SUBJECT OF RATING	PEOPLE GRID		ALL OTHER TECHNIQUES	
	Mean	Std Dev.	Mean	Ave Std Dev.
INTERESTING	5.6	0.92	5.46	1.09
THOUGHT-PROVOKING	5.6	1.11	5.25	1.17
ENLIGHTENING	5.1	1.30	4.40	1.29
DEMANDING / DIFFICULT	3.2	1.33	3.69	1.30
OPENNESS	6.3	0.47	6.28	0.66
RECOMMENDATION	5.5	0.67	5.34	0.97

Table 17: The means and SDs of the questionnaire ratings for the people grid compared to the means and SDs of the ratings for the other techniques being assessed

As shown in the table, the people grid technique was generally rated more highly for **enlightening** as compared to the other techniques being assessed.

6.1.3.4 Verbal feedback from feedback session

After the completion of all the sessions that assessed each individual technique, a feedback session was held with each participant to gain more feedback on the techniques as a whole. The format of this session was a semi-structured interview. An analysis of the responses that specifically addressed the people grid session is described below.

How beneficial was the session?

Analysis revealed 5 categories of responses, 4 being positive and 1 negative. First, four participants felt the people grid session was **useful**, 3 of whom noted that this was in terms of **changes**, such as “useful in illustrating how I’d changed over time” and “made me think quite a bit about how I’d changed”. Second, two participants felt the session was **revealing**, with comments such as “I found this technique the most revealing”. Third, two participants felt the session made **links and similarities** not previously thought about, such as “started to show similarities you could recognise in the different people and their traits”. Fourth, one participant felt the session was **interesting** but not that useful. On the negative side, one participant felt the session was **not useful**, making the comment “I don’t think it really told me anything”.

Did any changes in thinking or behaviour result from the session?

Analysis revealed that 2 participants felt changes had resulted from the session, one saying “behaviours – how I react to some of the people in the list”, the other saying “makes me think slightly differently about relationships”. One participant felt there was a possibility for change, making the comment “I could use it to change the way people see me”.

What might the uses of your grid be to you?

Analysis revealed three main categories of responses. First, 4 participants suggested uses in **relationships**, such as “I might be able to rationalise the relationship, such as work out why they irritate me by the priorities they have” and “it might be interesting to get the whole family together and do it as a bit of a game”. Second, 3 participants suggested uses in **personal growth**, such as “areas for growth” and “you could

identify where your points for improvement are, what are the scores you're unhappy about, compared to 'ideal me', and could prioritise those things". Third, 3 participants suggested uses in **team building at work**, such as "you could do it when you start up new teams, to see how people react" and "if a team of 20 people did this on each other it would be really useful to do".

What uses might your grid be to other people?

Eight participants offered uses for other people, analysis revealing two main categories of responses. First, 5 participants suggested uses in aiding **understanding of others**, such as "other people could see how I think about myself", "for others to see how you see yourself and compare to how they think of you" and "deriving properties for people, that are meaningful for them, can help understand what motivates them". Second, 4 participants suggested uses in helping **identify and solve problems and weaknesses**, such as "if the attributes are right, it could pin-point problem areas in relationships by comparing the two grids", "if a person is in a team, then finding compensation for their weaknesses" and "identify areas of growth and strength that others may not have thought of".

How could the people grid technique be improved?

Eight participants made suggested improvements. Three participants felt that the **selection and use of attributes** could be improved, making comment such as "maybe breaking down each of the descriptors into sub-categories" and "I had difficulty remembering the context of generating the properties". Two participants suggested that a **larger grid** with more people and attributes would be beneficial. A number of other improvements were suggested such as giving reasons for the scores and producing a summary at the end.

6.1.3.5 General Opinions from Each Participant

To conclude this section of results, Table 18 presents the general opinions from each participant in the main study to the people grid technique taken from various sources. The table is of the same format as Table 8 shown in section 5.1.3.5.

Par't	General impressions	Rank	How beneficial was the session
B	Extremely interesting	1	Looking at the grid afterwards and when you were filling it in it was interesting.
F	Very good	2	All the relationships that came, I hadn't really appreciated. Some were common sense, some I hadn't appreciated, I wouldn't have linked together.
J	Good, learnt a lot about similarities	3	The correlations were useful and good. Pulls out key areas you need to grow into
A	Interesting, conclusions seemed realistic and could relate to them	3	Started to show similarities you could recognise in the different people & their traits.
I	O.K. Sometimes didn't agree with correlations.	3	Useful in terms of a change in yourself – it's difficult to see that you change, but it tries to do that.
G	Understandable, thought-provoking, interesting	4	Useful in illustrating how I'd changed over time. Reinforced dominance of the properties I thought would be there.
H	Interesting	5	I don't think it really told me anything.
D	Interesting	5	It got me to think about relationships with mums and dads and siblings and the wife.
E	Interesting	6	Made me think quite a bit about how I'd changed and how I relate to my parents.
C	Interesting, Enjoyable	8	Links between people, e.g. me now and me at 35

Table 18: General opinion and ranking from each participant in the main study to the people grid session

6.1.4 Summary and Discussion

6.1.4.1 Summary of Results

The typical grid produced during a session comprised about 11 elements (people), 13 attributes (traits) and about 4 correlations (between elements and/or between attributes). The most common attributes used were **honesty** (6 participants) and **confidence/self-confidence** (6 participants). Four categories of attributes were identified, named **ambition & strength**, **emotions & niceness**, **social skills** and **thinking**. Each of these categories was broken down into a number of sub-categories, the most common being **kindness**, **honesty** and **sociability** (7 participants each).

The post-interview questionnaires revealed that 7 participants found the session to be **interesting**. Comments about what was good included 6 participants who felt that the technique **provoked thought**, and 3 participants who felt that the technique was **simple and clear**. Comments about what was poor included 3 participants who felt that there were **difficulties in performing the ratings** and 3 participants who commented on **difficulties with attributes**. 4 participants felt the session led to more understanding about **general comparisons between people**, 4 participants felt it led

to more understanding about **attributes** and 3 participants felt it led to more understanding about **specific comparisons between people**.

The ratings indicated that female participants found the people grid to be more **interesting**, more **thought-provoking**, more **demanding/difficult** and more **recommended** than male participants. Younger participants rated the people grid as being more **thought-provoking** than older participants, and non-graduates rated it as being more **enlightening** than graduates.

Results from the feedback session showed that 4 participants felt the session was **useful** and 4 participants felt it was **revealing**. 3 participants felt that changes in thinking/behaviour had resulted from the session. Suggestions for personal uses of the people grid included helping **relationships** (4 participants), helping **personal growth** (3 participants), and uses in **team building at work** (3 participants). Suggestions for uses by other people included aiding **understanding of others** (5 participants), and uses in **identifying and solving problems and weaknesses** (4 participants). Suggestions for possible improvements included improving the **selection and use of attributes** (3 participants), and use of a **larger grid** with more people and attributes (2 participants).

When ranking all the techniques being assessed, 5 participants placed the people grid technique in their top three, and 2 participants placed it in their bottom three.

6.1.4.2 Discussion

A number of indicators show that the participants found the people grid technique to be their second favourite of all the techniques being assessed. Indeed, five of the ten participants placed this technique in their top three when ranking all the techniques during the feedback session. Why was this technique regarded so favourably? Comments from the participants indicated that the main reason for this was due to the correlations shown in the focus grid, particularly those between people and aspects of self. It appears that this was interesting for most of the participants, provoked-thought and led to revelation of new thoughts.

Interestingly, comments on the revealing nature of the people grid were more positive during the feedback session than those made on the post-session questionnaire. Indeed, according to the ratings on the latter, the people grid is not significantly different in

any area compared to an average of the other techniques being assessed. The reasons for this are unknown.

A clear finding from the ratings on the post-interview questionnaire was that females preferred the people grid technique much more than males did. Perhaps this is due to the subject of the knowledge captured and revealed as it focused on personal traits and relationships with significant others. Alternatively, it may be spurious due to the small numbers involved and the chance occurrence that females had grids that showed more interesting correlations.

An impression gained from the feedback session was that participants found the grid to be difficult to interpret in its current form of presentation. A useful addition would be to summarise the correlations in another form, either as simple text or perhaps as a separate network diagram.

The capability of the people grid technique to acquire personal knowledge is not in question as this is one of the ways it is used in a wide range of disciplines. The modification made in this study to use selected traits (i.e. attributes, constructs) elicited during the semi-structured interview rather than use triadic elicitation did not seem to affect the use of the technique. Although one of the fundamentals of the repertory grid technique is that each individual provides their own set of constructs, there was a surprising similarity between many of the traits used by each participant in this study. It would be interesting to investigate the use of a standardised set of traits. This would overcome a likely problem if people want to view and understand other people's grids, since they may be unfamiliar with the traits used or may misinterpret the language used.

A number of problems and possible improvements to the people grid technique have been revealed. Some participants described problems with the attributes, particularly in selection and in remembering the exact definition used. The problem in selection seems to be the result of participants not knowing how they are to be used. This would be overcome if the people grid session were to be performed more than once. Although participants gave a short definition of each attribute before the scoring stage, in some cases this was deviated from as the scoring progressed. It would be beneficial if these short definitions are captured in the software and are displayed as each is being scored. A standardised set of attributes may also help with these problems. A

further problem noted by some participants was the inflexibility in the scoring to capture “don’t knows”. This is an inherent problem in the repertory grid technique and can only be overcome by removing the relevant attribute or element. A further problem was the need for a larger grid. Of all the techniques being assessed, this is the one that would probably most benefit from more time.

Further discussion will be covered in chapters 8 and 9.

6.2 Events/Periods Grid Technique

6.2.1 Introduction

The events/periods grid technique is a version of the repertory grid technique. A summary of the repertory grid technique was made at the beginning of the previous section on the people grid technique, so will not be repeated here. The events/periods grid technique is similar to the people grid technique but instead of having aspects of the participant and significant others as elements of the grid, it makes use of either events or time periods in a person’s life. It was found during the pilot study (see section 4.1.8.3) that confusion can arise when a mix of events and time periods are used as elements in the same grid. Hence, during the main study, it was decided to allow 5 participants to use events in their grids and 5 participants to use time periods. Selection of which participants to assign to these two groups was quasi-random so that the two groups were roughly equal in gender, age and qualifications. When analysing the transcripts of the semi-structured interviews, it was found that the participants mentioned very few attributes of events or time periods. Hence, the method used for the people grid technique for selecting attributes (i.e. constructs) for the grid from previously elicited material could not be relied upon. Hence, the triadic elicitation technique was used as the main method of generating attributes for the events/periods grids. Due to the length of time required for triadic elicitation and the 1-hour time restriction, it was decided to restrict the size of the grid to about 8 events/periods.

6.2.2 Method

For each participant, do the following prior to the session:

1. Identify the main life events and the dates they occurred from the transcript of the initial interview (using the PCPACK Protocol Editor tool).

2. Produce a timeline (on paper) showing the span of the participant's life from birth to the present, marking decades and placing events at the appropriate dates.
3. Using the timeline for reference, segment the participant's life into about 8 time periods. Name the periods including the dates, e.g. "at university ('79-'81)".
4. Using PCPACK Repertory Grid tool, add events/periods as elements including dates in the names. This operation adds these events/periods as concepts in the Concept Ladder tool of PCPACK. Print this part of the concept ladder for use during the session.

During the session, do the following.

1. Explain the format of the session to the participant. Show the participant the elements (events or time periods) that were selected and ask if they are happy to examine these during the session.
2. Ask the participant to think of a description for each of the events/periods. Add these descriptions (i.e. attributes) as constructs to the Repertory Grid tool with appropriate poles. For example, if the description for an event/period is "led to many changes", the attribute "amount changed life" is added, with poles of "led to no changes" and "led to very many changes". Use triadic elicitation to produce more attributes so that there are at least 8.
3. The remainder of the session follows the same format as described previously for the people grid technique (see steps 4-9 in the second half of section 6.1.2).

6.2.3 Results

This section is split into five parts. First, there is an analysis of the knowledge content captured during the session. Second, there is an analysis of the responses given to the open-ended questions on the feedback questionnaire. Third, there is an analysis of the scores given to the rating-scale questions on the feedback questionnaire. Fourth, there is an analysis of verbal responses given during the feedback session that specifically addressed the events/periods grid. Fifth, there is a summary of each participant's opinion of the events/periods grid technique. The results shown are all taken from the main study which involved 10 participants.

6.2.3.1 Content Analysis

Basic Statistics

The number of elements (events/periods) used by each participant ranged from 7 to 10, and averaged 8.4. The number of attributes used by each participant ranged from 8 to 14, and averaged 10.4. The number of correlations found for each participant (elements and attributes) ranged from 3 to 6, and averaged 4.6. An example of a typical grid produced during a session concerning time periods is shown on Figure 12.

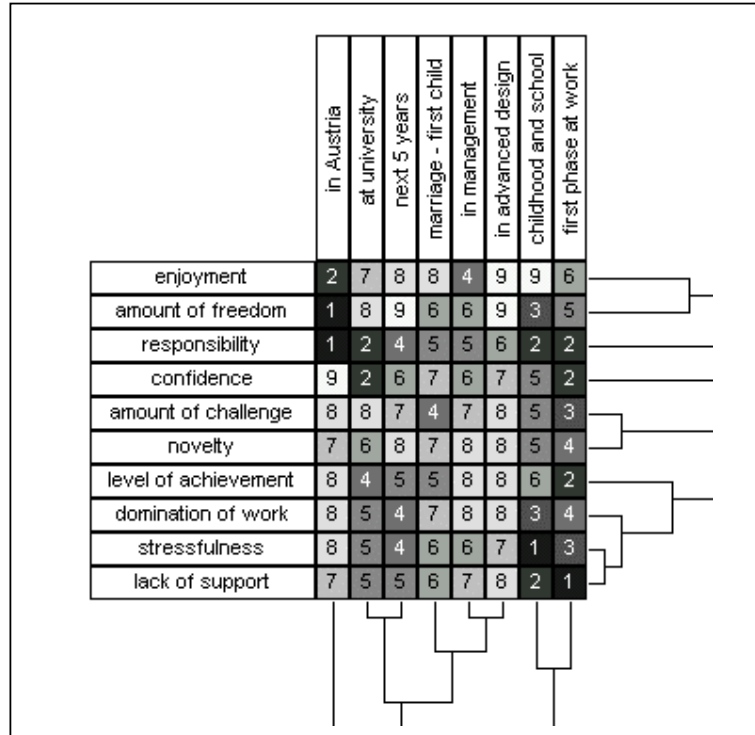


Figure 12: Example of a grid produced using the events/periods grid technique

Grid Attributes

The 104 attributes were analysed for commonality. The most common attribute was **happiness** with 6 participants using this in their grid. 3 participants used **stressfulness** and a further 3 used **amount of worry**. Of the remaining attributes, 12 of them occurred twice.

The 104 attributes were classified on the basis of general similarity of meaning. This resulted in 88 attributes falling into 8 categories. These categories are shown on Table 19.

Category	No.	No. Ps	Attributes
Feeling and Emotions	21	10	<ul style="list-style-type: none"> happiness (6), amount of joy, amount of enjoyment, sadness amount content with life, amount of work satisfaction, good-ness, level of personal satisfaction, peacefulness, pleasing-ness exciting-ness (2), interesting-ness, level of enthusiasm. level of interest, boringness
Moods and States	18	9	<ul style="list-style-type: none"> amount of worry (2), nervousness (2), level of worry, amount of frustration, frustration, amount threatened, intimidated-ness, unsettled-ness, amount of relief, frivolity stressfulness (2), traumatic-ness (2), amount of pressure, level of stress
Decisions and Outcomes	16	8	<ul style="list-style-type: none"> amount of uncertainty, ill-considered-ness, level of security, amount of security, riskiness, stability level of achievement (2), level of success, visibility of performance amount of control, level of control, amount of direct influence, proactive-ness amount of challenge, intellectual challenge
Experiences	9	7	<ul style="list-style-type: none"> amount of new experiences, level of novelty, new-ness, predictability amount of experience (2), maturity, time how much learnt, level of life learning
Significance	7	5	significance (2), amount changed life, how much of crossroads, importance, impact on relationships, amount of lifestyle change
Confidence	6	5	confidence, optimism, future confidence, level of confidence in future, positive-ness, self-consciousness
Priorities	6	5	importance of parental love, importance of friends, dominance of work, dominance of work, amount of commitment, amount of time/effort at home
Freedom	5	5	amount of freedom (2), dependence, influence from others, feeling of freedom/independence

Table 19: Categories of attributes used in the events/periods grid

In Table 19, the first column shows the category (a name given to summarise the class members), the second column shows the number of attributes that form the category and the third column shows the number of participants who used an attribute from the category in their grid. The fourth column shows all the members of a category and the number of occurrences of those attributes used by 2 or more participants (shown in brackets). As shown in the table, the four largest categories were further classified into sub-categories, which are depicted as separate bullet points in the fourth column.

Following the classification of attributes, the number of attributes from each category that were used in the two forms of grid (events and time periods) were calculated. This resulted in the percentages shown in Table 20. As shown, attributes from most

categories were used about equally in the two forms of grid. The notable exception is for attributes associated with significance, which were used far more when describing events (85.7%) than when describing time periods (14.3%).

Attribute Category	Percentage used in the events grids	Percentage used in the periods grids
Feeling and Emotions	57.1 %	42.9 %
Moods and States	38.9 %	61.1 %
Decisions and Outcomes	62.5 %	37.5 %
Experiences	50.0 %	50.0 %
Significance	85.7 %	14.3 %
Confidence	50.0 %	50.0 %
Priorities	50.0 %	50.0 %
Freedom	60.0 %	40.0 %

Table 20: Comparison of the types of attributes used in the two forms of grid

Grid Correlations

46 correlations were found across the 10 grids produced. 42 of these (91.3%) were simple correlations between two elements or two attributes. The other 4 correlations (8.7%) were like this but had another strong correlation between the pair that correlated and another element or attribute. Of the correlations found between elements (events/periods) for the 10 grids, 3 of the grids had 2 simple correlations, and 4 of the grids had 3 simple correlations. Of the correlations found between the attributes for the 10 grids, 6 of the grids had 2 simple correlations, and 2 of the grids had 3 simple correlations. Examples of simple correlations between attributes included *level of control* and *level of personal satisfaction*, *naturalness* and *level of confidence in the future*, and *amount of pressure* and *lack of support*.

6.2.3.2 Feedback questionnaire - Open-ended questions

Directly following the events/periods grid session, each participant completed a feedback questionnaire containing four questions on their reactions to use of this technique. An analysis of the responses is as follows.

What were your general impressions of the events/periods grid session? (2-3 adjectives please)

From the 10 questionnaires received in the main study, a total of 17 entries were made to describe the general impressions of the events/periods grid session. The most

popular impressions of the session were “interesting” and “difficult”, each used by 3 participants. “Challenging” and “good” were each used by 2 participants. Other impressions used included “highly visual”, “clear”, “quick to analyse the information” and “different to anything I’d seen before”. Of the 17 entries, 6 were of a negative nature. As well as the three occurrences of “difficult”, the other negative impressions were “unsure of conclusions”, “not very enlightening” and “confusing”.

What was good about the events/periods grid session?

Analysis revealed a single main category of responses made by 6 participants. This category was associated with the **impact and association between events and periods**, such as “amazing how things were brought together in ways I had not thought about”, “thinking about life events and how they had affected me” and “the opportunity to view the differences between different phases of your life was very interesting”. There were four other responses, such as “made good use of the previous interview” and “quick & efficient”.

What was poor about the events/periods grid session?

9 participants made comments on what was poor about the events/periods grid. Analysis revealed three categories of responses. First, 5 participants felt it was poor because of **difficulties in the use of attributes**, such as “some of the attributes seemed to be rather contrived”, “I felt I wanted to qualify the score I gave some events” and “I found it difficult to apply some of the descriptions across all the events”. Second, 2 participants felt the technique was poor because of **difficulties in identifying attributes**, such as “it was difficult to get initial words to describe the time periods” and “more help in identifying factors would have been useful”. Third, 2 participants felt the technique was poor because of **difficulties in making conclusions**, such as “possibly looking for things which weren’t really there” and “difficulty in making any firm conclusions”.

Please describe anything in the events/periods grid session that made you think about things you hadn’t (consciously) thought before, or helped give you a greater understanding of yourself?

Of the 10 questionnaires received, 6 participants responded to this question. Analysis revealed very little similarity between the responses made. Only 2 responses were similar and associated with **relationships between events**, i.e. “relationships between

different unconnected events” and “some of the closely linked events I hadn’t linked before for myself but I could understand how they were coming out close together”. Other responses covered a number of issues, such as “very enlightening, and made me think that really I had not changed a great deal in my ways over the years” and “it is interesting to consider the two extremes of an action and rate them as this is something that an individual does not ordinarily consider”.

6.2.3.3 Feedback questionnaire – Rating scales

After performing the events/periods grid session, each of the 10 participants in the main study completed a rating-scale questionnaire. The questionnaire included 6 ratings with Likert-type scales from 1 to 7.

The results of the questionnaire ratings were compared to explore any differences due to gender, age or qualifications. Table 21 shows average values and standard deviations (in brackets) for these demographic variables.

Rating	All	Gender		Age		Qualifications	
		Male	Female	<40 yrs	>40 yrs	Non-Grad	Graduate
Interesting	4.60 (1.65)	4.00 (1.67)	5.50 (1.29)	5.00 (1.22)	4.20 (2.05)	5.75 (1.26)	3.83 (1.47)
Thought-provoking	4.50 (1.65)	3.83 (1.60)	5.50 (1.29)	5.00 (1.22)	4.00 (2.00)	5.75 (1.26)	3.67 (1.36)
Enlightening	4.40 (1.71)	4.00 (1.79)	5.00 (1.63)	4.20 (1.10)	4.60 (2.30)	6.00 (1.15)	3.33 (1.03)
Demanding / Difficult	4.0 (1.70)	3.50 (1.52)	4.75 (1.89)	4.40 (1.81)	3.60 (1.67)	4.25 (1.71)	3.83 (1.83)
Openness	6.30 (0.82)	6.00 (0.89)	6.75 (0.50)	6.60 (0.55)	6.00 (1.00)	6.50 (0.58)	6.17 (0.98)
Recommend’n	4.60 (1.35)	4.00 (1.10)	5.50 (1.29)	4.80 (0.84)	4.40 (1.82)	5.75 (0.96)	3.83 (0.98)

Table 21. Comparison of the means and SDs of the questionnaire ratings for the events/periods grid based on the gender, age and qualifications of the participants

As shown the table, there are some notable differences in the ratings based on qualifications. Non-graduates rated the events/periods grid as being more **interesting** (mean=5.75), more **thought-provoking** (mean=5.75), more **enlightening** (mean=6.00) and more **recommended** (mean=5.75) than graduates (means=3.83, 3.67, 3.33 and 3.83 respectively). In addition, females tended to rate the technique higher than males. No statistical tests were performed due to the low number of participants involved.

The results of the questionnaire ratings for those participants that used events as the elements of their grid were compared to those participants that used time periods as the elements of their grid. The results of this comparison are shown in Table 22.

	EVENTS GRID		PERIODS GRID	
Rating	Mean	Std Dev.	Mean	Ave Std Dev.
Interesting	4.8	1.92	4.4	1.52
Thought-provoking	4.8	1.92	4.2	1.48
Enlightening	5.0	1.41	3.8	1.92
Demanding / Difficult	4.4	1.52	3.6	1.95
Openness	6.2	0.84	6.4	0.89
Recommendation	4.6	1.52	4.6	1.34

Table 22. The means and SDs of the questionnaire ratings for the events grid compared to the means and SDs of the ratings for the periods grid

As shown, the events grid was rated more highly for **thought-provoking** and **enlightening** (means = 4.8 and 5.0, respectively) than the periods grid (means = 4.2 and 3.8, respectively).

Table 23 shows the mean and standard deviation of ratings for the events/periods grid as compared to those from the other techniques being assessed.

	EVENTS/PERIODS GRID		ALL OTHER TECHNIQUES	
SUBJECT OF RATING	Mean	Std Dev.	Mean	Ave Std Dev.
INTERESTING	4.6	1.56	5.60	0.93
THOUGHT-PROVOKING	4.5	1.57	5.40	1.06
ENLIGHTENING	4.4	1.62	4.50	1.20
DEMANDING / DIFFICULT	4.0	1.61	3.54	1.24
OPENNESS	6.3	0.66	6.28	0.63
RECOMMENDATION	4.6	1.28	5.47	0.94

Table 23: The means and SDs of the questionnaire ratings for the events/periods grid compared to the means and SDs of the ratings for the other techniques being assessed

As shown in the table, the events/periods grid technique was generally rated as being less **interesting**, less **thought-provoking** and less **recommended** as compared to the other techniques being assessed.

6.2.3.4 Verbal feedback from feedback session

After the completion of all the sessions that assessed each individual technique, a feedback session was held with each participant to gain more feedback on the techniques as a whole. An analysis of the responses that specifically addressed the events/periods grid session is described below.

How beneficial was the session?

Analysis revealed 5 categories of responses, 3 being positive and 2 negative. First, two participants felt the events/periods grid session was **useful**, with comments such as “useful in a contemplative way – looking back on where I am now”. Second, two participants felt the session was **revealing**, with comments such as “the thing that was revealed was how much I’m like my ideal”. Third, one participant felt the session was interesting but not that useful, with the comment “it was just amazing how things just came together”. Of the negative opinions, three participants felt the session was **not useful**, with comments such as “didn’t reveal anything – no great surprises”, and two participants found the session to be **difficult**, with comments such as “made me think about events buried away - it was really hard work”.

Did any changes in thinking or behaviour result from the session?

Eight participants did not feel any changes resulted from the session, although four of these noted that their understanding had increased. Two participants felt they had changed, one saying “I’m probably a bit less stressed about things”, the other saying “I thought about things I thought I’d dealt with and moved on”.

What uses is the grid to you?

Only three participants offered possible uses of the events/periods grid for themselves. Two participants suggested uses in **decision-making**, such as “maybe in helping to make a major decision by plotting it on the grid” and “at a particular point in your career, use past events and some of the same attributes for decision-making and career guidance”. Another participant commented that if their ideal next 5 years had been more different from their current situation, this might have helped identify possible changes.

What uses is the grid to other people?

Five participants suggested uses of the events/periods grid for other people. Analysis revealed two categories of responses. First, three participants suggested uses at work for **Human Resources**, such as “to build a picture of how successful a person’s going to be in a certain situation”. Second, two participants suggested uses in **understanding other people**, such as “to look at the grid of someone who has had a significant event in their life and see how it has affected them”.

How could the events/periods grid technique be improved?

Eight participants offered suggestions for improvements. Four participants suggested that the **selection of events** could be improved, such as “it would be better if it used events that you didn’t already know much about” and “maybe use different events so it’s not so intense”. Four participants felt that the **selection of attributes** could be improved, such as “the way we generated the attributes was hard” and “sometimes the differences between the different attributes were difficult to separate”. Two participants noted that the **scoring** could be improved, making comments such as “there should be encouragement to use a wider range of scores” and “you should be able to give reasons for the scores, and how they might change”.

6.2.3.5 General Opinions from Each Participant

To conclude this section of results, Table 24 presents the general opinions from each participant to the events/periods grid technique taken from various sources. The table is of the same format as Table 8 shown in section 5.1.3.5.

Par’t	General impressions	Rank	How beneficial was the session
B	Very good	2	The grid when it comes out, that’s really interesting. It was just amazing how things just came together. I don’t know about benefits, not for myself anyway.
F	Interesting, challenging (initially)	3	Not particularly useful, but maybe helps me understand why I’m feeling the way I do. Doesn’t help me do anything with it, so just another way of identifying how I feel.
C	Interesting, Challenging	4	Like a road map of the major turnings that steered me a course. Useful in a contemplative way – looking back on where I am now, but not so sure with using it looking forward.
A	Difficult, unsure of conclusions	6	Didn’t reveal anything – not great surprises – I know that anyway.
D	Not very enlightening	6	I don’t think it revealed anything. I didn’t find it useful.
J	Good session	6	Quite an intense session. Quite deep. Made me think about events buried away. Emotional roller-coaster. Really hard work. Constantly had to analyse the events.
E	Interesting, Difficult	7	I hadn’t quite realised I was so close to an ideal. Very similar to the other repertory grid.
G	Highly visual, clear	7	Really interesting how it illustrated the linkages, how patterns between different phases of my life changed and where there were similarities.
H	Different to anything I’d seen before. Quick to analyse.	7	One of the least beneficial of all the sessions, because it didn’t throw up anything that surprised me, or that I hadn’t thought of before.
I	Difficult, confusing	8	It tried to make you think of your personality development – but was harder because the time periods were too similar.

Table 24: General opinion and ranking from each participant in the main study to the events/periods grid

6.2.4 Summary and Discussion

6.2.4.1 Summary of Results

The typical grid produced during a session comprised about 8 elements (events or time periods), 10 attributes, and about 4 or 5 correlations (between elements and/or between attributes). The most common attributes were **happiness** (6 participants), **stressfulness** (3 participants) and **amount of worry** (3 participants). Eight categories of attributes were discerned, the most common being **feeling & emotions** (all participants), **moods & states** (9 participants) and **decisions & outcomes** (8 participants). Both types of grids (event grids and period grids) had very similar types of attributes. The only notable difference being that the events grids had many more attributes associated with **significance** than did the periods grids.

The post-interview questionnaires revealed that 3 participants found the session to be **interesting** and 3 participants found the session to be **difficult**. Comments about what was good about the session included 6 participants who felt that it highlighted the **impact and association between events and phases**. Comments about what was poor about the session included 5 participants who felt that there were **difficulties in the use of attributes**. 6 participants felt that the session led to more understanding, 2 participants feeling that this was associated with **relationships between events**.

Comparison between the ratings of all the techniques being assessed showed that the events/periods grid technique was rated as being less interesting, less thought-provoking and less recommended than the other techniques. The ratings revealed that non-graduates rated the events/periods grid as being more **thought-provoking**, more **enlightening** and more **recommended** than graduates. Also, there was some indication that females rated this technique as more **recommended** than males. Comparison of the ratings for the events grid and the periods grid showed some tendency for the events grid to be rated as being more thought-provoking and enlightening than the periods grid.

Results from the feedback session showed that 3 participants felt the session was **not useful**, 2 participants felt it was **useful**, 2 participants felt it was **revealing** and 2 participants felt it was **difficult**. 2 participants felt that changes in thinking/behaviour had resulted from the session. Suggestions for personal uses of the events/periods grid included helping **decision-making** (2 participants), and suggestions for uses by other

people included use in **Human Resources** (3 participant) and uses in **understanding other people** (2 participants). Suggestions for possible improvements included improvements in the **selection of events** (4 participants), and improvements in the **selection of attributes** (4 participants).

When ranking all the techniques being assessed, 2 participants placed the events/periods grid technique in their top three, and 7 participants placed it in their bottom three.

6.2.4.2 Discussion

It is clear from a number of indicators that the participants found the events/periods grid technique to be their least favoured of all the techniques being assessed. Indeed, seven of the ten participants placed this technique in their bottom three when ranking all the techniques during the feedback session. The other three participants, however, did find the session to be interesting and useful.

Why this difference of opinions, and why was this technique generally regarded as the least favoured? As to the difference of opinions, there is some indication that female non-graduates preferred this technique to male graduates. Interestingly, for a technique that focuses on events and periods in a person's life, no difference was found in the opinions of older participants compared to younger ones. Looking at the problems participants found with the technique, the most commonly described were in the choice of which events/periods to use and in the generation of attributes. Perhaps one can account for male graduates' lower opinions because they found it more difficult to generate attributes for the events/periods, possibly because female non-graduates are more used to thinking about or describing life events. However, this is conjecture and more work is required to examine this in detail.

Moving to the question of why the events/periods grid technique was the least favoured of all the techniques, there are two major components that stand out. First, performing the technique during the session failed to reveal anything new to many of the participants. This may be due to the correlations that emerged from the cluster analysis. Certainly, these correlations appeared to be far less surprising and interesting to the participants than the correlations found using the people grid. Second, reviewing the grid at a later date (during the feedback session) did not appear to provoke any great interest in what had been captured nor how that might be useful in an ongoing

manner.

The lack of any major differences between the ratings from those that used an events grid and those that used a periods grid indicates that neither of these variants is perceived as better than the other. In comparing the events/periods grid technique with the people grid technique (described in the first part of this chapter), it is clear that participants preferred the people grid on almost all dimensions. Since the techniques are almost identical except for the difference in the elements used, it indicates that the participants find a grid of people preferable to a grid of events/periods. A likely reason for this is that the participants are much more familiar in using language to describe and compare people whereas are less familiar with generic attributes used to describe and compare different events and time periods. Perhaps a standardised set of attributes for events/periods may improve the efficacy of this technique for self-help purposes.

A number of specific problems and possible improvements to the events/periods grid technique have been revealed. Some participants described problems with the choice of events. Key life events elicited during the semi-structured interview were used and may have contributed to the low ranking of the technique. Hence, it is recommended in future research to allow the participants to choose less important life events, perhaps minor events that had occurred recently in the person's life. Some participants described problems with the generation of attributes. Unlike the people grid technique, triadic elicitation was used for the events/periods grid technique to generate the attributes. Thus, a possible improvement might be to try to elicit attributes using one of the other techniques, such as the interview or the event diagram techniques.

Further discussion and comparison with the other techniques will be covered in chapters 8 and 9.

6.3 Keirsey Temperament Technique

6.3.1 Introduction

Personality and temperament tests are much used by trait theorists to measure and categorise personality characteristics. Some of these tests are also used to facilitate help. The standard format involves the use of a questionnaire to acquire data about a person's attitudes and behaviours. The answers from each question, typically ratings or forced-choice, are then used to classify the respondent into a particular category. When

used for self-help, each category has an associated written portrait providing the user with a standard description of their own and other personality types. More information on personality and temperament tests was covered previously in section 2.1.4.2. The Keirsey Temperament Sorter is very similar to the Myers-Briggs Type Indicator (MBTI), which is the most widely used technique for personal development purposes in organisational contexts. On the surface, the Keirsey Temperament Sorter is virtually identical to the MBTI, categorising people into 16 types based on Jungian theory. However, the Keirsey Temperament Sorter can be considered a cut-down version of the MBTI, aimed more at self-help rather than a stricter measure of personality type (Keirsey & Bates, 1984). The Keirsey Temperament Sorter was selected as the control technique for this research study into personal knowledge technique as explained in section 4.2.1.

6.3.2 Materials

Using the internet site (www.keirsey.com), the following four materials were produced: 70 questions with forced-choice answers (i.e. 2 alternatives); an answer sheet; a type-to-temperament grid; print-outs of the portraits (i.e. descriptions) for the 4 main types and for the 16 temperaments. A summary of the 16 temperaments and 4 main types are shown in Appendix J.

6.3.3 Method

1. Explain to the participant the general outline of the session, using something like the following: “First, I’ll be asking you a series of questions. Based on the answers you give, I’ll work out your particular temperament or personality type. I’ll then show you some information describing this type and maybe some similar ones and opposite ones, and see what you think of them”.
2. The questioning stage begins by explaining that there are only two answers to each question, and that the participant must choose one or the other of the answers. The list of 70 questions is placed on the table in front of both the interviewer and the participant, so that the latter can see the questions and possible answers. Each question is asked in turn. A sheet of paper is used to cover-up the following questions to aid focus and avoid the participant reading ahead and becoming distracted. If the participant is struggling to select an answer for a question, and

comments that the answer depends on the situation, then explain that they are to do it as if they are at their most natural self, or what is termed “with the shoes off”. After the participant gives each answer, mark the appropriate response on the answer sheet using a highlighter pen. This questioning section is tape-recorded to capture the way the participant responded and any additional comments they made.

3. When all 70 questions have been asked, count how many answers have been given in each category. Write on the score sheet the letter representing the temperament dimensions. If the scores are close for a category, then write both dimensions and treat this as a marginal score.
4. Explain the scoring system to the participant and the dimension scores they have been given. Using the type-to-temperament table, mark which temperament type has been identified. If there is a marginal score (or scores), then mark a primary temperament and any secondary temperaments based on the marginal scores.
5. Select the portrait for the primary temperament type identified. Hand this to the participant and ask them to spend a few minutes reading it, after which you will ask for their reactions. Explain that they can feel free to make notes or mark the page/s. When the participant is ready, ask them what they thought of the portrait they have just read. Explore in what ways it is similar or different to how they see themselves. This questioning period is tape-recorded to capture the way the participant responded. For those with marginal scores, repeat this process with the relevant secondary portraits. If there is time, repeat the process with the primary, and if appropriate secondary, high-level temperament types.
6. Using the type-to-temperament table, mark the temperament types that are directly opposite those identified for the participant. If there is a marginal score, or a number of marginal scores, then mark a primary opposite temperament and any secondary opposite temperaments based on the marginal scores.
7. Repeat the process of giving the portraits and gaining feedback, for the opposite temperament types, and any secondary opposite temperament types if appropriate

6.3.4 Results

This section is split into five parts. First, there is an analysis of the knowledge content captured during the session. Second, there is an analysis of the responses given to the

open-ended questions on the feedback questionnaire. Third, there is an analysis of the scores given to the rating-scale questions on the feedback questionnaire. Fourth, there is an analysis of verbal responses given during the feedback session that specifically addressed the Keirsey temperament sorter. Fifth, there is a summary of each participant's opinion of this technique. The results shown are all taken from the main study that involved 9 participants.

6.3.4.1 Content Analysis

Scoring

On the extroversion-introversion scale, 3 participants scored higher on extroversion and 6 scored higher on introversion, although 2 of the latter were borderline (scoring 4-6). On the intuition-sensation scale, 3 participants scored higher on intuition and 5 scored higher on sensation, although 2 of the latter were borderline (scoring 9-11 out of 20). 1 participant was an exact borderline between intuition and sensation (scoring 10-10). On the feeling-thinking scale, 7 participants scored higher on feeling, 0 scored higher on thinking, and 2 scored the same on both (scoring 10-10). Of the 7 who scored higher on feeling, 3 were close to the border (scoring 11-9). On the judgment-perception scale, 5 participants scored higher on judgment and 4 scored higher on perception, although 2 of the latter were slightly borderline (scoring 8-12).

The scoring classified 3 of the participants as having the temperament of a Protector, and 2 having the temperament of a Healer. One participant was classified as Champion and another as Provider. One participant was on the border between Protector and Inspector. One participant, who had scored 10-10 on two categories, was on the borders between 4 temperaments (Promoter, Performer, Champion and Inventor). Using the four high-level temperaments, 4 of the participants were classed as Guardians, 3 as an Idealist, 1 as an Artisan and 1 as borderline between three types (Idealists, Artisans and Rationals).

Comments on Portraits

Each participant was shown about 10 portraits, including their primary temperament, their high-level temperament class, borderline temperaments and portraits directly opposite of their primary temperament. The 9 participants provided detailed comments on a total of 65 portraits, i.e. an average of 7.2 portraits per participant. The remaining 2 or 3 portraits that were read were not commented upon in detail as the participant

felt these were very unlike themselves. The most common portraits that were commented upon were the Guardian and the Idealist which were each commented upon by 7 participants. Other common portraits were the Inventor, which was commented upon by 6 participants, and the Champion, Protector and Artisan, which were each commented upon by 5 participants.

When shown the portrait of their primary temperament, most participants expressed very positive reactions, making comments such as “a very true relation of me”, “there wasn’t anything there that I could disagree with” and “maybe 90% of that is absolutely spot on”. When shown the portrait of their primary opposite, 6 participants agreed that it was very unlike themselves, making comments such as “that’s definitely not me”, “I don’t relate to any of that” and “if I painted a portrait of who I am not, there are an awful lot of words here I’d choose”. However, 3 participants pointed out that some parts of the descriptions of their opposite were like themselves, making comments such as “overall, it isn’t me at all, but there are bits that could be me” and “I wouldn’t say it was all the opposite”.

Comments on Selected Phrases

Within the 65 portraits commented upon, there were a total of 176 phrases (including single words and whole sentences) that participants selected as either agreeing with or disagreeing with. As part of the analysis, these phrases were classified based on similarity of subject matter. This resulted in the 6 categories shown in Table 25.

Event Category	No.	No. Ps	Examples
Traits	51	9	sociable, inventive, sensitive to the feelings of others, mindmates as spouses, quick to like and dislike, a completer
Behaviours & Emotional Reactions	50	8	abstract in thought and speech, are afraid to express their own emotional reactions, cooperative in accomplishing their aims
Jobs & Subject Areas	24	9	police officer, master of ceremonies, bank examiners, hospitals, insurance industry, educationally they go for the humanities
Focus & Attitudes	24	8	focus on human potentials, play-oriented as children, their preferred time and place is the past, think in terms of ethical values
Desires & Motivation	16	6	intention always to "be themselves", seek unity in their lives, insatiable hunger for knowledge, willing to work long hours
Abilities	11	6	good at functional analysis, can understand and deal with complex issues, have strong empathic abilities

Table 25: Categories of phrases commented upon in the Keirsey portraits

In Table 25, the first column shows the category (a name given to summarise the class members), the second column shows the number of phrases that form the category, the third column shows the number of participants who commented on phrases of the category, and the fourth column shows some examples of the category members.

Following this classification, the categories of phrases were analysed on the basis of the percentage of phrases contained in the category that had been agreed with or disagreed with by all those participants who commented on the phrase, or that had received both agreement and disagreement from different participants. The results are the percentages shown in Table 26.

	Number of phrases agreed with	Number of phrases disagreed with	Number of phrases with agreement & disagreement
Traits	62.7%	31.4%	5.9%
Behaviours & Emotional Reactions	54%	30%	16%
Jobs & Subject Areas	29.2%	54.2%	16.7%
Focus & Attitudes	75%	12.5%	12.5%
Desires & Motivation	68.8%	12.5%	18.8%
Abilities	36.4%	45.5%	18.2%
Average	54.4%	31.0%	14.7%

Table 26: Amount of agreement and disagreement with phrase categories

As shown in the table, participants agreed with 54.4% of the phrases they commented upon, which was generally reflected over all the phrase categories. The major exceptions to this were the phrases associated with **jobs and subject areas**. Of these, only 29.2% received agreement from participants. Similarly, participants disagreed with 31.0% of the phrases they commented upon, which was generally reflected over all the phrase categories, except for **jobs and subject areas** of which 54.2% were disagreed with. At the opposite extreme were phrases associated with **focus and attitudes**, 75% of which received agreement and 12.5% received disagreement.

The specific phrases that were selected for comments by participants were analysed for commonality. It was found that 9 phrases had been commented upon by 3 or more participants. These phrases and comments about the agreement or disagreement they received are shown in Table 27.

Phrase/Sentence	No.	Agreement	Taken from..
pessimistic about the future, fatalistic about the past, and their preferred time and place is the past and the gateway	5	all disagree	Guardian
intention always to "be themselves"	4	all agree	Champion
they can chat tirelessly about the ups and downs in their lives	3	1 agree, 2 disagree	Protector
the hospital is a natural haven for them	3	all disagree	Protector
shyness with strangers	3	2 agree, 1 disagree	Protector
empathic	3	all agree	Idealist
benevolent	3	all agree	Idealist
seeing to it that others toe the mark	3	1 agree & 2 disagree	Supervisor
have an eye out for a better way	3	all agree	Inventor

Table 27: Most common phrases selected for comment by the participants

Working with the Opposite

After being shown the portrait of their opposite and discussing this, 8 of the participants were asked if they felt they could work with this type of person or that it might cause friction. 4 participants felt that there would be problems working with their primary opposite, although 2 felt that they could avoid any clashes but would want to get out of the situation as soon as possible. The other 4 participants felt that they could, and had, worked successfully with people like their opposite temperament, 2 participants feeling that it was important to have people of opposite types to compliment each other and get the job done.

6.3.4.2 Feedback questionnaire - Open-ended questions

Directly following the Keirsey temperament session, each participant completed a feedback questionnaire containing four questions on their reactions to the session. An analysis of the responses is as follows.

What were your general impressions of the Keirsey temperament session?

From the 9 questionnaires received from the main study, a total of 17 entries were made to describe the general impressions to the Keirsey temperament session. The most popular impression was “interesting” used by 6 participants. A number of impressions were associated with enjoyment, such as “enjoyed session”, “very good” and “light-hearted”. Two participants described the accuracy of the portrait, using the terms “accurate” and “insightful”, although another participant noted that the

technique “did not really categorise me correctly”. A further 3 non-positive impressions were used: “forced difficult choices”, “ambivalent” and “not challenging”.

What was good about the Keirsey temperament session?

Analysis revealed two main categories of responses of what was good about the Keirsey temperament technique. First, 4 participants felt the technique was good because the **portraits given were accurate**, such as “came up with a personality trait that I found quite like how I perceive myself”, “the end result was exactly how I see myself”, and “I thought the analysis was remarkably accurate particularly when I read the opposites so as to confirm that I couldn’t relate to the portraits”. Second, 3 participants felt the technique was good because it was **quick and easy**, such as “relatively easy to do, except for some questions” and “quick and easy tool to use”. Other responses covered a variety of issues, such as “feedback information was focussed”, “very enlightening” and “could have been fun if gave better answer”.

What was poor about the Keirsey temperament session?

Of the 9 questionnaires received, 6 participants made comments on what was poor about the Keirsey temperament technique. Analysis revealed two categories of responses. First, 7 participants felt the Keirsey technique was poor because of **difficulties in answering the questions**, such as “I didn’t fully understand some of the questions”, “I felt that different answers would be applicable in different situations” and “I struggled with up to 30-40% of questions which answer to give”. Second, 3 participants felt the technique was poor because of **problems with the outcomes**, such as “did not categorise me well” and “no firm conclusions”.

Please describe anything in the Keirsey temperament session that made you think about things you hadn’t (consciously) thought before, or helped give you a greater understanding of yourself?

Of the 9 questionnaires received, 6 participants responded to this question. Analysis revealed a single category of responses, made by 3 participants, associated with **specific new thoughts about one’s personality**, such as “harmony in relationships is much higher up my priority list that I’d previously thought” and “interaction with others - empathetic approach”. Other responses covered a variety of issues, such as “some of the questions were things that I hadn’t consciously thought through before”

and “I’ve done a similar activity before using other tools”.

6.3.4.3 Feedback questionnaire – Rating scales

After performing the Keirsey temperament session, each of the 9 participants in the main study completed a rating-scale questionnaire. The questionnaire included 6 ratings with Likert-type scales from 1 to 7.

The results of the questionnaire ratings were compared to explore any differences due to gender, age or qualifications. Table 28 shows average values and standard deviations (in brackets) for these demographic variables.

Rating	All	Gender		Age		Qualifications	
		Male	Female	<40 yrs	>40 yrs	Non-Grad	Graduate
Interesting	5.33 (1.118)	4.83 (0.753)	6.33 (1.155)	5.80 (1.304)	4.75 (0.500)	5.67 (1.155)	5.17 (1.169)
Thought-provoking	4.33 (1.658)	4.00 (1.673)	5.00 (1.732)	5.00 (1.414)	3.50 (1.732)	4.00 (1.732)	4.50 (1.761)
Enlightening	3.33 (1.414)	3.17 (1.472)	3.67 (1.528)	4.00 (1.225)	2.50 (1.291)	3.00 (1.00)	3.50 (1.643)
Demanding / Difficult	2.78 (1.202)	3.00 (1.265)	2.33 (1.155)	2.80 (1.483)	2.75 (0.957)	2.33 (1.155)	3.00 (1.265)
Openness	6.44 (0.527)	6.33 (0.516)	6.67 (0.577)	6.60 (0.548)	6.25 (0.500)	6.33 (0.577)	6.50 (0.547)
Recommend’n	4.89 (1.537)	4.50 (1.517)	5.67 (1.528)	5.40 (1.342)	4.25 (1.708)	5.33 (1.528)	4.67 (1.633)

Table 28. Comparison of the means and SDs of the questionnaire ratings for the Keirsey temperament technique based on the gender, age and qualifications of the participants

As shown the table, there is little difference in scoring based on gender, age and qualifications. One exception is that females rated the Keirsey technique as being more **interesting** (mean=6.33) than males (mean=4.83). In addition, there was a tendency for younger participants to rate the Keirsey technique as being more **enlightening** (mean=4.00) than older participants (mean=2.50). No statistical tests were performed due to the low number of participants involved.

Table 29 shows the mean and standard deviation of ratings for the Keirsey technique as compared to those from the other techniques being assessed.

	KEIRSEY TEMPERAMENT		ALL OTHER TECHNIQUES	
SUBJECT OF RATING	Mean	Std Dev.	Mean	Ave Std Dev.
INTERESTING	5.33	1.05	5.50	1.00
THOUGHT-PROVOKING	4.33	1.56	5.43	1.06
ENLIGHTENING	3.33	1.33	4.66	1.25
DEMANDING / DIFFICULT	2.78	1.13	3.72	1.31
OPENNESS	6.44	0.50	6.26	0.66
RECOMMENDATION	4.89	1.45	5.43	0.92

Table 29: The means and SDs of the questionnaire ratings for the Keirsey temperament technique compared to the means and SDs of the ratings for the other techniques being assessed

As shown in the table, the Keirsey temperament technique was generally rated as being less **thought-provoking**, less **enlightening**, less **difficult/demanding** and less **recommended** as compared to the other techniques being assessed. The Keirsey temperament technique was rated as less **thought-provoking** and less **enlightening** than the other techniques.

6.3.4.4 Verbal feedback from feedback session

After the completion of all the sessions that assessed each individual technique, a feedback session was held with each participant to gain more feedback on the techniques as a whole. An analysis of the responses that specifically addressed the Keirsey temperament session is described below.

How beneficial was the session?

Analysis revealed 3 categories of responses, 1 being negative and 2 positive. First, four participants felt the Keirsey temperament session was **not useful**, with comments such as “it didn’t give me any understanding or anything revealing about me” and “you did it and said ‘I agree, I agree’, but what did it tell me that I didn’t already know?”. Second, three participants felt the session was **interesting** but not that useful, such as “it was interesting to see how the responses had pigeon-holed me so accurately”. Third, two participants felt this technique, like all personality techniques, was **useful**, such as “I always benefit from these personality things, because they help me focus on the positive side of my personality”.

Did any changes in thinking or behaviour result from the session?

None of the participants felt that the session had led to any changes in thinking or behaviour, making comments such as “helped confirm what I already knew”, “no conscious changes - maybe sub-conscious” and “possibly useful for people who don’t

know what they're like, but not for me".

What uses is the Keirsey temperament portrait to you?

Four participants offered personal uses of the Keirsey information. Two participants suggested uses in **decision-making and behaviour**, making the comments "it may help when thinking about going for a job to eliminate unsuitable jobs" and "helps me understand the things I might do or rationalise the way I might behave in certain circumstances". One participant felt personality techniques, in general, helped **raise self-esteem**, stating "they help make you think a bit more positively about yourself, about why you're different and that it's okay to be the way you are". Another participant suggested a use in **raising self-understanding**, stating "maybe it could help me to understand myself more by re-reading what my personality type should be, and might help me realise why I don't like doing certain things".

What uses is the Keirsey temperament portrait to other people?

Three categories of responses were found. First, six participants suggested using the technique for **selection and suitability for a job**, making comments such as "to help fit people to jobs", "useful for interviewers to give a more complete and balanced view than just doing an interview" and "suitability to the job you're in and how you approach it". Second, four participants suggested using the technique for **team building**, making comments such as "if you need a mixture of people to do a task, then having people with different personalities will help". Third, two participants suggested the technique could be used by a **dating agency**, making comments such as "might be interesting to match partners for long-term relationships by looking at relationships that have worked well".

How could the Keirsey temperament technique be improved?

Seven participants made suggested improvements. Three participants suggested that the **portraits were too general and needed to be more personal**. Two participants noted that **more time** was required to read through all the portraits. Two participants noted that the **clearer language** would be better in the questions and portraits. Two participants questioned the **repeatability of the answers** they had given.

6.3.4.5 General Opinions from Each Participant

To conclude this section of results, Table 30 presents the general opinions from each

participant to the Keirsey temperament technique taken from various sources.

Par't	General impressions	Rank	How beneficial was the session
E	Interesting	1	I really enjoyed it, mainly because of conversations I'd had with some friends who were very enthusiastic about it. It's interesting to see if you can tell things about people from the answers they give to some simple questions.
F	Very interesting. I'm fascinated by tools that assess personalities	4	I always benefit from these personality things, because they help me focus on the positive side of my personality.
J	Very good, enjoyed session	4	Like a lot of test info we use at work, such as Thomson International. Nothing mega-revealing, not like previous sessions.
A	Interesting, but lacking firm conclusions	5	I've done these sort of things before. Could relate to a lot of the statements afterwards. But didn't give me any understanding or anything revealing about me.
G	Interesting, forced difficult choices	5	Didn't tell me more than Myers-Briggs or Thomson International, just expressed it in another way. A useful tool. It pulls different elements of me together – how I am, but not how I've developed.
H	Quick	6	I was amazed that it was such a good likeness to me. It's interesting but not that useful, except realising that I slot exactly into a category.
I	Interesting, Ambivalent, Insightful	7	You did it and said "I agree, I agree", but what did it tell me that I didn't already know?
C	Light-hearted, Not challenging Accurate	7	The fact it's used in women's magazines made it light-hearted. I was impressed by the way it categorised me. I enjoyed it, but it didn't reveal anything.
D	Method simplistic. Did not really categorise me correctly	7	Nothing was revealed. In general, these techniques are very good and they do help to crystallise out some things that tend to be woolly before. But I didn't find this one useful at all.

Table 30: General opinion and ranking from each participant in the main study to the Keirsey Temperament Session

6.3.5 Summary and Discussion

6.3.5.1 Summary of Results

7 participants had scores that placed them in a single temperament: 3 being a Protector, 2 being a Healer, 1 as a Champion and 1 as a Provider. The other 2 participants were borderline due to equal scores on 1 or more dimension. When shown the portrait of their primary temperament, most participants expressed very positive reactions. When shown the portrait that is the direct opposite of their primary temperament, 6 participants commented that it was very unlike themselves, and 3 pointed out that some parts of the descriptions of their opposite were similar to how they see themselves. When commenting on phrases in the portraits, six categories of phrases were discerned, the most common being **traits** (all participants) and **jobs & subject areas** (all participants).

The post-interview questionnaires revealed that 6 participants found the session to be

interesting and 2 participants found the classification to be **accurate**. Comments about what was good about the session included 4 participants who felt that the **portraits given were accurate** and 3 participants who felt that the technique was **quick and easy**. Comments about what was poor about the session, included 7 participants who felt that there were **difficulties in answering the questions** and 3 participants who felt that there were **problems with the outcomes**. 6 participants felt the session led to more understanding, 3 participants feeling that this was associated with **specific new thoughts about one's personality**.

Comparison between the ratings of all the techniques being assessed showed that the Keirsey technique was rated as being less **thought-provoking** and **less enlightening** than the other techniques. Ratings indicated that females found the Keirsey technique to be more **interesting** than males, and there was some indication that younger participants found the technique to be more **enlightening** than older participants.

Results from the feedback session showed that 4 participants felt the session was **not useful**, 3 participants felt the session was **interesting but not that useful**, and 2 participants felt the session was **useful**. None of the participants felt that changes in thinking or behaviour had resulted from the session. Four participants made suggestions for personal uses of the Keirsey technique, including 2 participants who suggested uses in helping **decision-making and behaviour**. Suggestions for uses by other people included use in **selection and suitability for a job** (6 participants) and uses in **team building** (4 participants). Suggestions for possible improvements included **making the portraits more personal** (3 participants), having **more time** (2 participants), having **clearer language** in the questions and portraits (2 participants), and examining the repeatability of profiling (2 participants).

When ranking all the techniques being assessed, 1 participant placed the Keirsey technique in their top three, and 4 participants placed the Keirsey technique in their bottom three.

6.3.5.2 Discussion

It is clear from a number of indicators that the participants rated the Keirsey temperament technique quite poorly compared the other techniques. Indeed, only one participant placed this technique in their top three when ranking all the techniques

during the feedback session, whilst 4 placed it in their bottom three. Compared to the other techniques being assessed, this places the Keirsey temperament technique second to last in favouritism. Why should this be the case? It is certainly not due to the amount of interest generated, since almost all the participants found the Keirsey temperament session to be interesting, enjoyable and not that demanding or difficult. Rather, the reason for the low ranking seems to be the result of this technique not being as thought-provoking nor enlightening as most of the other techniques. Indeed, the post-session questionnaires showed that ratings for the Keirsey temperament technique were significantly lower for scores of *thought-provoking* and *enlightening* compared to the other techniques. What appears to be happening is that participants generally find the Keirsey technique to be interesting and enjoyable because of two factors: (1) the quiz-like nature of the method, and (2) the surprising accuracy of the portraits. Although the portraits are accurate, this merely states what the participants already know about themselves and does not lead them to explore aspects of themselves nor provide any revelations.

It is interesting that female participants tended to find the Keirsey technique to be more interesting than males, and there was some indication that younger participants found the technique to be more enlightening than older participants. Perhaps the latter point shows that younger participants are less certain or knowledgeable about their own temperament, hence find the portraits to be more enlightening.

One aspect of the full Keirsey temperament method is to explore the way people would work and interact with someone who fits their opposite temperament. From the limited amount of evidence gathered here, there was a wide range of opinions on this matter. About half the participants believed they could work with their opposite, and in some cases this would be positively beneficial. The other half, however, believed they definitely could not work with their opposite and it would be in no way beneficial. This wide range of opinions suggests that little is to be gained from presenting any firm recommendations on this matter, unless there is a deeper understanding of the way this changes from person to person and situation to situation.

A number of specific problems and possible improvements to the Keirsey technique have been revealed. Most participants described problems with the questioning stage. Three problems here were (1) understanding the question and answers (due to the

language used), (2) deciding which of the two answers to give, and (3) worries that answers would change depending on the mood/situation. Although such problems should not occur in a tried-and-tested technique, these problems perhaps indicate that the technique has been developed using one population of people (probably all American in this case) but then applied to another. A second suggested improvement from participants is to make the portraits less general and more personal. This somewhat contradicts the nature of this technique since the portraits are aimed at being general. However, this may reflect a need for a larger number of portraits, and by implication more than four dimensions.

Further discussion and comparison with the other techniques will be covered in chapters 8 and 9.

7 NETWORK-BASED TECHNIQUES

*A picture shows me at a glance what it takes dozens of pages of a book to expound.
(Ivan Turgenev, author, 1818-83)*

This chapter covers the empirical work undertaken on three techniques based on the construction of semantic networks. The chapter is divided into three sections. The first section covers the use of an event diagram technique to explore a person's life history. The second section covers the use of a state diagram technique to explore the states that a person can be in (e.g. their moods and feelings) and what events or actions move them from state to state. The third section covers the use of a decision ladder and an aspirations diagram to explore the issues surrounding a decision and how these represent the wider picture of a person's aspirations. Each of these sections includes the method used to administer the techniques, the results obtained and a discussion.

7.1 Event Diagram Technique

7.1.1 Introduction

The event diagram technique is based on the application of process mapping to capture a person's autobiography. Process mapping is a technique involving the construction and modification of a process map. A process map is a type of network diagram that shows the inputs, outputs, resources, roles and decisions associated with a process or task in a domain. Knowledge engineers often use a software tool, such as the Control Editor tool in PCPACK, to perform process mapping with an expert. More information on process maps and process mapping was previously covered in sections 3.1.1.3 and 3.1.3.8, and an example of a process map was shown on Figure 5 (in section 3.1.1.3). The results obtained for the event diagram technique during the pilot study were described in section 4.1.8.4.

7.1.2 Method

The event diagram technique makes use of 3 PCPACK tools: the Protocol Editor, Process Ladder and Control Editor (see Appendix B). The Control Editor is the tool most used during the session with the participant. For each participant, the following steps are performed prior to the session:

1. Identify events from the transcript of the initial interview (using the Protocol

Editor tool).

2. Produce a timeline (on paper) showing the span of the participant's life from birth to the present, marking decades and placing events at the appropriate dates.
3. Using the timeline for reference, segment the participant's life into about 8 time periods. Name the periods including the dates, e.g. "at university ('79-'81)".
4. Using the Laddering tool (process ladder), place the time periods as uppermost nodes in a hierarchical breakdown (in chronological order). Enter the events as child nodes to the appropriate time periods, again in chronological order. If the exact date of an event is not known, a position for it in the ladder is estimated.
5. Using the Control Editor tool, enter the time periods as oval-shaped "process" nodes on the top-level diagram, so that they appear in chronological order from top-left to bottom-right. The nodes showing time periods are joined by dotted lines showing the chronology.
6. For each time period, use the Control Editor tool to create a new diagram and enter the appropriate events as oval-shaped "process" nodes. The events, if sequential, should be ordered chronologically from top-left to bottom-right. If dates are unknown or events overlap or occur in parallel, then these are placed horizontally to one another.
7. Using the interview transcript, attempt to identify three things associated with each event. First, the reasons the event occurred (e.g. "It happened because he was being nasty to me"). Second, the way the event affected things (e.g. "It made my parents very proud of me"). Third, the way the event was described (e.g. "traumatic", "a turning point").
8. For each event, represent the reasons the event occurred as inputs (using the rectangular "datastore" nodes and solid arrows). For each reason, where applicable, show which previous event led to the reason using a solid arrow (i.e. by representing the reason as an output from a previous event). The reason is now an 'interface' between the two events.
9. For each event, represent the way the event affected things by showing the state of things before the event as inputs to the event, and the state of things after the event as outputs. Where applicable, connect these inputs and outputs to other events to

show how the effects of one event caused or were affected by a subsequent event. If this occurs across the boundaries of time periods, show the appropriate interface on the top-level diagram connected to the appropriate two time periods.

10. Represent descriptions of events using the rectangular “datastore” nodes placed at the right-hand edge of the associated events.

During the session, use a portable PC running PCPACK (version 2.11). For each participant, the following steps are performed during the session:

1. Use the Process Ladder to check for factual inaccuracies in the names and dates of time periods and events. Alter the position of the events in the ladder and in the Control Editor diagram if the event had been placed in the wrong period.
2. Using the Control Editor, show the top-level diagram which displays the time periods. In chronological order, show each diagram and describe what it represents. Use the diagram to check and modify the diagram to expand the knowledge captured. Try to link interfaces between events. Use the diagram to prompt for further knowledge, including additional events, reasons for events, the way events affected things and event descriptions. Add the new knowledge to the diagrams using the Control Editor tool.

7.1.3 Results

This section is split into five parts. First, there is an analysis of the knowledge content captured during the session. Second, there is an analysis of the responses given to the open-ended questions on the feedback questionnaire. Third, there is an analysis of the scores given to the rating-scale questions on the feedback questionnaire. Fourth, there is an analysis of verbal responses given during the feedback session that specifically addressed the event diagram session. Fifth, there is a summary of each participant’s opinion of this technique. The results shown are all taken from the main study that involved 10 participants.

7.1.3.1 Content Analysis

Basic Statistics

The number of **events** used by the participants ranged from 16 to 42, and averaged 25.2. The number of **interfaces** used by the participants ranged from 5 to 67, and

averaged 35.7. The number of **event-attributes** used by the participants ranged from 4 to 20, and averaged 10.6. The number of diagrams developed during the session (each diagram depicting a time period in a person's life) ranged from 3 to 6, and averaged 4.3. Using these basic statistics, the typical set of event diagrams produced by a participant during the session would include about 4 diagrams, each diagram depicting about 5 or 6 events, about 9 interfaces and 2 or 3 event-attributes. An example of such a typical diagram is shown in Figure 12.

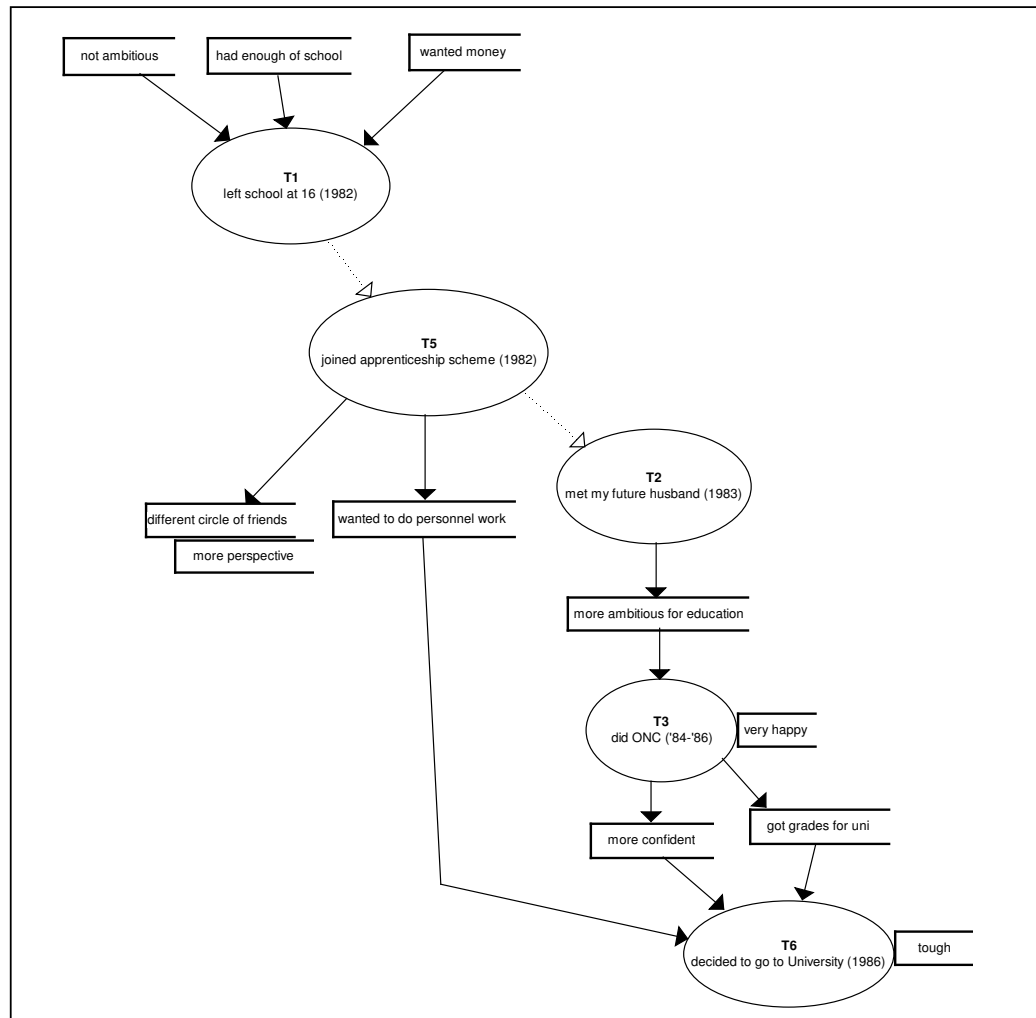


Figure 12: Typical example of one of the diagrams developed during an event diagram session
The basic content of the event diagrams was analysed to explore any differences due to gender, age or qualifications. Table 31 shows differences in the number of events, the number of interfaces, the number of attributes, the number of interfaces per event and the number of attributes per event for these demographic variables.

		Gender		Age		Qualifications	
	All	Male	Female	<40 yrs	>40 yrs	Non-grad	Graduate
Number of Events	25.20 (7.871)	26.33 (9.223)	23.50 (6.137)	23.00 (5.244)	27.40 (9.990)	21.25 (3.594)	27.83 (9.109)
Number of Interfaces	38.10 (17.175)	43.17 (14.176)	30.50 (20.535)	35.40 (11.149)	40.80 (22.830)	32.75 (22.470)	41.67 (13.779)
Number of Attributes	10.60 (5.797)	12.33 (7.062)	8.00 (1.633)	8.00 (3.162)	13.20 (6.9785)	6.50 (1.915)	13.33 (5.989)
Interfaces per event	1.494 (0.5789)	1.683 (0.3797)	1.211 (0.7662)	1.561 (0.4395)	1.427 (0.7413)	1.449 (0.9398)	1.524 (0.2654)
Attributes per event	0.4139 (0.1803)	0.4537 (0.2180)	0.3542 (0.1023)	0.3504 (0.1455)	0.4774 (0.2048)	0.3190 (0.1356)	0.4771 (0.1884)

Table 31. Comparison of the contents of the event diagram based on the gender, age and qualifications of the participants

As shown in the table, older participants used more **event-attributes** (mean=13.20) than younger participants (mean=8.00). Graduates tended to use more **interfaces** (mean=41.67), more **event-attributes** (mean=13.33), and more **attributes per event** (mean=0.4771) than non-graduates (means=32.75, 6.50 and 0.319, respectively).

Events

There were a total of 252 events across all the diagrams constructed. These were classified based on similarity of subject-matter. This resulted in 13 categories. The larger of these categories (with more than 20 occurrences) were associated with (1) **change in role**, (2) **training courses**, (3) **births and deaths**, (4) **relationships**, (5) **time on a job**, and (6) **joining/leaving an organisation**. These and the other categories are shown on Table 32. In this table, the first column shows the event category (a name given to summarise the class members), the second column shows the number of events that form the category, the third column shows the number of participants who used events of the category in their diagrams, and the fourth column shows some examples of the category members.

Event Category	No.	No. Ps	Examples
change in role	28	8	got a promotion, moved to HQ, became a foreman, left the labs
training courses	27	8	go on sales course, start MBA, course on presentation skills
births and deaths	26	9	birth of son, wife died, nan died
relationships	22	8	met first wife, first year of marriage, decided to be single
time on a job	22	8	change of boss, organised big event, get pay rise
start a job	21	10	got first job, got job at foundry, got job in shop
moved home	17	6	came back to Scotland, bought 2nd house, got place with J
marriage & split-up	16	10	got married, get engaged, wife decided to leave
illness	14	4	illness of father, broke neck, had car accident
school & university	13	7	went to Grammar School, left school at 16
redundancy	10	6	company went bust, made redundant
looking for job	8	4	spent time looking for a job, thinking about different jobs
interests	6	4	went to squash competitions, made a boat
realisations	5	2	realised things weren't forever, realised how nasty you can be
family matters	4	2	spent more time with family, son went to nursery
start/end a business	4	1	opened another business, started consultancy

Table 32: Categories of events used on the event diagrams

Interfaces

The participants produced a total of 388 interfaces (including inputs, outputs and input/outputs) across all the diagrams constructed. Removing those interface names that were repetitious, there were 371 unique interfaces. The number of interfaces produced by each participant ranged from 5 to 68, and averaged 38.8. Interfaces associated with **confidence** (e.g. more confident, knocked confidence) were used by 6 participants, and the interface **more independent** was used by 3 participants.

The 371 unique interfaces were classified based on similarity of subject matter. 351 were classified into one of 20 categories. These are shown on Table 33, which is of the same format as the previous table.

Category	No.	No. Ps	Examples
Situation & Context	53	10	job had novelty value, extra work, lived apart, more stability
Traits	37	8	lack of confidence, fairly easy-going, less outgoing
Wants	35	8	wanted to do engineering, wanted independence, wanted support
Feelings	29	10	felt guilty, felt a bit harder, more relaxed, feelings of regret
Thinking & Understanding	26	9	think more about health, more self-awareness
Learning	23	9	learnt to take responsibility, realised about limitations
Relationships	22	7	still remain friends, got on very well with manager
Interests	18	9	interest in manufacturing, bored with the job
Money	17	7	richer, more focused on saving money
Confidence	15	6	boost in confidence, knock to confidence
Help & Encouragement	11	6	advised to give-up work, parents encouraged me
Qualifications & Education	11	6	no qualifications, no others in family had been to university
Possibilities & Constraints	8	5	could go on holiday, couldn't cope on my own
Mood & State	8	5	relieved, hurt and angry, ready to get married
Priorities & Perspective	7	5	job a high priority, coloured my approach to things
Success	7	4	got me noticed, high standards of work
Independence	6	6	more independent, wife and child dependent on me
Motivation & Ambition	6	5	more determined, more ambitious for education
Norms	6	4	values of parents, peer group saw change as foolish
Needs	6	3	need to achieve, reinforced need for good friends

Table 33: Categories of event interfaces used on the event diagrams

The 388 interfaces were classified on the basis of whether the interface was acting as the input to an event, the output of an event, or both an input and an output. It was found that 35.9% of interfaces acted as inputs, 41.8% acted as outputs, and 22.4% acted as both an input and an output. The percentage figures for the most common categories of interface are shown in Table 34.

Common Interface Categories	%age of Inputs	%age of Outputs	% of Input/Outputs
Situation & Context	61.1 %	29.6 %	9.3 %
Traits	41.7 %	30.6 %	27.8 %
Wants	57.1 %	20.0 %	22.9 %
Feelings	12.9 %	38.7 %	48.4 %
Thinking & Understanding	8.3 %	79.2 %	12.5 %
Learning	4.5 %	77.3 %	18.2 %
Relationships	50.0 %	36.4 %	13.6 %
Interests	44.4 %	22.2 %	33.3 %
Money	18.8 %	50.0 %	31.3 %

Table 34: Percentage of interface types for the most common interface categories

As can be seen, the percentage of outputs for the categories of **Thinking & Understanding** and **Learning** are much higher than the average.

Event Attributes

The participants produced a total of 106 event-attributes across all the diagrams constructed. Only 5 attributes were used by more than one participant. **Traumatic** was used by 3 participants; **quite traumatic**, **stressful**, **fine** and **very happy** were used by 2 participants.

Of the 106 attributes, 93 were classified into 11 categories. The largest categories, with more than 10 occurrences, were associated with (1) **upset & difficulty**, (2) **emotions and moods**, (3) **expectancies & variation** and (4) **happiness & enjoyment**. These and the other categories are shown on Table 35 (which is of the same format as Table 33).

Category	No.	No. Ps	Examples
upset & difficulty	21	8	very upsetting, hard, tough, quite difficult, not too bad
emotions & moods	12	6	embarrassment, felt hollow, angry, self-doubt, husband a bit moody
expectancies & variation	11	8	shocked, very unexpected, disappointing, unusual, more varied
happiness & enjoyment	10	8	happy, enjoyable, exciting, felt good, we thought it was marvellous
attribute of other people	6	3	she was a political animal, she was protective & nagged a lot
success & results	5	4	very successful, stood out in the job
stress	5	3	very stressful, lots of stress & trauma
importance	5	2	an important transition, turning point in my career
regrets	4	3	never regretted the decision, big mistake
attribute of self	4	3	had to rely on own strength, had problems with exams
wants & needs	2	2	wanted to do well, needed a lot of work

Table 35: Categories of event attributes used on the event diagrams

Observations in Participant's Use of the Event Diagram Session

An interesting and unexpected limitation was found in the symbology available in PCPACK for constructing event diagrams. Quite often, a participant required to show that a particular state of the world (as represented by an interface) had caused another state of the world to occur without an explicit intervening event. For example, the event "found out our son was very ill" resulted in the output "needing to cope with

stress” which led to the interface “put problems at work in perspective” which was an input to the event “got promotion”. The representation used was to simply place the two interface boxes next to each other. An example of this was shown previously on Figure 12 for the interfaces “different circle of friends” and “more perspective”.

7.1.3.2 Feedback questionnaire - Open-ended questions

Directly following the event diagram session, each participant completed a feedback questionnaire containing four open-ended questions on their reactions to the session. An analysis of the responses is as follows.

What were your general impressions of the event diagram session? (2-3 adjectives please)

From the 10 questionnaires received from the main study, a total of 17 entries were made to describe the general impressions of the event diagram session. The most popular impressions were “interesting” used by 6 participants, and “thought-provoking”/“stimulating” used by 3 participants. “Enlightening” and “Simple”/“Easy to follow” were each used by 2 participants. The other impressions were “very impressive”, “enjoyable”, “quick” and “novel”. No negative impressions were used.

What was good about the event diagram session?

Analysis revealed five main categories of responses of what was good about the event diagram technique. First, 5 participants felt the session was good because of the **clarity of the diagram format**, such as “the events were clear to see in their logical order”, “it helped me visualise events in chronological order” and “fast way of structuring this type of information”. Second, 3 participants felt the session was good because it **revealed new knowledge**, such as “enabled linkages to be made between important but different events in life and work” and “I feel I learn a lot more through this mapping process and can be more reflective”. Third, 3 participants felt the session was good because it **provoked thought**, such as “it made me think about key events and how they influenced my behaviour and decisions” and “it pulled out many thoughts we had not discussed before”.

What was poor about the event diagram session?

Of the 10 questionnaires received, 6 participants made comments on what was poor about the event diagram technique. Analysis revealed little similarity between the

responses. Only two of the responses were similar and associated with a **lack of time**, i.e. “I would have liked more time” and “it opened up other linkages and prompted other memories which time pressure made impossible to capture”. Other responses covered various issues, such as “a bit clinical perhaps”, “I didn’t feel it looked in-depth at how the events had affected my life” and “difficult to appreciate how it will be useful to anyone other than me!”.

Please describe anything in the event diagram session that made you think about things you hadn’t (consciously) thought before, or helped give you a greater understanding of yourself?

Of the 10 participants only one did not respond to this question. Analysis revealed three main categories of the ways the event diagram technique helped lead to greater self-understanding. First, 5 participants felt the session led to more understanding about **links between events**, such as “helped me reflect on past experiences and how they affected my decisions”, “it made some links between events that I’d realised were probably there, but hadn’t thought about in much detail” and “it was the first time that a total picture of actions and their relationships to one another along a time-line began to emerge”. Second, 2 participants felt the session led to more understanding about **links between events and behaviours**, such as “made me see links between events and my subsequent changes in behaviour that I hadn’t previously considered”. Third, 2 participants felt the session led to more understanding about **specific issues**, such as “made me think how things like health and money does shape your life”.

7.1.3.3 Feedback questionnaire – Rating scales

After performing the event diagram session, each of the 10 participants in the main study completed a rating-scale questionnaire. The questionnaire included 6 ratings with Likert-type scales from 1 to 7.

The results of the questionnaire ratings were analysed to explore any differences due to gender, age or qualifications. Table 36 shows average values and standard deviations (in brackets) for these demographic variables.

Rating	All	Gender		Age		Qualifications	
		Male	Female	<40 yrs	>40 yrs	Non-Grad	Graduate
Interesting	5.50 (1.179)	5.50 (0.837)	5.50 (1.732)	5.00 (1.581)	6.00 (0)	5.50 (1.732)	5.50 (0.837)
Thought-provoking	5.30 (1.494)	5.50 (1.049)	5.00 (2.160)	4.80 (1.924)	5.80 (0.837)	4.75 (2.062)	5.67 (1.033)
Enlightening	5.00 (1.633)	5.33 (1.033)	4.50 (2.380)	4.20 (1.924)	5.80 (0.837)	4.75 (2.500)	5.17 (0.983)
Demanding / Difficult	3.20 (1.398)	3.00 (1.549)	3.50 (1.291)	3.00 (1.581)	3.40 (1.342)	2.75 (0.957)	3.5 (1.643)
Openness	6.40 (0.516)	6.33 (0.516)	6.50 (0.577)	6.40 (0.548)	6.40 (0.548)	6.50 (0.577)	6.33 (0.516)
Recommend'n	5.60 (0.843)	5.67 (0.516)	5.50 (1.291)	5.20 (1.095)	6.00 (0)	5.75 (1.258)	5.50 (0.548)

Table 36. Comparison of the means and SDs of the questionnaire ratings for the event diagram technique based on the gender, age and qualifications of the participants

As shown in the table, there are no notable differences in the ratings based on gender, age and qualifications. The only tendency is for older participants to rate the event diagram technique more highly than younger participants. No statistical tests were performed due to the low number of participants involved.

Table 37 shows the mean and standard deviation of ratings for the event diagram as compared to those from the other techniques being assessed.

SUBJECT OF RATING	EVENT DIAGRAM		ALL OTHER TECHNIQUES	
	Mean	Std Dev.	Mean	Ave Std Dev.
INTERESTING	5.5	1.12	5.48	0.99
THOUGHT-PROVOKING	5.3	1.42	5.29	1.08
ENLIGHTENING	5.0	1.55	4.42	1.21
DEMANDING / DIFFICULT	3.2	1.32	3.66	1.28
OPENNESS	6.4	0.49	6.26	0.66
RECOMMENDATION	5.6	0.80	5.33	1.01

Table 37: The means and SDs of the questionnaire ratings for the event diagram technique compared to the means and SDs of the ratings for the other techniques being assessed

As shown in the table, the event diagram technique was generally rated as being more **enlightening** as compared to the other techniques being assessed.

7.1.3.4 Verbal feedback from feedback session

After the completion of all the sessions that assessed each individual technique, a feedback session was held with each participant to gain more feedback on the techniques as a whole. An analysis of the responses that specifically addressed the

event diagram session is described below.

How beneficial was the session?

In general, 7 participants felt the session was beneficial and 3 felt it was not. Analysis revealed 4 categories of responses, 3 being positive and 1 negative. First, four participants felt the session was **revealing**, such as “it pulled out patterns I’d not seen before, which is that my life tends to go in lots of phases” and “starts to tie things together and reveal reasoning why some events happen”. Second, two participants felt the session helped them **learn** more about themselves, such as “began to make connections and come down to a number of core motivations that sat behind decisions – I learnt a bit about myself”. Third, two participants felt the session was **interesting but not useful**, such as “it was interesting to see how unrelated events many years apart could have very similar effects”. Fourth, two participants felt the session was **not useful and of no interest**, such as “it just put down on paper what I know”.

Did any changes in thinking or behaviour result from the session?

Four participants felt that changes had resulted from the session. Two participants commented that they felt **more comfortable** afterwards, one saying “it makes me a little more settled to think I don’t know what I could have changed”, the other saying “it made me feel more comfortable about the root causes of decisions”. One participant noted “it does help you start to think about how you approach problems and events as they occur”. Another noted “it made me think how little things can have just as big an affect on how you are as bigger things”.

What uses are the event diagrams to you?

Eight participants suggested personal uses of the diagrams. Analysis revealed four main categories of responses. First, 4 participants suggested use in aiding **self-understanding**, such as “it’s diagnostic – it looks at the root cause, rather than just the symptoms of things” and “it gives a greater understanding about the interaction of the events and how you deal with them”. Second, 3 participants suggested uses in **decision making**, such as “maybe to influence some decisions” and “reflecting on outcomes”. Third, 3 participants suggested uses as **an autobiographical record**, such as “good concise way of recording what’s going on” and “like a brief life-history to map out what someone did”. Fourth, 2 participants suggested uses in **recognising situations**, such as “ensuring you’re recognising what’s going on and the

interactions”.

What uses are the event diagrams to other people?

Seven participants suggested uses of the diagrams by other people. Two categories of responses were found. First, four participants suggested that if other people seeing their diagram it would be for **interest only**, making comments such as “maybe of some interest to people who know me” and “my wife might find it interesting”. Second, three participants suggested using the technique for **Human Resources**, making comments such as “lots of uses - it could be used quickly and easily, for job fit, terms of conditions, trade off in stability-income balance” and “career development, what training a person needs, and team recruitment”. Other suggestions included use in relationship counselling and use by psychologists.

How could the event diagram technique be improved?

Seven participants made suggested improvements. Of the suggestions made, three participants noted that **more time** was required. Three participants suggested that **more information** could be captured about events, such as their importance and their emotional impact. Two participants felt the **elicitation process was crucial**, one suggesting that **prompt questions** from the software would aid the process. One participant suggested that the diagram format was **too clinical**.

7.1.3.5 General Opinions from Each Participant

To conclude this section of results, Table 38 presents the general opinions from each participant to the events diagram technique taken from various sources. The table is of the same format as Table 8 shown in section 5.1.3.5.

Par't	General impressions	Rank	How beneficial was the session
D	Very impressive	1	It made me realise something I had not realised before
J	Really enlightening session	2	Really enjoyed this style of learning. Had to reflect on issues.
C	Enlightening, Stimulating	2	Didn't get a greater understanding, but it's like a road map where events/decisions are put down that weren't apparent.
G	Novel, Interesting, Enjoyable	3	Began to make connections and come down to a number of core motivations that sat behind decisions.
A	Interesting, Thought-provoking	4	Starts to tie things together and reveal reasoning why some events happen
B	Interesting	5	It mapped out all the important things and it brought out everything that was important
E	Interesting	5	Nothing particular was revealed.
I	Interesting, Thought-provoking	6	It was different because it is event-based rather than assessing your personality or ranking with no detail or reasoning behind.
F	Interesting	8	Nothing really surprises me, but a fairly quick way of putting down thoughts.
H	Quick, simple, easy to follow	8	It just put down on paper what I know

Table 38: General opinion and ranking from each participant in the main study to the event diagram technique

7.1.4 Summary and Discussion

7.1.4.1 Summary of Results

The typical set of diagrams produced during a session comprised about 4 diagrams, each diagram depicting about 5 or 6 events, about 9 interfaces and 2 or 3 event-attributes. There were no significant differences in the number of nodes and links in the diagrams based on gender, age or qualifications, except for some indication that graduates use more event-attributes than non-graduates. The most popular types of event were associated with **starting a job** (all participants), **the break up of a marriage or serious relationship** (all participants) and **births and deaths** (9 participants). The most popular types of interface were associated with **feelings** (all participants), **situation & context** (all participants) and **interests** (9 participants). On average, 35.9% of interfaces acted as the input to an event, 41.8% acted as an output from an event, and 22.4% acted as both an input and an output. The most popular event-attributes were associated with **upset & difficulty** (8 participants), **expectancies & variation** (8 participants), and **happiness & enjoyment** (8 participants).

The post-interview questionnaires revealed that 6 participants found the session to be **interesting**. Comments about what was good about the session included 6 participants

who felt the **diagram format was clear**, 3 participants who felt the technique **revealed new knowledge** to them, and 3 participants who felt the technique **provoked thought**. There was no consensus among the participants about what was poor about the session, except for 2 participants who both mentioned a **lack of time**. 3 participants felt the session led to more understanding about **links between events**.

The ratings showed some indication that older participants liked the event diagram technique more than younger participants. The ratings also showed some indication that the event diagram technique was found to be more **enlightening** than the other techniques being assessed.

Results from the feedback session showed that 4 participants felt the session was **revealing**, 2 participants felt it helped them **learn** more about themselves, 2 participants felt it was **interesting but not useful**, and 2 participants felt it was **not useful and of no interest**.

4 participants felt that changes in thinking/behaviour had resulted from the session, 2 of them feeling **more comfortable** afterwards. 4 participants suggested using the technique to aid **self-understanding** and 3 participants suggested **autobiographical** uses. Suggestions for uses of the diagrams by others included uses for **Human Resources** (3 participants). Suggestions for possible improvements included having more time, the ability to capture the importance of events and use of prompt questions.

When ranking all the techniques being assessed, 4 participants placed the event diagram technique in their top three, and 3 participants placed the event diagram technique in their bottom three.

7.1.4.2 Discussion

In general, the event diagram technique proved to be successful in capturing and representing autobiographical knowledge and in so doing facilitating more self-understanding.

The technique enabled the capture of a large variety of event types, the reasons why events happened, the ways events affected the person's life and the attributes of events. The diagram format was found to be clear to follow and all the participants found it easy to understand and use. The technique helped prompt the participant to provide a clear description of events and how the effects of one event had

repercussions for later events. About half the participants found the session had revealed new knowledge, especially in the links between events.

Although the event diagram technique could probably be used without any preparation, the use of material from the semi-structured interview provided an efficient means to initiate the session and allow the participant to validate and add to the knowledge already captured.

It seems that part of the power of this technique is the way in which it prompts the participant to view events from the perspective of 'inputs' and 'outputs', i.e. how a particular event affected the participant, significant others or their circumstances, and how these changes acted as either triggers or factors for subsequent events. One of the problems with the diagrammatic format used was the lack of differentiation between three types of 'input', i.e. (1) the factors that triggered an event to occur, (2) the factors that influenced the way the event occurred, and (3) the factors that were altered by the event. Using different symbols for these three categories would be a useful modification to the current format.

Three further modification to the diagram format were found. First, the addition of one or more classes of relation (i.e. types of link), to represent causal links between 'inputs' and 'outputs' (as described previously at the end of section 7.1.3.1). Second, some means to capture the importance of events and their emotional impact. Perhaps the use of colour or different symbols might help with this. Third, the use of a customisable set of symbols and possible use of pictures and images might help the personalisation of the technique since some people may find the format too formal and clinical in its current state.

A number of problems and possible improvements to the event diagram technique have been revealed. Some participants suggested a need for more time. This can be viewed as encouraging as it implies the participants who suggested this are sufficiently motivated and interested to spend more time with this technique. Another suggestion was the use of prompt questions, i.e. to make use of a form-filling piece of software and automatically construct prototype diagrams from the responses given. This would be a useful move towards automating the technique.

Further discussion and comparison to the other techniques will be covered in the following two chapters.

7.2 State Diagram Technique

7.2.1 Introduction

The state diagram technique is based on the use of a state transition network to capture and explore the states that a person can be in (e.g. their moods and feelings) and how they move from state to state. A state transition network is a type of network diagram that comprises two elements: (1) nodes that represent the states that a concept can be in, and (2) arrows between the nodes showing all the events and actions that can cause transitions from one state to another. An example of a state transition network for a telephone was shown previously on Figure 6 (in section 3.1.1.3). More information on the use of state transition networks for knowledge acquisition can be found in sections 3.1.1.3 and 3.1.3.8. The results obtained for the state diagram technique during the pilot study were described in section 4.1.8.8.

7.2.2 Method

This technique consists of a network-construction technique using a single sheet of A3 paper, a pencil and rubber. The procedure is as follows.

1. Explain to the participant the following “In this session, we’ll be drawing a diagram called a state transition network” (make light of the fact that it is a complex name and they will not have heard of it). Explain the basics of a state transition network, i.e. “it’s a diagram showing the states that something can be in and the possible transitions that can occur to move from state to state”.
2. Using the reverse side of the A3 paper, draw a simple example of a state transition network, e.g. for a telephone. Explain the following whilst drawing this “If we take a telephone as an example, then it can have a number of states, for instance it can be just sitting there, it can be ringing, a person can be dialling, it can be used for a conversation, it can be broken”. For each of these states draw an oval shape containing a brief textual description of the relevant state.
3. Explain “Now we have some states that the phone can be in, we can show the ways in which it moves from one state to another, for instance it can move from the ‘just sitting there’ state to the ‘ringing’ state if the number is dialled”. At this stage, add an arrow on the diagram between these two nodes with ‘number is dialled’ as a label next to it. This explanation is repeated for some other

transitions, which are added to the diagram.

4. Explain that the telephone can be in only one state at one time, and that this a particular feature of this type of diagram.
5. Explain that transitions will generally be one of two things. First, they can be actions that someone performs such as dialling a phone number, or picking up a receiver. Secondly, they can be events that happen, such as what would happen to make the phone break. Also explain that there can be more than one way of moving from one state to another, so we can have more than one label on the arrows. Also explain that the diagram, when completed, shows not only all the transitions that can occur, but also that the absence of an arrow between two states shows that those states cannot follow each other.
6. Explain “What we will be doing in this session is not drawing one of these diagrams for a telephone but for the states that you get into” (make light of this). Turn the A3 sheet of paper to the blank side.
7. Ask the participant “to think of a few states that you get into”. Explain that these might be “emotional states, behavioural states, physical states or different states of thinking, or different patterns of thinking or behaving that you get into”. If the participant is struggling to think of any states, then suggest that they think of things like different moods or emotions.
8. As the participant describes each state add it as an oval-shaped node to the A3 sheet of paper. These nodes should be placed near the centre portion of the paper and spaced so that transitions can be entered later (an appropriate size is to make the ovals about 2cm across and separated by about 2-3cm).
9. When a number of states have been added, start to add transitions. Take the first two states mentioned and ask the participant in what ways he/she can move from the first to the second state. For example, ask “in what ways can you move from the state of being happy to the state of being annoyed”. If the participant responds with a transition between these states, then enter an arrow and label it with the action or event explained. Ask “are there any other ways in which you might move from the state of being happy to the state of being annoyed”. If further responses are given, then add these as extra labels on the arrow.

10. Staying with the first two nodes, ask the participant in what ways he/she can move in the opposite direction, i.e. from the second state to the first state. For example ask “in what ways can you move from the state of being annoyed to the state of being happy”. Add an arrow and label/s, if appropriate.
11. Repeat steps 8 and 9 for every other pair of nodes.
12. If at any stage the participant responds that they cannot move from one state to another, or cannot think of an appropriate transition, do not add an arrow or label.
13. As the diagram grows and is explored, more states will emerge, and transitions will be added as appropriately. If needs be, a number of smaller separate diagrams can be constructed for sets of discrete states.
14. When the session is about 5 or 10 minutes from the end, try to bring the diagram construction to a conclusion. Explain that “the final thing to do is to go through each of these states and write down an approximate figure of how much of your time you spend in that state. I’d like to put down two figures, one is the percentage of time you’re in the state at work, and the other is the percentage of time you’re in the state outside of work, at home”. Starting with the more central states, ask the participant to estimate these percentages for each state in turn, first for time at work, then time outside work. As each figure is given, add it to the diagram either inside or directly next to the appropriate node (depending which is clearer) using the labels “w” for work and “h” for home (for conciseness).

7.2.3 Results

This section is split into five parts. First, there is an analysis of the knowledge content captured during the session. Second, there is an analysis of the responses given to the open-ended questions on the feedback questionnaire. Third, there is an analysis of the scores given to the rating-scale questions on the feedback questionnaire. Fourth, there is an analysis of verbal responses given during the feedback session that specifically addressed the state diagram session. Fifth, there is a summary of each participant’s opinion of this technique. The results shown are all taken from the main study which involved 10 participants.

7.2.3.1 Content Analysis

Basic Statistics

The number of **states** used by the participants ranged from 5 to 25, and averaged 7.9. The number of **links** used by the participants ranged from 11 to 40, and averaged 21.6. Of the 216 links used across all the diagrams constructed, 63.4% were annotated with a single transition (i.e. label), 27.3% were annotated with two transitions (joined with AND or OR), 6.0% were annotated with three transitions and 2.8% were annotated with four transitions. This resulted in a total of 323 individual transition descriptions. Based on these statistics, a typical diagram would depict 8 states and 22 links. An example of part of a typical diagram is shown on Figure 13.

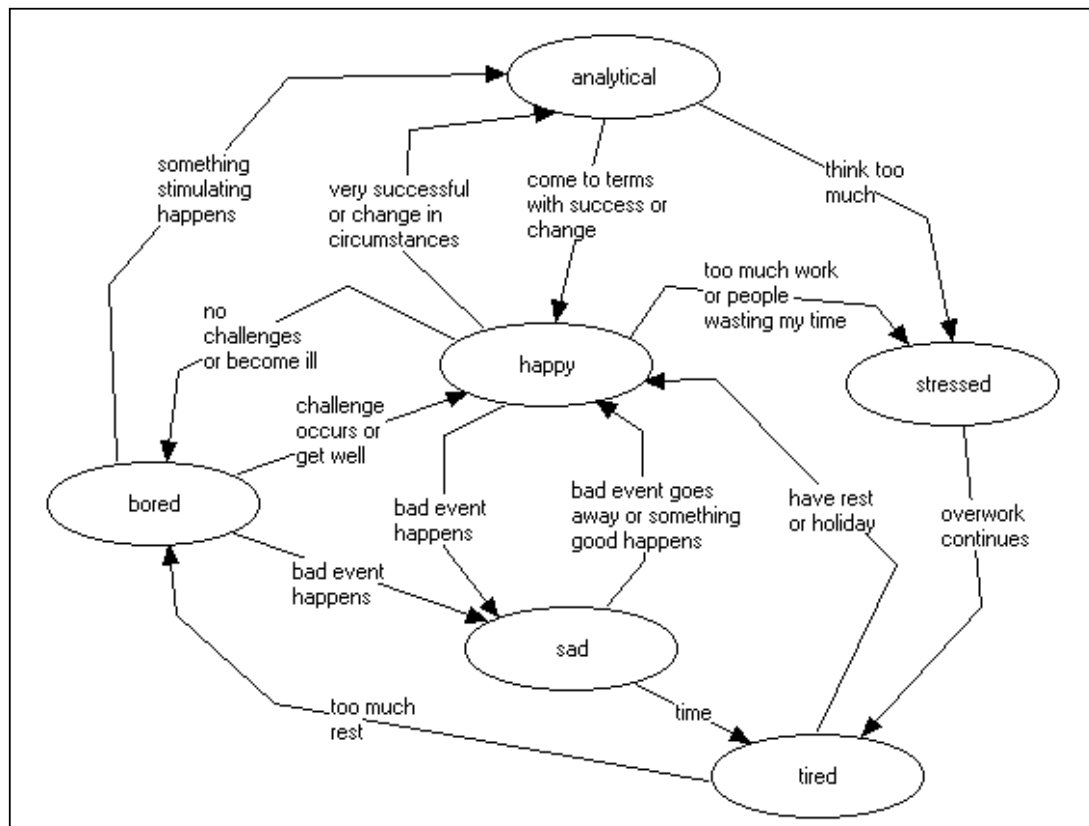


Figure 13: Part of a typical state diagram

The basic content of the state diagrams was analysed to explore any differences due to gender, age or qualifications. Table 39 shows differences in the number of states, the number of links, the number of individual transitions, the number of links per state and the number of individual transitions per state for the demographic variables.

	All	Gender		Age		Qualifications	
		Male	Female	<40 yrs	>40 yrs	Non-grad	Graduate
Number of States	10.10 (5.743)	10.50 (7.232)	9.50 (3.317)	9.20 (2.775)	11.00 (8.031)	9.00 (3.367)	10.83 (7.139)
Number of Links	21.50 (7.619)	24.67 (7.737)	16.75 (4.924)	20.20 (3.421)	22.80 (10.71)	18.50 (6.137)	23.50 (8.361)
Individual transitions	32.30 (10.95)	36.50 (10.65)	26.00 (9.092)	31.60 (6.348)	33.00 (15.12)	23.25 (4.992)	38.33 (9.585)
Links per state	1.532 (0.324)	1.500 (0.235)	1.580 (0.467)	1.595 (0.401)	1.469 (0.255)	1.302 (0.203)	1.685 (0.306)
Ind'l tran's per state	3.577 (1.264)	4.054 (1.332)	2.862 (0.8356)	3.825 (1.710)	3.328 (0.718)	2.755 (0.691)	4.124 (1.299)

Table 39. Comparison of the contents of the state diagrams based on the gender, age and qualifications of the participants

As shown in the table, males used more **links** (mean=24.67), more **individual transitions** (mean=36.50) and more **individual transitions per state** (mean=4.054) than females (means = 16.75, 26.00 and 2.862, respectively). Graduates used more **individual transitions** (mean=38.33), more **links per state** (mean=1.685) and more **individual transitions per state** (mean=4.124) than non-graduates (means = 23.25, 1.302 and 2.755, respectively).

States

The 79 states were analysed for commonality. 11 states were found to have been used by two or more participants. The most common state was **happy** with 5 participants using this in their diagram. **Stressed** and **worried** were each used by 4 participants. **Depressed**, **frustrated** and **sad** were each used by 3 participants, and **annoyed**, **bored**, **busy**, **tired** and **upset** were each used by 2 participants.

The 79 states were classified on the basis of similarity of meaning. This resulted in six categories that were named **emotions**, **feelings**, **behaviours**, **physical**, **cognitive**, and **neutral**. Information on these is shown in Table 40. In this table, the first column shows the category name, the second column shows the number of states that form the category, the third column shows the number of participants who used states of the category in their diagram, and the fourth column shows some examples of category members.

Category	No.	No. Ps	Examples
emotions	25	10	happy, calm, angry, nervous, panic, worried, concerned, impatient
feelings	20	8	bored, confident, enthusiastic, guilty, unfulfilled, work mood
physical	11	6	feeling fit, tired, headaches, ill, drunk
cognitive	10	6	reflective, creating, analytical, ambitious, denial
behaviours	11	3	busy, playing, influencing, rest, looking for a new job
neutral	3	3	neutrality, normal, even keel

Table 40: Categories of states used on the state diagrams

Transitions

The 323 individual transitions were classified into categories based on similarity. Of these, 290 unique transitions were classified into one of 6 classes, associated with **events**, **actions**, **time**, **needs**, **cognitions** and **states**. A detailed explanation of the categories is as follows.

The largest category was associated with **events** and comprised 126 unique transitions. These were classified into 10 sub-categories as illustrated in Table 41 (which is of the same format as the previous table).

Sub-Category	No.	No. Ps	Examples
other people	21	8	someone else panics, people don't do what I want, recognition from others, event is caused by others
challenge & boredom	17	3	new challenge occurs, no challenges occur, source of boredom removed, new situation becomes familiar
general negative events	13	6	unwanted event occurs, bad things happen
circumstances	12	4	major re-organisation occurs, more work & responsibility
expectations	12	4	good event expected, expectations fulfilled
health	11	3	catch illness, get tired, better health
work	8	4	good day at work, jobs do not go well
control	6	3	lack of control, situations accelerate out of control
general positive events	5	3	good event occurs, things going your way
money	4	3	money difficulties, get huge cheque

Table 41: Sub-categories of transitions associated with events

The second largest class was associated with **actions** and comprised 114 unique transitions. These were classified into 10 sub-categories as illustrated in Table 42.

Sub-Category	No.	No. Ps	Examples
success & achievement	23	7	achieved something productive, do a good job, don't achieve all objectives, failing at anything
cognition	21	10	realise I should have done something, spot that I am in a stressed state, decide to move, coming to terms with bad event
health & energy	13	4	eating lots, sleeping well, feeling fit
general action	10	6	taking action, do things, find something to do
completion	10	4	finish job, resolve problem, find solution
rest/relaxation	9	6	take time off, have a holiday, work too hard
mood change	6	5	get too serious, calm down, have mood change
other people	6	4	making others a disciple of your view, socialising
pastimes	4	2	drink, listen to music, find something to read
work	4	2	get new job, make work enjoyable, retire

Table 42: Sub-categories of transitions associated with actions

The four smallest categories are described in Table 43.

Category	No.	No. Ps	Examples
time	25	9	time, time passing, 2 or 3 days later, appeal wears off with time
needs	6	2	need stimulation, need to produce something
cognitions	5	5	belief that things are going against you, knowing there must be a conclusion
states	4	2	physically/mentally worn out, being busy at work

Table 43: Four smallest categories of transitions

Observations in Participant's Use of the State Diagram Technique

Some difficulties and issues were observed in the use of the state diagrams with the participants. First, there was some confusion in the difference between states and transitions. For example, the state “rest” and the transition “have a rest” are virtually synonymous. The need for good prompting and supervision is needed to clarify such instances. Second, although there was a possible difficulty in the constraint of a person being in only one state at a time, such multiple states as “depressed and irritable” did not seem to cause any problems. Third, diagrams became quite complex and untidy. The use of software would have been preferable to pencil and paper.

7.2.3.2 Feedback questionnaire - Open-ended questions

Directly following the state diagram session, each participant completed a feedback questionnaire containing four open-ended questions on their reactions to the session.

An analysis of the responses is as follows.

What were your general impressions of the state diagram session?

From the 10 questionnaires received from the main study, a total of 16 entries were made to describe the general impressions of the state diagram session. The most common impressions of the session were “interesting” used by 6 participants, and “simple”/“straightforward” used by 3 participants. Other impressions included “intriguing”, “organic”, “looks at the way you feel holistically” and “would not think of drawing a diagram to reflect moods etc”. Of the 16 entries, all but one gave a positive reaction. The only mildly negative impression was “perhaps too simple”.

What was good about the state diagram session?

Analysis revealed four categories of responses of what was good about the state diagram technique. First, 3 participants felt the session was good because it **provoked thought**, such as “forced me to think about factors which influence my moods/behaviour” and “made me think about how I separate life & work issues”. Second, 3 participants felt the session was good because it **revealed new knowledge and understanding**, such as “understanding the linkages between moods/feelings and the differences between home and work” and “recognising the different states of mind that I can be in”. Third, 3 participants felt the session was good because it was **an aid to clearer thinking**, such as “separated out different aspects of life so could reduce clutter in brain” and “highlighted just how things are interlinked”. Fourth, 2 participants felt the session was good because it was **interesting**, such as “the most interesting of the sessions to date”.

What was poor about the state diagram session?

Of the 10 questionnaires received, 6 participants made comments on what was poor about this technique. Analysis revealed very little similarity between the responses. Only two of the responses were similar and associated with the **outcome**, i.e. “no interpretation of what it all means!” and “I was a little confused to where it was leading – results”. Other responses covered various issues, such as “a bit clinical”, “I probably have more states but it was quite difficult identifying them” and “could possibly ignore complex interaction of events”.

Please describe anything in the state diagram session that made you think about things you hadn't (consciously) thought before, or helped give you a greater understanding of yourself?

8 participants provided responses to this question. Analysis revealed two main categories of responses. First, 3 participants felt the session led to more understanding about the **transitions and progression between states**, such as “I’d not really thought about the various stages I go through to reach my best or worst states” and “it gave me a greater understanding of the efforts I will take in order to maintain an emotional equilibrium”. Second, 3 participants felt the session led to more understanding about the **amount of time spent in states**, such as “I had never considered how much time (%) I spend in each mood/state before”.

7.2.3.3 Feedback questionnaire – Rating scales

After performing the state diagram session, each of the 10 participants in the main study completed a rating-scale questionnaire. The questionnaire included 6 ratings with Likert-type scales from 1 to 7.

The results of the questionnaire ratings were analysed to explore any differences due to gender, age or qualifications. Table 44 shows means and standard deviations (in brackets) for these demographic variables.

Rating	All	Gender		Age		Qualifications	
		Male	Female	<40 yrs	>40 yrs	Non-Grad	Graduate
Interesting	5.90 (1.101)	5.67 (1.366)	6.25 (0.500)	5.40 (1.342)	6.40 (0.548)	6.25 (0.500)	5.67 (1.366)
Thought-provoking	5.60 (0.699)	5.50 (0.548)	5.75 (0.957)	5.60 (0.894)	5.60 (0.548)	5.50 (0.577)	5.67 (0.817)
Enlightening	5.30 (0.950)	5.33 (1.033)	5.25 (0.957)	5.00 (0.707)	5.60 (1.140)	5.50 (1.000)	5.167 (0.983)
Demanding / Difficult	4.20 (1.135)	3.67 (1.033)	5.00 (0.816)	5.00 (0.707)	3.40 (0.894)	4.75 (0.957)	3.83 (1.169)
Openness	6.00 (0.943)	5.83 (1.169)	6.25 (0.500)	6.00 (1.225)	6.00 (0.707)	6.25 (0.500)	5.83 (1.169)
Recommend'n	5.50 (0.707)	5.33 (0.817)	5.75 (0.500)	5.40 (0.548)	5.60 (0.894)	6.26 (0.500)	5.00 (0)

Table 44. Analysis of the questionnaire ratings for the state diagram technique based on demographic factors

As shown in the table, there are few notable differences in the scoring based on gender, age and qualifications. There are two exceptions to this. First, non-graduates rated the state diagram as being **more recommended** to others (mean=6.26) than

graduates (mean=5.00). Second, younger participants rated the state diagram as being **more demanding/difficult** (mean=5.00) than older participants (mean=3.40). No statistical tests were performed due to the low number of participants involved.

Table 45 shows the mean and standard deviation of ratings for the state diagram as compared to those from the other techniques being assessed.

SUBJECT OF RATING	STATE DIAGRAM		ALL OTHER TECHNIQUES	
	Mean	Std Dev.	Mean	Ave Std Dev.
INTERESTING	5.9	1.04	5.42	1.01
THOUGHT-PROVOKING	5.6	0.66	5.25	1.19
ENLIGHTENING	5.3	0.90	4.38	1.31
DEMANDING / DIFFICULT	4.2	1.08	3.51	1.32
OPENNESS	6.0	0.89	6.32	0.60
RECOMMENDATION	5.5	0.67	5.34	1.03

Table 45: The means and SDs of the questionnaire ratings for the state diagram technique compared to the means and SDs of the ratings for the other techniques being assessed

As shown in the table, the state diagram technique was generally rated as being more **interesting**, more **enlightening** and more **difficult/demanding** as compared to the other techniques being assessed.

7.2.3.4 Verbal feedback from feedback session

After the completion of all the sessions that assessed each individual technique, a feedback session was held with each participant to gain more feedback on the techniques as a whole. An analysis of the responses that specifically addressed the state diagram session is described below.

How beneficial was the session?

In general, 7 participants felt the state diagram session was beneficial and 3 felt it was not. Analysis revealed 4 categories of responses, 3 being positive and 1 negative. First, five participants felt the session was **revealing**, such as “I had previously thought I was quite moody, but not realised all the triggers that can trigger those off” and “it made me see it could be just time or my sub-conscious efforts that could change my state”. Second, two participants felt the session was **useful**, such as “I found it difficult to put percentages on the states, but it was useful”. Third, two participants felt the session was **interesting but not useful**, such as “consolidation rather than anything new - but enjoyable”. Fourth, one participant felt the session was **not useful and of no interest**, making the comment “I was really unsure where it was going - nothing came

out of it”.

Did any changes in thinking or behaviour result from the session?

Nine participants commented that no changes had resulted from the session, although six of these described possible uses of the diagram. The one participant who described a change made the comment “it’s helped in the way I feel about work, and I feel a bit more positive about it”. Those that described possible uses of the diagram made comments such as “the sort of thing that could come out of it was, go get a hobby, or you’re spending too much time on the computer” and “it would be useful if had a copy of it and asked ‘which bubble I’m in and what can I do to get into a better mood?’”.

What uses is the state diagram to you?

Nine participants suggested personal uses of their diagram. Analysis revealed three categories of responses. First, 3 participants suggested use in **moving to a better state**, such as “you could look at it to understand whereabouts in it you are and try and come through a different route, a more direct route”. Second, 2 participants suggested uses in **increasing self-understanding**, such as “from a self-awareness point of view and for decision-making, I think that’s very good”. Third, 2 participants suggested uses in **balance and prioritisation**, such as “to get a more balanced life, to decide what to concentrate on, perhaps to decide how you would spend your day”.

What uses is the state diagram to other people?

Nine participants suggested uses of the diagram for others. Analysis revealed one main category of responses associated with **improving relationships**, which was mentioned by six participants. Comments on this subject included “if my wife and I did one of those, and showed each other, you’d start to understand things to avoid in the future, without getting into a confrontation to find out”, “if you’re working with someone in a team, it would be useful to know what makes them get upset” and “if you knew what causes people to move from one state to another, it would help dealing with them”. Other suggestions included uses in reducing stress, identifying training requirements, and identifying the best way to spend one’s day.

How could the state diagram technique be improved?

Eight participants made suggested improvements. Two participants suggested the inclusion of a **standard list** of states and transitions to select from. Two participants

noted that **more time** was required. Two participants suggested that the **presentation** could be improved, one saying that software could help, and the other saying that the diagrammatic format should be less clinical. Other suggestions included calibrating the meaning of the terms across people, and giving more explanation of what the technique was aiming to achieve.

7.2.3.5 General Opinions from Each Participant

To conclude this section of results, Table 46 presents the general opinions from each participant to the state diagram technique taken from various sources. The table is of the same format as Table 8 shown in section 5.1.3.5.

Par't	General impressions	Rank	How beneficial was the session
C	Enlightening. Thought-provoking. Intriguing.	1	Made me see that it could just be time, or my sub-conscious efforts, that change my state to make myself happy.
H	Interesting	1	I never sit down and analyse why I feel guilty, or why I feel depressed, and the links between these.
F	Fairly straightforward	1	All sorts of interesting things have come out of that.
D	Quite good	2	The part where we put down the percentage of time in each state. I think that would help to get the balance right in life.
A	Interesting – the more so as we got into the session	2	So much was downloaded, I wasn't able to make any conclusions. I need to study the diagram and understand what it all meant.
E	Interesting	2	I had previously thought I was quite moody, but not realised all the triggers that can trigger those off.
B	Extremely interesting	3	It makes you realise about how much you do worry about when you have got a family.
I	Interesting. Perhaps too simple. Looks at way you feel holistically.	5	If we went into more detail on it, it could be a good self-diagnostic tool
G	Organic, simple	6	Another way of mapping events. Consolidation rather than anything new.
J	Interesting	8	Really unsure where it was going. Nothing came out of it.

Table 46: General opinion and ranking from each participant in the main study to the state diagram technique

7.2.4 Summary and Discussion

7.2.4.1 Summary of Results

The typical diagram produced during a session comprised about 8 states and 22 links between states. Of the links used in all the diagrams, 63.4% were annotated with a single transition and 27.3% were annotated with two transitions. There was no significant difference in the number of states used based on gender, age or qualifications, but there was evidence that graduates used more transitions than non-

graduates. The most common types of states were associated with **emotions** (all participants) and **feelings** (8 participants). The **happy** state was used by 5 participants, and **stressed** and **worried** by 4. The most common types of transitions were associated with **actions involving cognitions** (all participants), **time** (9 participants) and **events involving other people** (8 participants).

The post-interview questionnaires revealed that 6 participants found the session to be **interesting**. Comments about what was good about the session included 3 participants who felt that the technique **revealed new knowledge and understanding** to them, and 3 participants who felt that the technique was **an aid to clearer thinking**. There was no consensus among the participants about what was poor about the session, except for 2 participants who both mentioned problems in understanding the outcome of the session. 3 participants felt the session led to more understanding about the **transitions and progression between states**, and 3 participants felt the session led to more understanding about the **amount of time spent in each state**.

The ratings indicated that the state diagram technique was found to be more **enlightening** than the other techniques being assessed. The ratings also indicated that non-graduates felt the state diagram was more **recommended** to others than graduates, and that younger participants felt the technique was more **demanding/difficult** than older participants.

Results from the feedback session showed that 5 participants felt the session was **revealing**, 2 participants felt it was **useful**, 2 participants felt it was **interesting but not useful**, and 1 participant felt it was **not useful and of no interest**. Only 1 participant felt that changes in thinking/behaviour had resulted from the session. 3 participants suggested using the technique to help **move oneself to a better state**, and 6 participants suggested the technique could be used for **improving relationships**. Suggestions for possible improvements included the inclusion of a **standard list** of states and transitions to select from (2 participants), improving the **presentation** (2 participants), and having **more time** (2 participants).

When ranking all the techniques being assessed, 7 participants placed the state diagram technique in their top three, and 2 participants placed the state diagram technique in their bottom three.

7.2.4.2 *Discussion*

It is clear from a number of indicators that the participants found the state diagram technique to be their most favoured of all the techniques being assessed. Indeed, six of the ten participants placed this technique in their top two when ranking all the techniques during the feedback session. Why was this technique regarded so favourably? Comments from the participants indicated three main reasons for this. First, performing the technique revealed new knowledge and understanding. Indeed, the questionnaire ratings indicated that the state diagram technique was more enlightening than the other techniques. The main revelations centred on the transitions and progression between states and on the amount of time spent in each state. Second, performing the technique provoked thought and was an aid to clearer thinking. Third, reviewing the state diagram at a later date (during the feedback session) indicated that the diagram could be used in an ongoing fashion to understand the state currently in and perhaps find measures to move to a better state.

It is interesting to note that non-graduates recommended the state diagram technique to other people more than graduates did. The reasons for this are unknown, but are perhaps associated with the less emotionally-involved roles that graduates fulfil at work, or that non-graduates perceive that other people would benefit more from a greater understanding of their emotional states. Although the participants were given free choice of what types of states to choose, most decided to use emotional states and moods.

As described above, uses of the state diagram technique for personal uses focused on its use in an ongoing fashion. The other main use suggested by the participants was in improving relationships.

The capability of the state diagram technique to acquire personal knowledge was evident in a number of areas. First, the technique captured a large range of states and transitions. Second, a number of participants noted the simple and straightforward nature of the technique. Third, use of the state diagram at a later date for self-help purposes indicates good knowledge acquisition. Fourth, revelation of knowledge indicates that tacit knowledge has been captured.

Although untried in the area of self-help and capturing personal knowledge, use of a state transition network worked very successfully. However, some areas for

improvement were identified.

Further discussion and comparison to the other techniques will be covered in chapters 8 and 9.

7.3 Aspirations Technique

7.3.1 Introduction

The aspirations technique is based on the application of two network-based knowledge acquisition techniques: laddering using a decision ladder and concept mapping. As described in section 3.1.3.3, laddering is a powerful knowledge acquisition technique used to capture and validate knowledge represented in a hierarchical (tree-like) structure. A decision ladder is a form of ladder that shows the alternative courses of action for a particular decision. It also shows the pros and cons for each course of action. More information concerning decision ladders was previously covered in section 3.1.1.3. and the results obtained for the decision ladder technique during the pilot study can be found in section 4.1.8.5. The second element of the aspirations technique makes use of a concept mapping technique. This technique involves the construction and modification of a concept map, as covered in section 3.1.3.8. A concept map is a form of network diagram that shows concepts as nodes and the relationships between them as labelled arrows. Any types of concepts and relationships can be used. The concept map is very similar to the semantic network used in cognitive psychology and its many applications include aiding learning (see section 2.4.4), facilitating creativity (see section 2.4.3.3), use by clinicians (see section 2.3.1), and use in qualitative research (see section 3.2.10.4). The aspirations network used here contains aspirations, sub-aspirations and various associated concepts for nodes, and relevant user-defined relationships as links between them. The results obtained for the aspirations technique during the pilot study can be found in section 4.1.8.6.

7.3.2 Method

This technique combines two network-construction techniques with a connecting questioning technique. It uses two sheets of A3 paper, a pencil and rubber. The procedure is as follows.

1. Explain to the participant the following “In this session, we’ll be doing two

diagrams. The first will be a decision tree showing a decision that you are currently thinking about or have recently made. It'll show the alternative possible decisions that could be made, and the pros and cons for each of these. Then I'll ask you some questions about those pros and cons with me pretending to be someone who doesn't know much about people, like a kind of Martian. We'll then use that diagram as the starting point for a second diagram, called an aspirations network. This will show the main aspirations, goals, ambitions, etc. that you have, any sub-goals, sub-ambitions, and various things that help you to achieve those, or stop you in some way".

2. Ask the participant to think of a decision, either a current one or one recently made. If the participant asks what sort of decision to choose, say "any decision from any aspect of your life, but quite a major one, not 'should I go to the shops or not?'". Add that there should be at least 3 or 4 possible courses of action that are, or were, being considered.
3. When the participant has chosen a decision, précis the decision as a node on the left-middle of the A3 sheet of paper (arranged in portrait format).
4. Ask the participant what were the possible courses of action that were being considered. Add these as sub-nodes to the right of the main node, placing them vertically at roughly equal distances from the top of the page to the bottom, and placing them horizontally approximately 30% of the distance from the left-hand edge of the sheet of paper.
5. Explain "we will now add some pros and cons, advantages and disadvantages, for each of these courses of action".
6. Taking the top course of action, ask the participant for an advantage of taking that course of action, e.g. "What would be an advantage of staying on in your present job?". Précis the response as a sub-node to the right of the course of action. Add a tick to the link line to indicate that this is an advantage. Repeat this for 1, and ideally 2, more advantages for that course of action. When about 3 advantages have been added to the diagram, ask the participant for disadvantages, e.g. "What would be a disadvantage of staying on in your present job?". Add the disadvantages, ideally 3, to the diagram with a cross on each link line to indicate they are disadvantages.

7. Repeat step 6 for each of the other courses of action. Note, the pros and cons should form a vertical column, placed horizontally approximately 60% of the distance from the left-hand edge of the sheet of paper.
8. Explain the following. “I want you now to imagine I’m a Martian. I know nothing about people, or human nature, or decisions, or why people want things. Now assuming this, I’m going to ask you some questions about the pros and cons you’ve given”.
9. Taking the upper-most advantage, ask the participant why it is a good thing for this to occur, e.g. “Why is it good that you have a lot of freedom?”. Précis the response in a box to right of the relevant advantage node. Repeat the “why” questioning on the box just added, e.g. “Why is it good that you don’t have to do what other’s tell you to do?”. Again précis the response in a box, to the right of the previous box (or below if there is no room left on the paper). Repeat the why question on this new box, and so on. The stopping condition for this “why” questioning should be when a basic feeling or idea occurs (e.g. “it makes me happy”, “to avoid being sad”) or the participant cannot answer any further.
10. Repeat step 9 for each of the advantages and disadvantages. For disadvantages, phrase the why question as “Why is it bad ... ?”, e.g. “Why is it bad to not spend enough time with your family?”. For later “why” responses, a further stopping condition is that a response previously noted is given. Then, an arrow from that point to the previous point is added to the diagram.
11. When all the “why” questioning is complete, explain “We’ll now move on to the second diagram, the aspirations network, using the information you’ve just been giving me. As I mentioned at the start, this diagram shows the main aspirations, goals, ambitions, etc. that you have, any sub-goals, sub-ambitions, and various things that help you to achieve those, or stop you in some way”. Note, at this point in the session, approximately 50%-60% of the time should have elapsed (i.e. about 25-30 minutes).
12. Using the second A3 sheet of paper, arranged in landscape format, add a node at the top-middle called ‘aspirations’. Referring to the right-hand portion of the decision ladder, ask the participant to choose any of the things (responses to the “why” questions”) that they think are main aspirations, goals, ambitions and things

they want in their life. Add these as nodes below the 'aspirations' node, in a horizontal line. Do not add links at this time. Ask the participant for any other main aspirations, goals, ambitions and things they want in their life, that are not already there. Add these as nodes along the same horizontal line.

13. The remainder of the session involves the expansion of the aspirations network using the abstract concepts from the decision ladder as a source for the nodes. The participant is encouraged to link relevant nodes with labelled arrows representing relationships between them. If the participant struggles to think of a relationship name, then suitable options should be suggested.

7.3.3 Results

This section is split into five parts. First, there is an analysis of the knowledge content captured during the session. Second, there is an analysis of the responses given to the open-ended questions on the feedback questionnaire. Third, there is an analysis of the scores given to the rating-scale questions on the feedback questionnaire. Fourth, there is an analysis of verbal responses given during the feedback session that specifically addressed the aspirations technique. Fifth, there is a summary of each participant's opinion of this technique. The results shown are all taken from the main study which involved 10 participants.

7.3.3.1 Content Analysis

Basic Statistics

Four of the participants chose decisions that involved staying or moving to a new job as the subject of their decision ladder. The other participants chose subjects involving the purchase of a new car, going on holiday, moving house, paying off the mortgage, who to date and what qualification to take. The number of possible courses of action per participant ranged from 3 to 5 and averaged 4.0. Participants produced an average of 3.0 advantages per possibility (which ranged from 2.6 to 3.5) and an average of 2.35 disadvantages per possibility (which ranged from 1.6 to 3.3). The number of abstracted nodes added during the questioning ranged from 21 to 48 per decision ladder and averaged 39.0.

The number of nodes on each aspirations diagram ranged from 21 to 37, and averaged 27.2. The number of links used by each participant ranged from 30 to 46, and averaged

37.6. Hence, the number of links per node averaged 1.41. Of the 376 links used across all the aspirations diagrams, 47 different types of link were found. A total of 46 links were not labelled. Based on these statistics, a typical aspiration diagram would depict about 27 nodes and 37 links. An example of part of a typical diagram is shown in Figure 14.

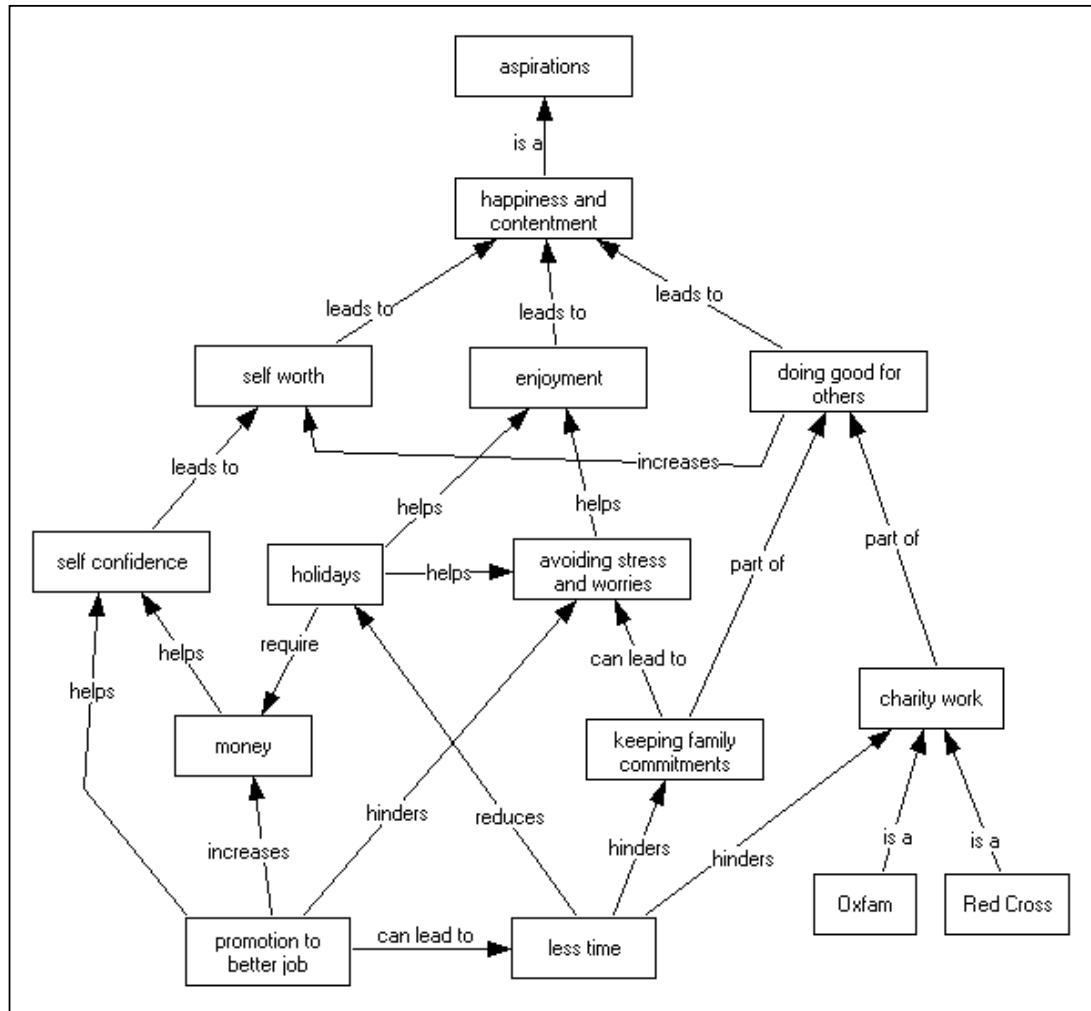


Figure14: Part of a typical aspirations diagram

The basic content of the aspirations diagrams was analysed to explore any differences due to gender, age or qualifications. Table 47 shows the number of nodes, the number of links and the number of links per node for these demographic variables.

	All	Gender		Age		Qualifications	
		Male	Female	<40 yrs	>40 yrs	Non-grad	Graduate
Number of Nodes	27.20 (5.473)	25.00 (4.733)	30.50 (5.323)	29.00 (5.000)	25.40 (5.857)	31.00 (5.354)	24.67 (4.179)
Number of Links	37.6 (6.603)	37.17 (6.401)	38.25 (7.848)	35.4 (5.177)	39.8 (7.694)	41.25 (6.898)	35.17 (5.672)
Links per Node	1.409 (0.256)	1.509 (0.263)	1.258 (0.177)	1.229 (0.119)	1.588 (0.230)	1.335 (0.125)	1.458 (0.318)

Table 47. Comparison of the contents of the aspirations diagrams based on the gender, age and qualifications of the participants

As shown in the table, older participants used a higher number of **links per node** (mean=1.588) than younger participants (mean=1.229). In addition, non-graduates used a higher **number of nodes** (mean=31.00) than graduates (mean=24.67). No statistical tests were performed due to the low number of participants involved.

Nodes on the Aspirations Diagrams

6 participants had a single aspiration at the top of their diagram, all using terms such as happiness, contentment and well-being. Below this, were second-level aspirations which ranged in number from 2 to 7, and averaged 5.5. The other 4 participants had a number of high-level aspirations that ranged from 3 to 5, and averaged 4.25.

272 nodes were analysed for commonality. 4 types of node were used by 3 or more participants. The most common was “money” with 6 participants using this in their diagram. “Happiness” was used by 4 participants, “feel good” was used by 3 participants and “good job performance” was used by 3 participants.

The 272 nodes used across all the aspiration diagrams were classified into categories based on similarity. Of these, 262 were classified into 19 classes as shown on Table 48. In this table, the first column shows the category (a name given to summarise the class members), the second column shows the number of nodes that form the category, the third column shows the number of participants who used nodes of the category, and the fourth column shows some examples of the category members.

Category of Nodes	No.	No. Ps	Examples
Interests	26	5	holidays, walking, theatre, church work, football
Friends and Others	24	7	true friendship, helping others, support from people
Job	23	8	job satisfaction, promotion, good job performance
Family	22	8	make parents proud, happy marriage, family health/future
Achievement	16	6	reward and recognition, status, leave a mark
Stress & Hassles	15	8	avoid pressure and stress, avoid hassles, pressure at home
Money	15	10	more money, financial security, buy material things
Happiness	14	9	enjoyment, feel good, feeling of well-being / being happy
Comfort & Satisfaction	14	8	feeling comfortable, convenience, bad personal lifestyle
Stimulation & Excitement	11	6	need stimulation, reduce stagnation, avoid boredom
Safety & Security	10	5	be safe, minimise risk, avoid uncertainty
Time & Freedom	10	8	time for interests, not waste time, have freedom and time
Self-esteem	9	6	self-worth, feeling confident, feel proud
Perspective & Growth	9	6	having balance, developing as a person, broaden horizons
Health & Illness	8	5	to remain fit and well, doing exercise, ill health
Motivation & Challenge	7	6	self-motivation, have new challenge
Learning	7	4	learning new things, getting degree
House & Transport	6	4	sell house, living near work
Emotions	6	4	avoid feeling guilty, bad mood

Table 48: Categories of nodes used on the aspirations diagrams

Links on the Aspirations Diagrams

The participants used a total of 49 types of links across all the aspirations diagrams. Analysis revealed that 6 types of link were used by 4 or more participants. These link types are shown on Table 49. Also shown are the number of participants who used a link class and the average number of times the links were used per participant.

Link	Example	No. of Ps	Total no. of occurrences	Ave. per participant
leads to	avoiding frustration – leads to – feeling content	9	83	9.22
helps (to)	knowing what to expect – helps – avoid uncertainty	8	65	8.13
is a	promotion – is a – reward	7	41	5.86
e.g.	voluntary work – e.g. – Red Cross	6	17	2.83
part of	helping people – part of – doing good	4	12	3.00
reduces	work – reduces – time for interests	4	7	1.75

Table 49: Most common links used in aspirations diagrams

It was noticed that there is a correlation between the number of participants who used a link and the number of times the link was used by each participant. To check this correlation, a Pearson product-moment test was performed. The result was a highly

significant correlation ($r=0.904$, $N=47$, $p<0.01$).

The 49 types of link were classified into categories based on similarity. This resulted in 5 classes being identified as illustrated on Table 50. In this table, the first column shows the category (a name given to summarise the class members), the second column shows the number of link types that form the category and the third column shows the total number of links from the category used across all the diagrams. The fourth column shows all the members of each category; the figures in square brackets denoting the number of occurrences of the link across all the participants. The fourth column also shows that the three largest categories have been split into sub-categories. The fifth column shows the number of participants who used the category, or sub-category, in their diagram.

Category	No .	Total used	Members	No. Ps
enables	14	184	leads to [83], gives [7], allows [3], enables[2], provides [1]	10
			helps (to) [65], increase/s [4], contributes to[3], improves[2]	8
			can lead to [10], can help [1], could increase [1], could lead to [1], sometimes provides [1]	6
inhibits	12	25	hinders[2], hampers [1], decreases [3], reduces [7], avoids [1]	6
			inhibits [4], stops [1], prevent [1]	3
			helps prevent[2], can reduce [1], could hamper [1]	3
			have adverse affect on [1]	1
class & composition	8	77	is a/an [41], e.g. [17]	8
			part of [12], has aspect [1], has by-product [1]	5
			equivalent to[2], could be[2], close-ish to [1]	2
requirements	5	33	required by/for [13], require/s [8], needed for [8], is necessary for [2], resource for [2]	7
misc	7	7	doesn't decrease [1], could affect [1], reduces risk to [1], short term version of [1], sometimes boredom [1], break from [1], distracts from [1]	3

Table 50: Categories of links used on the aspirations diagrams

Those links used to represent one node affecting another node can also be classified on the basis of certainty/stability and uncertainty/variability. For example, “leads to”, “increases”, “prevents” and “provides” are certain and imply stability across time and different situations. On the other hand, such links as “can lead to”, “could increase”, “helps prevent” and “sometimes provides” indicate there is uncertainty in the effect

and/or some variability across situations.

7.3.3.2 Feedback questionnaire - Open-ended questions

Directly following the aspirations technique session, each participant completed a feedback questionnaire containing four open-ended questions on their reactions to the session. An analysis of the responses is as follows.

What were your general impressions of the aspirations technique session? (2-3 adjectives please)

From the 10 questionnaires received in the main study, a total of 21 entries were made to describe the participant's general impressions of the session. The most popular impression was "interesting" used by 6 participants. "Thought-provoking" and "useful"/"effective" were each used by 3 participants, and "simple" was used by 2 participants. Other impressions included "enjoyable", "fun", "challenging", "abstract" and "different". Of the 21 entries, all but one was a positive reaction. The one negative entry was "difficult".

What was good about the aspirations technique session?

Analysis revealed two main categories of responses of what was good about the aspirations technique. First, 4 participants felt the session enabled **links and relationships** to be made, such as "it highlighted inter-relationships which I previously hadn't connected", "linked decision making to ambitions/aspirations" and "it enabled linkages to be made to key drivers". Second, 2 participants felt the session was good because it provoked **thought and analysis about decision-making**, such as "provoked some thought about the wider issues associated with any decision – and putting issues into perspective" and "good for analysing why/how I come to decisions". Other impressions included "it made me think about my future in a way I had not done before" and "the process is quite visual and seems easy to use".

What was poor about the aspirations technique session?

Of the 10 questionnaires received, 6 participants made comments on what was poor about the aspirations technique. Analysis revealed very little similarity between the responses. Only two of the responses were similar and were associated with the **choice of what decision to analyse**, such as "somewhat vague but could be based on what decision you use to analyse" and "topic may not have brought out all aspirations".

Other responses covered various issues, such as “how it should be used, or what can we learn from it, was not really covered” and “it could do with some software or even post-its to help the structuring”.

Please describe anything in the aspirations technique session that made you think about things you hadn’t (consciously) thought before, or helped give you a greater understanding of yourself?

8 participants responded to this question. Analysis revealed four categories of responses. First, 3 participants felt the session led to more understanding about **general aspirations, drivers and factors**, such as “it was interesting to see the inter-relationships that are working in my life and how they affect each other” and “helped me understand drivers and why I act the way I do”. Second, 2 participants felt the session led to more understanding about **specific new ideas**, such as “it made me realise that I’m a person who is quite happy with my life”. Third, 2 participants felt the session led to more understanding about **decision-making**, such as “the process I go through to come to a decision”. Fourth, 2 participants felt the session led to more understanding about **links**, such as “how all our decisions are linked to aspirations”.

7.3.3.3 Feedback questionnaire – Rating scales

After performing the aspirations technique session, each of the 10 participants in the main study completed a rating-scale questionnaire. The questionnaire included 6 ratings with Likert-type scales from 1 to 7.

Rating	All	Gender		Age		Qualifications	
		Male	Female	<40 yrs	>40 yrs	Non-Grad	Graduate
Interesting	5.40 (0.699)	5.67 (0.817)	5.00 (0)	5.00 (0)	5.80 (0.837)	5.00 (0)	5.67 (0.817)
Thought-provoking	5.80 (0.422)	5.833 (0.408)	5.75 (0.500)	5.60 (0.548)	6.00 (0)	5.75 (0.500)	5.83 (0.408)
Enlightening	4.50 (1.080)	4.83 (1.169)	4.00 (0.817)	4.00 (0.707)	5.00 (1.225)	4.50 (1.291)	4.50 (1.049)
Demanding / Difficult	3.70 (1.252)	3.33 (1.033)	4.25 (1.500)	4.00 (1.581)	3.40 (0.894)	4.00 (1.414)	3.50 (1.225)
Openness	6.50 (0.527)	6.67 (0.516)	6.25 (0.500)	6.20 (0.447)	6.8 (0.447)	6.50 (0.577)	6.50 (0.548)
Recommend’n	5.80 (0.632)	6.00 (0.632)	5.50 (0.577)	5.60 (0.548)	6.00 (0.707)	5.75 (0.500)	5.83 (0.753)

Table 51: Comparison of the means and SDs of the questionnaire ratings for the aspirations technique based on the gender, age and qualifications of the participants

The results of the questionnaire ratings were analysed to explore any differences due to gender, age or qualifications. Table 51 shows means and standard deviations (in brackets) for these demographic variables. As shown the table, there is little difference in scoring based on gender and qualifications. Older participants tended to rate the technique as being more **interesting** (mean=5.80), more **thought-provoking** (mean=6.00) and more **enlightening** (mean=5.00) than younger participants (means=5.00, 5.60 and 5.40 respectively). No statistical tests were performed due to the low number of participants involved.

Table 52 shows the mean and standard deviation of ratings for the aspirations technique as compared to those from the other techniques being assessed.

	ASPIRATIONS TECHNIQUE		ALL OTHER TECHNIQUES	
SUBJECT OF RATING	Mean	Std Dev.	Mean	Ave Std Dev.
INTERESTING	5.4	0.66	5.49	1.06
THOUGHT-PROVOKING	5.8	0.40	5.22	1.22
ENLIGHTENING	4.2	1.25	4.53	1.26
DEMANDING / DIFFICULT	3.7	1.19	3.59	1.30
OPENNESS	6.5	0.50	6.25	0.66
RECOMMENDATION	5.7	0.64	5.31	1.04

Table 52: The means and SDs of the questionnaire ratings for the aspirations technique compared to the means and SDs of the ratings for the other techniques being assessed

As shown in the table, the aspirations technique was generally rated as being more **thought-provoking** than the other techniques being assessed.

7.3.3.4 Verbal feedback from feedback session

After the completion of all the sessions that assessed each individual technique, a feedback session was held with each participant to gain more feedback on the techniques as a whole. An analysis of the responses that specifically addressed the aspirations technique session is described below.

How beneficial was the session?

In general, 8 participants felt the session was beneficial and 2 felt it was not. Analysis revealed 4 categories of responses, 3 being positive and 1 negative. First, six participants felt the session was **revealing**, with comments such as “I didn’t realise everything I did aimed towards being more happy” and “it really did drive back to those things that are fundamental to me”. Second, two participants felt the session was **useful**, making comments such as “it was useful as it links events and feelings to

demonstrated behaviour, then goes beyond those to say what are the needs you're serving to act in this way". Third, one participant felt the session was **interesting but not useful**, making the comment "some of the links were interesting, but I don't know if it was all that enlightening". Fourth, one participant felt the session was **not useful and of no interest**, making the comment "too similar to the event diagrams – seemed to cover the same ground".

Did any changes in thinking or behaviour result from the session?

Eight participants commented that no changes had resulted from the session, although two of these described possible uses and benefits of the technique. One participant who described a change made the comment "I've thought more analytically about things, such as when having a discussion, thinking 'does it really matter if I win the argument?'". Another participant noted "it has made me realise I want to do a bit more... I would like to travel a bit more". Those that described possible uses of the diagram made comments such as "it might have helped make life decisions" and "sometimes you do things out of instinct not really knowing why, and this helps to pull out the 'why', which sometimes is useful".

What uses are the decision ladder and aspirations diagram to you?

Eight participants suggested personal uses of the diagrams. Analysis revealed three categories of responses. First, 3 participants suggested use in **identifying priorities**, such as "it began to illustrate the things that are really important to me" and "it could be useful to work towards your higher aspirations". Second, 3 participants suggested use in **making and capturing decisions**, such as "it's a very structured way of putting your thoughts down, and really saying what you mean, rather than covering up with frilly words" and "if I was wondering why I made the decision afterwards, there's evidence why". Third, 2 participants suggested uses in **reflection**, such as "when you look back on it, it does make you think what you've done - you don't always think about it, but when it's mapped out you do".

What uses are the decision ladder and aspirations diagram to other people?

Six participants suggested uses of the diagrams by other people. Three participants suggested a use in **aiding understanding of oneself by others**, such as "it could help people understand the steps you need to take towards your aspirations" and "it could

tell somebody the steps that you take to make a decision - it shows that I don't just jump in". Other suggestions covered areas such as recruitment consultancy, one-to-ones with a manager or mentor, and self-development in the workplace.

How could this technique be improved?

Seven participants made suggested improvements. Three participants noted that **more time** was required. Two participants suggested that **software** could aid the process. Two participants felt that exploring **more than one decision** would be beneficial. Other suggestions included having a predefined list of aspirations to select from, making the technique into a game, and having a summary at the end.

7.3.3.5 General Opinions from Each Participant

To conclude this section of results, Table 53 presents the general opinions from each participant to the aspirations technique taken from various sources. The table is of the same format as Table 8 shown in section 5.1.3.5.

Par't	General impressions	Rank	How beneficial was the session
G	Different, interesting	2	Really did drive back to those things that are fundamental to me & the decision-making activity. Was an aid to knowing me better. It made connections.
I	Abstract, Challenging, Thought provoking	2	Was useful as it links events and feelings to demonstrated behaviour.
C	Interesting, Thought-provoking	3	What it revealed was that the lower level things in the hierarchy are being driven by the higher ones.
D	Fun, Interesting	3	It brought out some things that hadn't been brought out before. It made me look at me from a slightly different perspective.
E	Difficult	3	Didn't realise everything I did aimed towards being more happy.
H	Useful, simple to follow	4	Some of the links were interesting. But I don't know if it was all that enlightening.
J	Good, made me think of how situations link-in	5	Too similar to event diagrams – seem to cover the same ground. Didn't learn anything new, because done event diagram first.
B	Very interesting	6	It made me realise that I am quite happy with what I have done.
A	Interesting & enjoyable	7	The amount of information we were turning over was difficult to manage.
F	Simple, effective and again interesting (help me to learn more about myself)	7	What came out was what I'd expect.

Table 53: General opinion and ranking from each participant in the main study to the aspirations technique

7.3.4 Summary and Discussion

7.3.4.1 Summary of Results

Each decision ladder produced during a session comprised about 4 possible courses of action, 3 advantages per course of action, 2 or 3 disadvantages per course of action, and 39 nodes describing abstracted reasoning behind the advantages/disadvantages.

Each aspirations diagram produced during a session comprised about 27 nodes and 37 links between the nodes. Older participants used a higher number of links per node than younger participants, and there was some indication that non-graduates used a higher number of nodes than graduates. The most common types of nodes on the aspirations diagrams were associated with **money** (all participants), **happiness** (9 participants), **job** (8 participants), **family** (8 participants), **stress & hassles** (8 participants), and **comfort & satisfaction** (8 participants). The most common types of links on the aspirations diagram were *leads to* (9 participants), *helps* and *helps to* (8 participants) and *is a* (7 participants). Four classes of links were discerned, named *enables*, *inhibits*, *class & composition* and *requirements*. An interesting and unexpected correlation was found between the number of participants who used a particular link and the number of times the link was used by each participant

The post-interview questionnaires showed that 6 participants found the session to be **interesting**. Comments about what was good about the session included 4 participants who felt the session enabled **links and relationships** to be made, and 2 who felt the decision ladder provoked **thought and analysis about decision-making**. There was little consensus among the participants about what was poor about the session, except for 2 participants who both mentioned problems in using only one decision. 3 participants felt the session led to more understanding about **general aspirations, drivers and factors**. The ratings revealed a tendency for older participants to find this technique to be more **interesting** than younger participants.

Results from the feedback session showed that 6 participants felt the session was **revealing** and 2 participants felt it was **useful**. 2 participants felt that changes in thinking/behaviour had resulted from the session. 3 participants suggested using the aspirations diagram to **identify priorities**, and 3 participants suggested using the decision ladder for **making/capturing decisions**. Suggestions for possible improvements included having **more time** (3 participants), use of **software** (2

participants) and **exploring more than one decision** (2 participants).

When ranking all of the techniques being assessed, 5 participants placed the aspirations technique as in their top three, and 3 participants placed it in their bottom three.

7.3.4.2 Discussion

In general, the aspirations technique proved to be successful in capturing and representing knowledge of decision-making and aspirations and in so doing facilitating more self-understanding.

The technique enabled the capture of a large variety of nodes used on the aspirations diagram and a small set of links that were common across most of the participants' diagrams. These classes of nodes and links might offer useful generic elements that might be selected from in future variants of the technique.

An interesting and unexpected finding was found with the number of links used on the aspirations diagrams: the number of participants who used a link correlated with the number of times the link was used by each participant. For example, the "leads to" relationship was used by 9 participants, each participant using it an average of 9.2 times. Whereas, the "part of" relationship was used by 4 participants, each participant using it an average of 3.0 times. This correlation would suggest that relationships such as "leads to" and "helps" are fundamentally more common in linking the concepts associated with aspirations, whereas relationships such as "part of" and "requires" are less common. If the technique were to be developed to be fully computer-enabled then this might suggest the inclusion of a list of relationships (in priority order) that users would be encouraged to apply to the nodes in the diagram, and to prompt for new nodes to be added.

A number of encouraging findings emerged from the post-session questionnaire and feedback session. Participants' reactions to the aspirations technique were generally very positive in the post-session questionnaire, with a number describing the session as interesting and thought-provoking. Indeed, the average scores for *thought-provoking* and *recommendation* were higher than any other technique being assessed.

A reaction from a number of participants was that the technique enabled linkages and inter-relationships to be revealed. Both the decision tree and the aspirations diagram

were both seen as useful. These positive reactions were reflected in the rankings made during the feedback session with the aspirations diagram being placed in 4th place of all the techniques being assessed.

A number of problems and possible improvements to the aspirations technique have been revealed. One suggestion was the need for more than one decision to be mapped and that this would contribute to changes in the aspirations diagram. Another suggestion was the need for more time. This would allow the use of more than one decision and also allow a more detailed exploration of the links between the factors lying behind a decision and the factors mapped on the aspirations diagram.

Further discussion will be covered in the following two chapters.

8 COMPARISON OF TECHNIQUES AND ONTOLOGY

Man is a tool-using animal... Without tools he is nothing, with tools he is all.
(Thomas Carlyle)

This chapter brings together the empirical work described in the previous three chapters. There are two sections in the chapter. The first section compares and contrasts the techniques being assessed by drawing upon the empirical results, particularly the results of the feedback session. The second section uses the personal knowledge captured during the acquisition sessions to propose an ontology of personal knowledge. This ontology is then tested for potential validity and completeness using a range of psychological theories and approaches.

8.1 Comparison of the Techniques

For clarity, the previous three chapters have presented the results for each technique in isolation from one another. To provide a more holistic account of the empirical research of this study, this section provides a comparison of the techniques. This comparison is based on a number of key criteria: how the techniques compared overall with each other, what were the particular properties of each technique, how the demographics of the participants affected their use and opinions of the techniques, and how suitable is each technique for automation. In addition, this section provides opinions from the participants on wider issues, such as how the techniques assessed here rate against other techniques of a similar nature, and what were the participants' impressions of the study as a whole.

8.1.1 Ranking of the Techniques

During the feedback session, each participant was asked to rank the techniques. The ranking was based on how much the technique was favoured by the participant in terms of its capability to capture personal knowledge and provide self-help. The participants were asked for their personal opinions based on the sessions that had occurred. Table 54 presents a summary of the results. The techniques are ordered from top to bottom based on the average ranking that was obtained, to give an overall ranking. Also shown in the table are histogram data on the number of participants that ranked a particular technique in their top 2 positions, 3rd & 4th positions, 5th and 6th

positions and bottom 2 positions.

Technique	Overall ranking	Number of participants giving the rank positions			
		Rank 1 & 2	Rank 3 & 4	Rank 5 & 6	Rank 7 & 8
State Diagram	1	6	1	2	1
Interview	2	3	4	2	1
People Grid	3	2	4	3	1
Aspirations	4	2	4	2	2
Event Diagrams	5	3	2	3	2
Interview Review	6	3	0	3	4
Keirsey Temp't	7	1	2	3	3
Events/periods grid	8	1	2	2	5

Table 54: Rankings and histogram information on rankings

As clearly demonstrated in the table, the **state diagram** technique was ranked well ahead of the rest, with 6 participants ranking it in their top two. On the other hand, the **Keirsey temperament** and **events/periods grid** techniques were least favoured overall, each having only 1 participant ranking that technique in the top two positions.

To provide a verification of these rankings, they were compared to the ratings made on the post-interview questionnaires. To do this, the average ratings for each key item on the post-interview questionnaire were calculated for each technique. These average ratings were then ranked. Table 55 displays these rankings in columns 3 to 6. Column 2 in the table shows the average of the rankings taken from the feedback session. The final column in the table shows the average of the scores in the preceding 4 columns, i.e. an overall score for each technique taken from the key items on the post-session questionnaires.

Technique	Average rankings from the feedback session	Rankings of the ratings from the post-session questionnaires				
		Interest-ing	Thought-Provoking	Enlighten-ing	Recomm-endation	Average from q's res
State Diagram	3.1	2	3	1	3	2.3
Interview	3.9	1	1	6	5	3.3
People Grid	4.0	3	3	2	3	2.8
Aspirations technique	4.2	5	1	4	1	2.8
Event Diagrams	4.4	4	5	3	2	3.5
Interview Review	5.0	5	6	7	5	5.8
Keirsey technique	5.1	7	8	8	7	7.5
Events/periods grid	5.6	8	7	5	8	7.0

Table 55: Comparison of average ranking and average scores from the post-session questionnaires

As is evident in the table, the rankings made in the feedback session generally correspond with the ratings made on the post-session questionnaires. Indeed, the correlation between the average rankings from the feedback session (shown in column 2 of the table) and the average ratings on the 4 key items taken from the post-session questionnaires was found to be highly statistically significant using a Pearson's product-moment test ($r=-0.902$, $N=8$). An illustration of the strength of this correlation is shown in Figure 15, which is a scatter diagram of the average rankings from the feedback session (column 2 in the table) plotted against the average rankings of the ratings from the post-session questionnaires (the final column in the table).

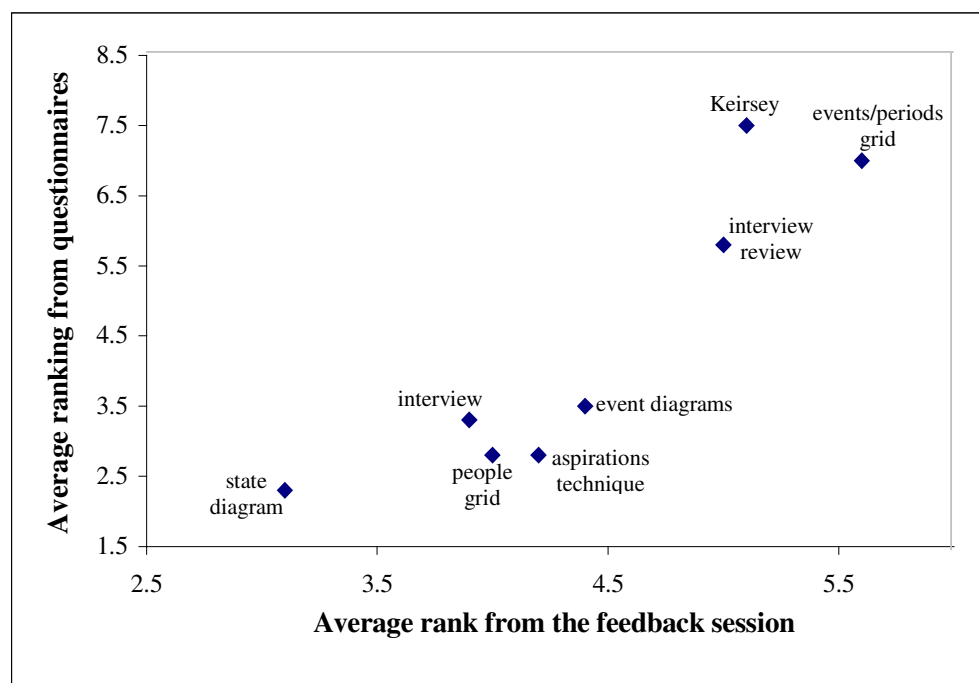


Figure 15: Graph of the average rankings from the feedback session and the post-session questionnaires

As a statistical test of these rankings, the ratings from the post-session questionnaires for the key items of *interesting*, *thought-provoking*, *enlightening* and *recommendation* were subjected to pairwise comparisons using t-tests. This involved taking all of the ratings from these items (a total of 40) for each technique and comparing that against all of the ratings for each of the other techniques. This produced a number of significant results. The **state diagram** technique was found to have significantly higher ratings than the **interview review** technique ($t=2.232$, $N_1=N_2=40$), the **events/periods grid** technique ($t=3.756$, $N_1=N_2=40$) and the **Keirsey temperament** technique ($t=4.308$, $N_1=40$, $N_2=36$). In addition, the **people grid** technique, the

interview technique, the **aspirations technique** and the **event diagrams** technique all had significantly higher ratings than the **events/periods grid** technique and the **Keirsey temperament** technique. This provides a statistical verification of the information presented visually in the graph above, i.e. there are four ‘divisions’ of techniques:

- Division 1: the **state diagram** technique (the most favoured technique)
- Division 2: the **interview**, **people grid**, **aspirations** and **event diagrams** techniques
- Division 3: the **interview review** technique
- Division 4: the **events/periods grid** and **Keirsey temperament** techniques

As a further piece of information on the participants’ overall impression of the techniques, each participant was asked during the feedback session, which of the techniques they would be interested in using in the future. Results showed that the network-based techniques were the most commonly mentioned in this context; the **state diagram** and **event diagram** techniques being mentioned by 4 participants, and the **aspirations technique** by 3 participants. The **interview review** was mentioned by 3 participants, as were the grids: one saying the **people grid**, one saying the **events/periods grid**, and one saying both. None of the participants mentioned the **interview** or the **Keirsey temperament** techniques when asked this question. These results generally match those found for the rankings and questionnaire ratings, with two main exceptions. First, the **interview review** technique did better on this question than might be expected from its overall ranking. However, as covered in the discussion section on the interview review technique (section 5.2.5.2), there was a dichotomy of opinions for this technique, with 3 participants ranking it in their top 2 techniques, and 7 participants ranking it in their bottom 4. Second, none of the participants mentioned the **interview** although it fared well in the overall rankings. This seems to indicate that the interview need only be performed once, and that it is sufficient to use the transcript of the interview later for the interview review technique.

Having examined the overall impressions of the participants to the techniques, two questions arise. First, what properties of the techniques led the participants to gain a certain impression? Second, did any differences in the demographic details of the participants affect their individual opinions of the techniques? These two questions are

explored in the following two sections.

8.1.2 Properties of the Techniques

What was it about each technique that led the participant's to gain a particular impression? To examine this, the ratings on particular items in the post-session questionnaires were subjected to a number of statistical tests.

First, a series of t-tests was performed between the ratings on each item for each technique and the ratings of all the other techniques for that item. These results, already presented in chapters 5 to 7, are summarised in Table 56. Two points are illustrated in the table. First, only 6 significant differences were found (3 of which were for a single technique), showing that the differences of opinions are not the result of a single factor. Second, there are no items in the table that appear many times in the table, showing that no single factor has a dominant effect.

Technique	Item	Significant Differences for Actual Ratings
Interview	<i>Openness</i>	Less openness than the other techniques (means=5.8 & 6.35, t=2.31, df=77, p<0.05)
Events/periods grid	<i>Interesting</i>	Less interesting than the other techniques (means=4.6 & 5.60, t=2.72, df=77, p<0.05)
	<i>Thought-provoking</i>	Less thought-provoking than the other techniques (means=4.5 & 5.40, t=2.11, df=77, p<0.05)
	<i>Recommendation</i>	Less recommended than the other techniques (means=4.6 & 5.47, t=2.44, df=77, p<0.05)
Keirsey temperament	<i>Thought-provoking</i>	Less thought-provoking than the other techniques (means=4.33 & 5.43, t=2.44, df=77, p<0.05)
	<i>Enlightening</i>	Less enlightening than the other techniques (means=3.33 & 4.66, t=2.77, df=77, p<0.05)

Table 56: Significant differences in questionnaire ratings for each technique compared to all other techniques

To further examine this, another set of t-tests was performed, this time between the ratings for each technique compared to those for each of the other techniques. The significant differences are shown on Table 57. Unlike the previous table, two particular items predominate in this table: *enlightening* appears 5 times and *thought-provoking* appears 4 times. This gives some indication that the differences in the overall opinions of the participants may be due to how thought-provoking and enlightening they found the techniques.

Technique	Significant difference (t-test)	Technique
State Diagram	More enlightening (t=2.22, df=18)	Interview
	More enlightening (t=2.24, df=18)	Interview Review
	More enlightening (t=3.59, df=17)	Keirsev temperament
	More demanding/difficult (t=2.65, df=17)	
Interview	More interesting (t=2.25, df=18)	Aspirations technique
	More thought-provoking (t=2.51, df=17)	Keirsev temperament
	More interesting (t=2.58, df=18)	Events/periods grid
	More thought-provoking (t=2.25, df=18)	
People Grid	More enlightening (t=2.76, df=17)	Keirsev temperament
Aspirations technique	More thought-provoking (t=2.71, df=17)	Keirsev temperament
	More thought-provoking (t=2.41, df=18)	Events/periods grid
	More recommended (t=2.55, df=18)	
Event Diagrams	More enlightening (t=2.36, df=17)	Keirsev temperament

Table 57: Significant differences in questionnaire ratings from technique to technique (read from left to right)

To further examine this, the average rankings from the feedback session (i.e. the figures shown in column 2 of Table 55) were compared to the average ratings for each item on all the techniques taken from the post-session questionnaires. This revealed that the rankings strongly correlated with the ratings for *interesting* ($r=-0.880$, $N=8$), the ratings for *thought-provoking* ($r=-0.812$, $N=8$) and the ratings for *recommendation* ($r=-0.730$, $N=8$). This contradicts the finding from above that *enlightening* and *thought-provoking* may be the main factors. Once, again it seems that a number of factors are responsible for the overall impressions.

This is supported by a comparison of the ratings for each item on the post-session questionnaires with each of the other items. A number of significant correlations were revealed using a series of Person product-moment tests. The strongest of these was between the ratings for *interesting* and the ratings for *thought-provoking* ($r=0.740$, $N=79$). Another strong correlation was between the ratings for *thought-provoking* and *enlightening* ($r=0.611$, $N=79$). In addition, significant correlations were found between *recommendation* and the 3 key items of *interesting*, *thought-provoking* and *enlightening* ($r=0.619$, 0.614 and 0.526 , respectively). As with most of the statistical tests described above, the ratings for *demanding/difficult* and for *openness* did not show any statistically significant results, indicating that these do not play a consistent part in the participant's opinions and impression of the techniques.

In summary, the participant's opinions and impression of a particular technique seem to be due to a mixture of factors associated with how **interesting**, how **thought-provoking** and how **enlightening** they found the technique. However, more data would need to be collected from a much larger sample of participants to examine this further and determine the actual mechanisms that are operating.

8.1.3 Effect of the Demographics of the Participants

Did any differences in the demographic details of the participants affect their individual opinions of the techniques? As a first pass to this question, Table 58 presents the effect of the gender, age and qualifications of the participants to the way they ranked the eight techniques during the feedback session.

Technique	Overall ranking	Gender		Age		Qualifications	
		Female	Male	Young	Old	Non-grads	Grads
State Diagram	1	1	1	1	1	1	1
Interview	2	4	2	6	3	6	2
People Grid	3	3	5	3	4	3	3
Aspirations technique	4	5	3	4	4	5	4
Event Diagrams	5	7	3	7	2	3	5
Interview Review	6	5	6	1	8	2	7
Keirsey technique	7	2	8	5	7	8	6
Events/periods grid	8	8	7	8	6	6	8

Table 58: Effect of gender, age and qualifications on rankings from feedback session

The clearest differences are shown shaded in the table. For instance, younger participants ranked the **interview review** in equal first position, but older participants ranked it in last place. The **interview review** was also more preferred by non-graduates (second place) than by graduates (seventh place). Age also seemed to affect the rankings for the **event diagrams**, with older participants ranking it in second place, and younger participants ranking it seventh. The largest effect of gender was on the **Keirsey temperament** technique, with female participants ranking it in second place and males ranking it last.

To examine such differences in more detail, a number of statistical tests were performed on the ratings from the post-session questionnaires. The results of these tests are contained in Appendix K, and are summarised as follows. The **interview review** technique seems to be preferred by university graduates and by those having a

Guardian personality temperament, i.e. high on sensation and high on judgement (these terms are described in Appendix J). The **people grid** technique seems to be preferred by women and by younger participants. The **events/periods grid** technique seems to be preferred by women and by participants without a university degree. The **Keirsey temperament** technique seems to be preferred by younger participants, whereas the **event diagram** technique seems to be preferred by older participants. The **aspirations technique** seems to be preferred by men, older participants and university graduates. No differences were found for the **interview** and **state diagram** techniques.

It should be noted that a very small population of participants was involved in the analysis. As such, the results from the statistical tests must be treated with some caution until they can be verified with a larger population.

8.1.4 Suitability of the Techniques for Automation

During the feedback session, each participant was asked which of the techniques they felt was most suited to automatic presentation using a computer, and which ones required the presence of a human facilitator. Table 59 shows each of the techniques and the number of participants (from a total of 10) who made comments that the technique could be presented and facilitated by a computer or who made comments that the technique required a human facilitator.

Technique	Can be presented by a computer	Requires a human facilitator	Made no comment
Keirsey Temperament	4	0	6
People Grid	5	2	3
Events/periods grid	5	2	3
Interview Review	1	0	9
Event Diagrams	2	2	6
State Diagram	2	4	4
Aspirations Technique	2	5	3
Interview	0	6	4

Table 59. Number of participants who commented on whether a technique could or could not be automated

As shown in the table, the **Keirsey temperament** technique was generally felt to be the technique that would be most easily mediated by software. The **grid-based** techniques were also felt to be amenable to software although two participants felt a human facilitator was required. There were mixed opinions for the **network-based**

techniques, with some feeling that a human was required to explain and prompt, whilst others feeling that either an intelligent system could do this or a small amount of help from a human was required. The **interview** was generally felt to require a human interviewer for three reasons (1) the need for spontaneous speech rather than just typing, (2) the need for prompts which were conditional on what had been said, and (3) the need for flexibility in the subject matter conditional on the participant. A number of participants also mentioned the importance of having a human involved at the end of using a technique for final analysis and feedback to the participant on what had been found and how this could be used.

8.1.5 Comparison to Standard Organisational Techniques

During the feedback session, each participant was asked how the techniques being assessed compared to techniques of a similar nature that they had experienced in their working life. The overall result of this was that the techniques being assessed fared well compared to other techniques that the participants had experienced.

Of the other techniques described, the most commonly mentioned by the participants was 360 degrees appraisals, a technique whereby managers are assessed by their boss, their peers and the people who work for them. Four participants all described the merit of this technique as gaining other people's opinions, and because of this, these participants felt they would rank the 360 degrees appraisals technique near to the top of those being assessed.

A number of personality-based techniques were described such as Belbin, Myers-Briggs and SDI. These were described as being similar to the Keirsey technique, and would have been similarly ranked (i.e. towards the low end). Other techniques described, such as Learning Style Questionnaires, psychometric profiles, SWOT and Mind Mapping, were described as being about as useful or less useful than the techniques under assessment.

The participants made a number of interesting overall comments, especially two of them who work in the area of Human Resources (HR) and Training. One of these stated that the interview review and event diagrams were "a lot better" than some of the techniques used in HR. The other participant who works in this area stated that the novel techniques under assessment (such as the network-based techniques) would "complement the standard couple of tools that we use" and would be "very valuable".

Comments from the other participants confirmed the view that the techniques being assessed would be a useful supplement to traditional approaches and that having a range of different techniques is more useful than just having one or two standard techniques.

8.1.6 Overall Impressions of the Study

The final question in the feedback session asked the participants for their overall impressions of the study as a whole, and how it might be improved if it were to be repeated in the future.

In describing the study as a whole some very encouraging remarks were made. A number of participants commented that they had enjoyed and been interested in the study, such as “I liked the project”, “I enjoyed it”, “I’ve thoroughly enjoyed the experience”, “I found it really interesting”, and “it’s a fascinating project”. A number of participants commented on what they had learnt during the study, such as “I’ve learnt quite a lot about myself”, “I’ve learnt a fair amount about the tools and techniques, and about myself”, and “I feel I’ve learnt odds and ends about myself, but I don’t think it’s changed my life radically”.

Two main points emerged in suggested improvements. First, 2 participants suggested that more information should be given before a technique was used on what sorts of knowledge were to be covered and what was to happen during the session. Second, 2 participants suggested that there should be some feedback and analysis after each session informing the participant what had been found and what could happen next with the knowledge captured. Other suggestions made included having a final group session to discuss the techniques and having the post-session questionnaires being filled-in at the end of a session (rather than giving the participant the option to take the questionnaire away to fill-in). A discussion of these suggested improvements will be made in the next chapter.

8.2 Personal Knowledge Ontology

This section describes a proposed ontology based on a content analysis of the knowledge captured in this study. The ontology is a first attempt to provide an ontology that would form part of an initial version of the Personal Knowledge Methodology, and that would be developed as the methodology was used. The purposes and uses of an ontology in this context, were briefly covered in chapter 1, and are expanded upon in this section. The way the provisional ontology was developed is also described, followed by a summarised description of the ontology. This section ends with a test of the ontology using a number of psychological approaches and models.

8.2.1 Definition and Purpose of the Ontology

The term ‘ontology’ is usually defined as a formal description of the knowledge in a domain. However, there are two variants of this definition. First, ‘ontology’ can refer to a full description of all the knowledge, so that it can be represented and used within a computer system. Second, ‘ontology’ can refer to a generic model that applies to a class of domains. It is the latter definition that will be used here.

Whichever definition one uses, an ontology is most often conceptualised as comprising three main elements: (1) a set of knowledge objects; (2) a set of relations that form associations (relationships) between the knowledge objects; (3) a set of axioms that provides rules and constraints for the relationships (e.g. if A is next to B, then B is next to A). The ontology described here will make use of the first two elements, but not include any axioms, which requires more development.

There are a number of reasons for including an ontology as part of the Personal Knowledge Methodology. First, it can help to integrate and coordinate the use of the Personal Knowledge Techniques for more efficient acquisition of knowledge and facilitation of self-help. Second, the ontology can provide a common underlying language that aids users to understand the information available to them (e.g. from other users) and aids researchers to compare knowledge from different users. Third, the ontology can help the user when searching for, and being presented with, advice from the system. This is achieved by using the ontology to provide key words and semantic tags with which to code the information for searching. Fourth, the ontology

provides a structured set of categories that can be used to analyse the knowledge captured from users. Fifth, as multiple users make use of the Personal Knowledge Methodology, the ontology can develop to be a reflection of the commonalities between these users' lay psychological theories. Sixth, the ontology can be a contribution to the ongoing development of ontologies within knowledge engineering. Finally, a longer-term goal would be to develop multiple versions of the ontology appropriate to different populations that might help to unify various psychological models and theories for intervention and application. It should be stressed that although the ontology may resemble a psychological theory, it would be presumptuous at this stage to consider it as such. However, in the longer term, it is hoped that the ontology can be developed to be a psychological theory.

8.2.2 Development of the Ontology

The ontology was developed in three main steps. First, an initial set of high-level knowledge objects was selected. Second, relationships were created between pairs of these knowledge objects. Both of these steps drew upon four sources of information: (1) an initial set of elements underlying the choice and design of the techniques being assessed, (2) a content analysis of the interview transcript and knowledge models constructed in the empirical study, (3) analysis of the feedback from the participants on difficulties, gaps and improvements, and (4) ontological elements described in the background literature. The third step added lower-level classes of knowledge objects using material from the interview transcript and knowledge models from the empirical study. In performing the latter step, the initial high-level ontology was modified to maintain consistency with the empirical data that was captured.

8.2.3 Description of the Ontology

The ontology is described in three parts. First, there is a diagrammatic representation of the high-level knowledge objects and the relationships that exist between them (described below). Note, that the knowledge objects represent an individual's personal knowledge, not the concepts themselves. For example, the object "events" represents the person's knowledge of events, not the events themselves. Second, there is explanatory text for each of the high-level knowledge objects (described below). Third, there is a taxonomy for each of the high-level knowledge objects (see www.epistemics.co.uk/staff/nmilton/phd).

8.2.3.1 Network Representation

Figure 16 shows a diagrammatic representation of the high-level knowledge objects and the relationships that exist between them. For clarity, some relationships have not been shown, particularly those related to ‘events’ and ‘beliefs’.

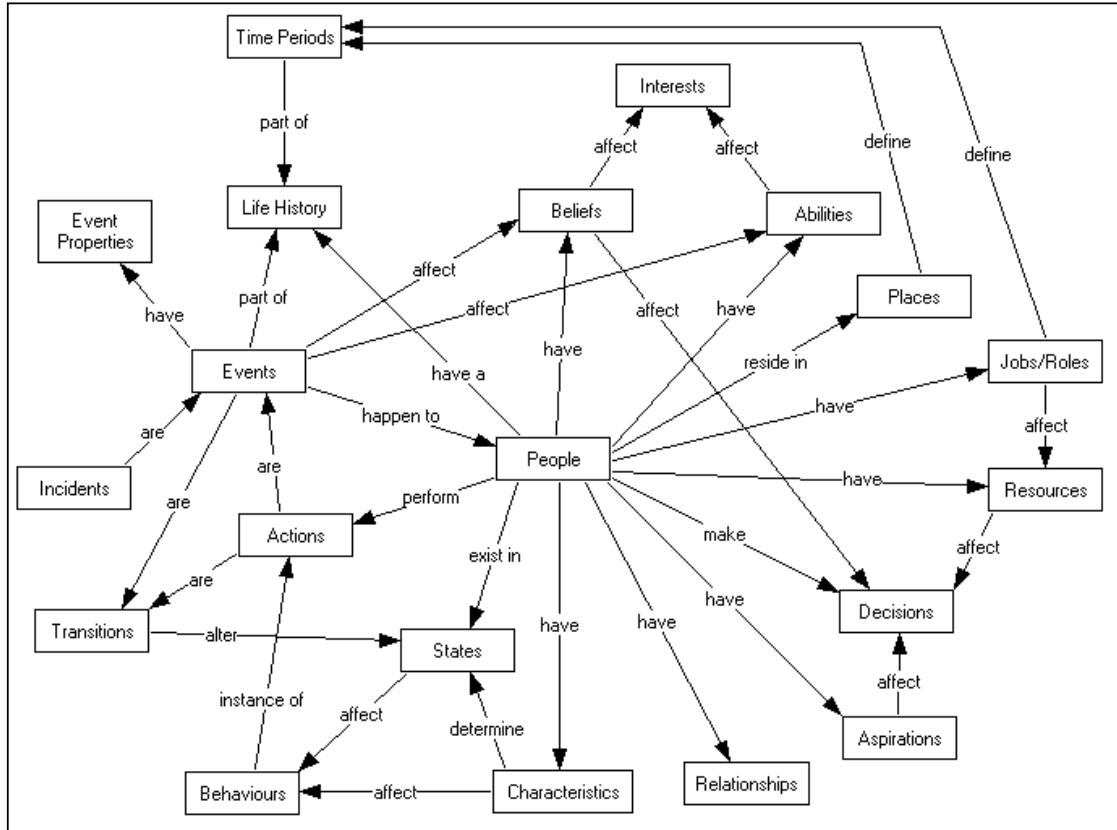


Figure 16: Network diagram showing the high-level objects in the ontology and the associated relationships

8.2.3.2 Explanatory text for each high-level knowledge objects

A brief description of each of the knowledge objects shown in Figure 16 follows.

People: Knowledge of the characters in a person’s life. Examples include the self, significant others, admired others, and hypothetical others (such as ‘the ideal me’, ‘me as others see me’, ‘me in 5 years time’), and stereotypical others (such as ‘a good boss’, ‘a poor teacher’, ‘an ideal parent’). People have a life history, have beliefs, have abilities, reside in places, have jobs/roles, make decisions, have aspirations, have relationships, have characteristics, exist in states, and perform actions. Events happen to a person and affect all aspects of the person’s life.

Events: Knowledge of the discrete happenings that a person is involved in. Types of events include single events, complex events (such as multiple similar events e.g.

mum had lots of miscarriages, and distributed events e.g. they did a lot for the church), generic events and hypothetical events. Events have event properties and are part of a person's life history. Events affect all aspects of a person.

Incidents: Knowledge of the types of event that are beyond the control of a person, such as accidents, illnesses, deaths, redundancies and socio-political occurrences (such as wars).

Event Properties: Knowledge of the properties of events. These include the valence of the event (such as positive e.g. I went on holiday, and negative e.g. I wasn't allowed to go on holiday), emotive-ness (e.g. it was good, it was dreadful), the effect on people, etc.

Life History: Knowledge of the biographical history of a person's life. A life history is made up of events and segmented into time periods.

Time Periods: Knowledge of the main phases that constitute a person's life history. Time periods are often defined by two main factors (1) the places resided in, educated in and worked in, and (2) the jobs/roles occupied.

Actions: Knowledge of the events in which a person is a main actor. Actions can be tangible (involving something of the physical world) or intangible (a cognitive action, such as reflections and realisations). Actions are a form of transition that moves a person from one state to another.

States: Knowledge of the temporary characteristics that a person can exist in. Examples include emotions (e.g. happy, sad, and excited), cognitive states (e.g. ambitious, creating), and physical states (e.g. tired, ill). States affect a person's behaviour and are altered by transitions. The set of states that a person can exist in are determined by the person's characteristics.

Transitions: Knowledge of the ways in which a person's state is altered. The three main types of transitions are (1) actions (purposeful happenings), (2) incidents (events beyond the control of the person), and (3) the passing of time.

Characteristics: Knowledge of the stable properties of a person. Examples include a person's traits (e.g. sociability, intelligence, niceness) and physical characteristics. Characteristics affect behaviours, determine states and are affected by events.

Behaviours: Knowledge of the actions of a person that are repeated and form patterns. Examples include particular responses to particular stimuli. Behaviours are affected by a person's characteristics and states.

Decisions: Knowledge of the choices made by a person when there is more than one course of action available. Decisions affect a person's actions, and are affected by a person's aspirations and beliefs.

Aspirations: Knowledge of the ambitions, goals, motivations, wishes and desires of a person. Aspirations affect a person's decisions and are affected by events and resources.

Resources: Knowledge of the economic, physical and cognitive capabilities possessed by, or available to, a person. Examples include money, possessions, tools and techniques. Resources affect a person's decisions and aspirations, allow or limit a person's actions, and are affected by a person's jobs/roles.

Abilities: Knowledge of the physical and cognitive aptitudes and resources possessed by a person. Examples include the capability of the person to perform certain actions in certain ways. Abilities affect, and are affected by, a person's interests.

Beliefs: Knowledge of the ways in which a person thinks about various aspects of their life. Examples include thoughts, ideas, opinions, attitudes (likes and dislikes), priorities, perspectives, expectations and second order beliefs (i.e. beliefs about beliefs). Beliefs affect a person's interests and decisions, and are affected by events.

Interests: Knowledge of the domains and subjects with which a person is involved. Interests can be at work (occupation, subject areas, expertise) and outside work (e.g. pastimes, hobbies, arts, crafts, voluntary work, religion).

Places: Knowledge of the locations in which a person resides or visits for work or social occasions. Places are an important factor in defining time periods.

Jobs/Roles: Knowledge of the occupations and/or positions held by a person. Jobs/roles exist both inside work and outside work in various organisations and social situations. Jobs/roles affect a person's resources and are an important factor in defining time periods.

Relationships: Knowledge of the interactions of a person with significant others.

Relationships include having beliefs concerning one another and inter-personal actions. Relationships affect, and are affected, by events.

A fuller description of these objects, the ways in which they are related and examples taken from the content analysis can be found at the following URL: www.epistemics.co.uk/staff/nmilton/phd.

8.2.4 Testing the Ontology

As a test of the completeness of the ontology, it was compared to the elements that constitute various psychological theories and models particularly those covered in the background literature.

8.2.4.1 *Decision-Making and Behavioural Models*

A comparison of the knowledge objects in the ontology and those used in decision-making and behavioural theories is shown in Table 58.

Theory	Elements used in the Theory	Knowledge Objects from the Ontology
Subjective Expected Utility Theory	Actions	Actions
	Events	Incidents
	Assessment of the probability	Beliefs
	Expected utility	Beliefs
Conflict Theory of Decision Making	Actions	Actions
	Coping patterns	Behaviours
	Pros/Cons	Beliefs
Theory of Planned Behaviour	Beliefs	Beliefs
	Attitudes	Beliefs
	Intentions	Aspirations
	Behaviour	Behaviours
Health Belief Model	Actions	Actions
	Assessments	Beliefs
Transtheoretical Model of Change	Stages of behavioural change	Behaviours, Actions & Decisions
	Processes of change	Actions

Table 58: Comparison of decision-making theories and knowledge objects from the ontology

8.2.4.2 *Attitude, Attribution and Schema Models*

Table 59 shows a comparison of the knowledge objects in the ontology and those used in some influential theories/models of social psychology. The theories and models included in the table are the Three-Component Model of Attitudes (Rosenberg & Hovland, 1960), an influential theory of attributions called Correspondent Inference

Theory (Jones & Davis, 1965) and the main schema developed for use in Social Cognition (Fisk & Taylor, 1991).

Theory/Model	Elements used in the Theory/Model	Knowledge Objects from the Ontology
Three-Component Model of Attitudes	Stimuli	Events & Relationships
	Attitudes	Beliefs
	Affect	States, Actions & Behaviours
	Cognition	Actions & Behaviours
	Behaviour	Actions & Behaviours
Correspondent Inference Theory	Dispositions	Characteristics
	Intention	Aspirations
	Knowledge	Beliefs & Abilities
	Ability	Abilities
	Action	Actions
Schema from Social Cognition	Person schema	People
	Self-schema	People
	Role schema	Jobs/Roles
	Event schema	Events
	Causal schema	Beliefs

Table 59: Comparison of attitude & attribution theories/models and knowledge objects from the ontology

8.2.4.3 *Psychological Models Comprising Many Elements*

As a final comparison, the ontology was tested against two approaches that contain a substantial number of ontological elements. The first of these is the Biographical Inventory of the Autobiographical Research method (De Waele & Harré, 1979), which is a very large questionnaire used to capture knowledge of many aspects of a person's life. A sub-set of the concepts used in this questionnaire has been included in the table. The second approach shown in the table is the Intentional Action Formulation used in Descriptive Psychology (Ossorio, 1981). This is a parametric analysis of behaviour intended to identify and discriminate between behaviours along ten dimensions. The comparisons are shown in Table 60.

Theory/Approach	Elements used in the Theory/Approach	Knowledge Objects from the Ontology
Intentional Action Formulation	Behaviour	Behaviours
	Intentional Action	Actions
	Identity	People
	Want	Aspirations
	Know	Beliefs & States
	Know how	Ability & States
	Performance	Actions & Behaviours
	Achievement	Actions & Resources
	Individual Difference	Characteristics
	Significance	Event properties
Concepts from the Autobiographical Research	The time course	Life history
	Significant others	People
	Wishes	Aspirations
	Attitudes	Beliefs
	Artefacts	Resources
	Socio-economic factors	Incidents & Resources
	Norms	Beliefs
	Expectations	Beliefs
	Roles	Jobs/Roles
	Institutions	Places
	Interpretations	Beliefs
	Occupations	Jobs/Roles
	Interests	Interests
	Leisure activities	Interests
	Goals	Aspirations
	Aspirations	Aspirations
	Conflicts	Beliefs

Table 60: Comparison of knowledge objects from the ontology with two large psychological ontologies

8.2.5 Summary

As a first attempt at providing an ontology for use in the Personal Knowledge Methodology, the ontology described here is felt to be a good starting point. The knowledge objects included can be mapped to the classes identified in the empirical study and to the main elements in various psychological theories and models. This indicates that there is a degree of completeness and discrimination. The lower-level knowledge objects and relationships between the knowledge objects have not yet been assessed or tested on the empirical data. The addition of axioms to the ontology to show rules, inferences and constraints acting upon the knowledge objects requires further work and assessment.

9 DISCUSSION AND FUTURE WORK

*A love affair with knowledge will never end in heartbreak
(Michael Garrett Marino)*

This final chapter contains two parts. The first part summarises the work performed in the research, makes some tentative conclusions and discusses the issues raised. The structure reflects the research aims described towards the end of chapter 1. The second part looks forward to future work that might be undertaken to explore the issues raised in this research study. The next steps in the development of the Personal Knowledge Methodology are proposed and some possible uses of the Personal Knowledge Techniques are discussed.

9.1 Summary, Conclusions and Discussion

This section reviews each of the research aims described in chapter 1 in light of the background literature covered in chapters 2 and 3 and the empirical work described in chapters 4 to 8.

9.1.1 Research Aims Associated with Personal Knowledge Techniques

9.1.1.1 Which techniques are most suitable as Personal Knowledge Techniques?

A large number of possible techniques taken from the background literature were assessed for their suitability as Personal Knowledge Techniques. From these, 8 were selected for empirical assessment in this study. Of these, two were interview-based techniques (a semi-structured interview and interview review), two were based on constructing repertory grids, one was a personality test (the Keirsey temperament technique), and three were network-based techniques (event diagram, state diagram and aspirations technique). The Keirsey temperament technique was used as a control technique, since it represents a much-used technique for self-help and knowledge capture.

The general results demonstrated that most of the techniques showed promise as Personal Knowledge Techniques. The overwhelming impression from the participants was that the techniques were interesting and thought-provoking. Each of the participants felt that a number of the techniques were enlightening and were capable of facilitating self-help. In comparison to the control technique, all but one of the

techniques gained better rankings and ratings from the participants. When the participants made comparisons to other techniques of a similar nature, the techniques under assessment fared very well. It was particularly encouraging to have two personnel professionals state that a number of the techniques under assessment could provide useful supplements to existing tools in organisational contexts.

A number of participants noted that analysis and feedback would be very useful additions to the passive knowledge construction and capturing techniques. Evidence indicated that the techniques that did offer some analysis and feedback (e.g. the people grid and Keirsey temperament techniques) were liked because of these aspects. To provide feedback automatically would require each technique to be supplemented by a knowledge-based system. In this way, methods of analysis and rules could be included into the Personal Knowledge Techniques. Hence, expanding the methodology to include a tutoring aspect (by giving advice to the users) rather than just providing them with a set of tools that they use to explore their personal knowledge.

A brief summary of each technique and the results obtained in the main study is as follows.

The **semi-structured interview** is a standard technique used in many knowledge engineering projects. It makes use of a set of pre-designed questions but allows unplanned supplementary questions to be asked during the session. The design of the interview for this study included 12 questions partitioned into 3 sections based on the structure of De Waele & Harré's Biographical Inventory. Responses to the interview questions provided a large and rich source of personal knowledge, covering such areas as life events, self-descriptions and opinions on personal knowledge. The content of the responses also provided an efficient way of leading into the other techniques being assessed. The interview was ranked by the participants in 2nd place of the 8 techniques. A number of participants felt it was useful to have the opportunity to talk about and examine things that are not normally talked about. The main problem identified by the participants was a lack of clarity in some questions, which may be overcome by a more structured answering system and advice on what knowledge can be captured.

The **interview review** technique was inspired by the use of diaries for therapeutic means. It makes use of the transcripts from the semi-structured interviews, which were read and reviewed by the participants about 9 months after the interview. Reactions

are captured as the transcript is read by adding symbols and remarks in the margin. Analysis of the responses indicated that about 80% showed agreement with what they had previously said, and about 8% showed surprise at what they had said. The interview review was ranked by the participants in 6th place of the 8 techniques. There was a polarisation of opinions with 3 participants placing this technique in their top 2 most favoured of the techniques and 7 participants placing it in their bottom 4. There was some evidence that this may be due to the personality type of the participants. The main problems identified by the participants was the need for a longer period in between the interview and the review, and for an improvement to the marking scheme, possibly making use of software.

The **people grid** technique is based on the construction of a standard form of repertory grid. The elements in the grid are aspects of the self and significant others. The constructs (attributes) are traits selected from those used in the semi-structured interview. The technique involves rating the elements for each of the constructs on a numerical scale. These ratings are subjected to a cluster analysis using special software (PCPACK) to produce a focus grid. The final stage involves reviewing and amending this grid. A content analysis of the results revealed that four classes of constructs were used: ambition & strength, emotions & niceness, social skills and thinking. The people grid technique was ranked by the participants in 3rd place of the 8 techniques. The main problems identified by the participants were difficulties in performing the ratings.

The **events/periods grid** technique is very similar to the people grid technique but uses key events or time periods in the participant's life as the elements. The constructs are selected using a triadic elicitation method. A content analysis of the results revealed that eight classes of constructs were used, the most common being associated with feelings/emotions, moods/states and decisions/outcomes. The technique was ranked by the participants in last place of the 8 techniques. The main reported reason for this is that the technique failed to reveal anything new to many of the participants. The main problems identified by the participants were in the choice of which events/periods to use and the generation of the constructs. Using less important life decisions and using another technique to elicit the constructs may overcome these problems.

The **Keirsey temperament** technique is a standard personality technique used in many contexts, and was included as the control technique. It makes use of a set of questions that provide scores on 4 scales. These scores then categorise the person into one of 16 temperaments which group into 4 temperament classes. The participants felt the Keirsey temperament technique was less thought-provoking and less enlightening than the other techniques, and ranked it in 7th place of the 8 techniques. The main problem identified by the participants was difficulty in answering the questions, since they were forced-choice and sometimes used unfamiliar language.

The **event diagram** technique is based on the construction of a set of diagrams very similar to the kind of process models used by knowledge engineers. The diagrams show events as the primary nodes. Inputs and outputs of the events are shown as other nodes, which are linked by arrows to the relevant event node. The inputs represent the state of affairs before an event, and the outputs show what the event has caused to change. Also shown are the attributes of the events. The technique involves the construction of a hierarchical set of these diagrams using special software (PCPACK). A preliminary set of diagrams is constructed before the session using information from the semi-structured interview. These diagrams are then modified and expanded as the session proceeds. Analysis of the results revealed that each participant produced about 4 diagrams each containing about 6 events and 9 inputs/outputs. The most common types of events were associated with starting a job, the break up of a marriage or serious relationship and birth/deaths. The most common types of inputs/outputs were associated with feelings, situation/context and interests. The event diagram technique was ranked by the participants in 5th place of the 8 techniques. A number of participants found the technique to reveal new thoughts such as identifying patterns and connections. Suggestions for possible improvements included the use of standard prompt questions from the software and having more time.

The **state diagram** technique is based on the construction of a state transition network. This type of diagram includes states as nodes linked by arrows representing transitions. The states in the network diagram are selected by the participant and can be any type of state, such as emotional states, moods, behavioural states, etc. The transitions are the ways in which the person moves from state to state, and are usually either actions performed or external events. The technique involves the construction of

such a diagram from scratch on a large sheet of paper. The technique concludes with the participant assessing how long he/she spends in each state both at work and at home. Analysis of the results revealed that each diagram contained about 8 states and 22 links between states. The most common types of states were associated with emotions and feelings, with the ‘happy’ state being the most common. The state diagram technique was ranked by the participants in 1st place of the 8 techniques, with 7 of the 10 participants placing it in their top 3 positions. There were indications that this popularity may be due to this technique being more enlightening than many of the other techniques. Suggestions for possible improvements included the use of standard lists of states and transitions to select from, improving the presentation, and having more time.

The **aspirations technique** is based on the construction of two types of network diagram. First, a decision tree is constructed based on a key decision that the participant is considering or has recently made. The nodes on the tree are the possible courses of action, and the sub-nodes are advantages and disadvantages for each of these. There then follows a questioning procedure in which the participant is asked repeated “why” questions for the reasons behind the advantages and disadvantages. A second diagram, the ‘aspirations diagram’ is then constructed which uses the abstracted answers from the “why” questions as nodes on a concept map. This diagram has “aspirations” as a top-level node. The links in the diagram represent the relationships between the nodes. The results revealed that each decision tree contained about 4 courses of action, each of which had about 3 advantages and 3 disadvantages. Each aspirations diagram contained about 27 nodes and 37 links between the nodes. The most common types of nodes on the aspirations diagram were associated with interests, friends/others and job. The aspirations technique was ranked by the participants in 4th place of the 8 techniques. Interestingly, the average ratings for *thought-provoking* and *recommendation* on the post-session questionnaires were higher than any other technique. Suggestions for possible improvements included the need for more than one decision to be mapped, and having more time.

9.1.1.2 What types of personal knowledge can each technique capture?

Table 61 provides a mapping from the high-level classes identified for the Personal Knowledge Ontology (as described in section 8.2) and the main types of knowledge

elicited and captured using the non-interview techniques (covered in chapters 6 and 7). The interview and interview review techniques have not been included in the table, as they both cover all types of knowledge.

	People Grid	Events/ Periods Grid	Keirse Technique	Event Diagrams	State Diagram	Aspiration Technique
People	■					
Events		■		■	■	
Incidents				■		
Event Properties		■		■		
Life History				■		
Time Periods		■		■		
Actions					■	
States					■	
Transitions					■	
Characteristics	■		■			
Behaviours			■		■	
Decisions						■
Aspirations						■
Resources				■		■
Abilities			■			
Beliefs						■
Interests			■			■
Places				■		
Jobs/Roles			■			
Relationships	■			■		

Table 61: Types of knowledge (high-level classes in the ontology) that each technique can capture

As illustrated in the table, the techniques provide a broad coverage of all types of personal knowledge and no two techniques exactly overlap. That said, some of techniques do overlap. This is most notable for the events/periods grid and event diagram techniques. Does this make one of these techniques redundant? The results are not clear on this matter. Certainly, some participants did mention that the ground covered in one session had previously been covered in another. This was most noticeable for the events/periods grid, and may have contributed to the lack of popularity of this technique. On the other hand, a well-known principle amongst practicing knowledge engineers is that techniques need to be used that approach the same knowledge from different angles. Although this can be somewhat repetitive, it is valuable in prompting for new knowledge and ensuring consistency and validity. On the whole, the techniques selected for assessment in this research provided good coverage of personal knowledge, although it would be useful to assess other

techniques, especially those that focus on knowledge of beliefs, abilities and roles.

9.1.1.3 Does the process of capturing a person's personal knowledge increase his/her personal knowledge, or have some other effects or benefits?

Comments on the post-session questionnaires indicated that some increase in personal knowledge does occur during an elicitation session. The majority of the comments concerning new thoughts, split into two main categories. First, many comments were associated with the **thought-provoking** nature of the techniques, with phrases such as “made me think about...” and “made me consider...” being commonly used. Second, many comments were associated with an **increase in personal knowledge**, with phrases such as “made me realise that...” and “made me understand ...” being commonly used. A particularly prevalent notion was that the participant saw links or associations between factors (such as people or events) that they had not seen before.

9.1.1.4 Is a person helped by having their personal knowledge increased?

Opinions on this issue were gained by asking each participant during the semi-structured interview what the effects, and possible benefits, there might be for having more knowledge about oneself. The responses showed that most of the 18 participants felt that knowing more about oneself would be useful. Analysis of the responses revealed six main categories of how more knowledge would be beneficial. These categories are summarised in Table 62.

Way in which more personal knowledge would be beneficial	Example quotations from participants
Recognition and Change	“If you can recognise that you're actually performing that behaviour, and you know a way of getting out of it, then it can influence the way you behave”. “It would snap you out of that mode of behaviour that you're in”.
Dealing with difficulties	“I'd probably handle things better”. “The more you understand about yourself or about the human condition generally, the easier it is to cope with someone being unpleasant or difficult”.
Generally helpful	“Wisdom comes from learning more”. “It might make certain things easier”.
Understanding other people	“Knowing how my behaviour and actions affected others”.
Decision-making and Planning	“You're able to make better decisions”
Control and Confidence	“I'd like to be able to know which sort of buttons to push within myself”.

Table 62: Participants' opinions on the usefulness of more personal knowledge

A small number of participants, mentioned ways in which an increased knowledge of oneself would not be helpful, and may be detrimental. Analysis of these responses resulted in three categories of opinions: (i) even if you had more knowledge it would be useless if you couldn't change; (ii) more knowledge may lead to one becoming too analytical or concerned; (iii) more knowledge may reveal bad thoughts.

During the final sessions, each participant was asked whether any changes in thinking or behaviour had resulted from each of the previous sessions. Results showed that about one third of the sessions (27 from 79) had provoked some change in thinking or behaviour. The types of change are summarised in Table 63, with example quotations.

Type of change	Example quotations
Provoked thinking about issues raised in the session	"Probably started me thinking about those things more often". "Helped me to think about what I had to do to change the way I behaved".
Increased analytical thinking	"I've thought more analytically about things". "It does make you think about what you're doing".
Changed attitudes or understanding	"Makes me think slightly differently about relationships". "An aid to helping me understand",
Increased understanding about past events	"Makes me a little more settled to think I couldn't have changed things". "Made me feel more comfortable about the root causes of decisions".
Increased motivation for change	"It has made me realise I want to really do a bit more". "The sort of thing that could come out of it was: go get a hobby or you're spending too much time on the computer".
Modified behaviours	"I've tried to be nicer to people, and not be as selfish" "It's changed how react with people and how I learn from them"
Reminder or Consolidation	"Confirmed views – re-rationalised – especially what I want to be". "It's a reminder".

Table 63: Participants' opinions on the usefulness of more personal knowledge

9.1.1.5 Do the results of capturing and representing personal knowledge in an explicit format (e.g. transcripts, diagrams, grids) help the person?

During the final sessions, each participant was asked in what way the transcripts, diagrams and grids created in the sessions might be used and be of benefit. Four main uses and benefits were identified:

- (1) Diary uses, such as reviewing the way one thought and felt when creating the representations, seeing how much one has changed, and capturing one's life story

- (2) Uses in decision-making, such as capturing the decision process (for later reflection) and making better decisions by learning from the past
- (3) Uses in gaining a perspective on where one is (such as one's emotional state), how one got there, and how one could proceed
- (4) Increased self-understanding, such as providing more self-awareness, altering priorities, and identifying areas for growth

When participants were asked whether they would like to view the transcripts, diagrams and grids of other people, most felt this would be interesting and beneficial. Three main classes of benefits were mentioned. First, help in understanding other people, such as understanding their personality, their priorities, their problems and the reasons behind their decisions. Second, help in improving relationships, such as dealing with people and relationship counselling. Third, uses in organisations and by professionals, such as use for career development, recruitment and team building.

9.1.1.6 Can a person operate the techniques on his/her own?

The literature on self-help and computer-assisted therapies shows that non-experts can operate these techniques and software for their benefit. There is a practical and ethical problem of not being able to easily monitor the use of self-help literature. The Personal Knowledge Methodology has been designed to overcome this by constantly acquiring knowledge on the use and reactions of users to the techniques being used.

Evidence from the use of knowledge acquisition techniques by relative novices for knowledge management projects shows that with a short training period and careful coaching, people with no prior experience of knowledge engineering can become proficient users of the techniques. Although there have been some recent moves in knowledge engineering to provide software-assisted methods to allow experts to elicit and model their own knowledge, such techniques are still in their infancy. As such, most knowledge elicitation is performed with the expert and knowledge engineer co-operating together. In this context, many of the techniques that involve modelling are relatively easy to learn and apply, and in practice experts can directly model their knowledge with the knowledge engineer providing guidance and prompts. The use of software, such as PCPACK, to support such activities ensures the expert does not stray from good knowledge engineering practices due to imposed constraints.

Except for the interview review technique, none of the other techniques assessed here were operated solely by the participants. Hence, one cannot draw any definite conclusions on this issue. However, it is worth noting that many of the participants found a number of the techniques, notably the grid techniques, to be difficult to grasp and understand at first. Indeed, a number of comments made in the feedback sessions mentioned the need for clear instructions on the technique and description of the aims and outcomes expected. In later studies, it is recommended that a longer time be spent at the start of a session, or prior to the session, explaining exactly what will happen and the types of knowledge that will be involved. In this way, it may be possible to design the software implementation of the techniques to be easily and effectively operated by the user alone.

9.1.1.7 Are there any differential effects in the use and usefulness of the techniques associated with demographic details?

The research literature indicates that women are the primary users of self-help books and that female users of self-help methods may have a different set of requirements to male users. There is also evidence of possible gender differences in people's use and reaction to computer-based techniques. There is some evidence for a possible differential effectiveness of bibliotherapy for people with different personality traits.

Evidence from the research presented in chapters 5-8 indicated some differential effects of gender, age, qualifications and personality type on participant's reactions to the techniques. The **interview review** technique seems to be preferred by university graduates and by those having a Guardian personality temperament (i.e. high on sensation and high on judgement). The **people grid** technique seems to be preferred by women and by younger participants. The **events/periods grid** technique seems to be preferred by women and by participants without a university degree. The **Keirsey temperament** technique seems to be preferred by younger participants, whereas the **event diagram** technique seems to be preferred by older participants. The **aspirations technique** seems to be preferred by men, older participants and university graduates. No differences were found for the **interview** and **state diagram** techniques.

It should be noted that a very small population of participants was involved in the analysis. As such, these results must be treated with some caution until they can be verified with a larger population in future work.

9.1.2 Research Aims Associated with Personal Knowledge Methodology

9.1.2.1 *How useful might the methodology be to the person using it?*

Studies of the effectiveness and use of self-help books, bibliotherapy, diaries and computer-assisted therapy demonstrates that the direct involvement of a therapist is unrelated to treatment effectiveness for many types of problems. This demonstrates that the self-help aspect of the methodology is potentially very useful. The background literature indicates two main ways in which self-help techniques can aid people: (1) increasing understanding of self and others (often involving the revelation of insights and unconscious thoughts), and (2) analysing and challenging this understanding to eliminate or reconstruct maladaptive thoughts and feelings. The Personal Knowledge Methodology is potentially useful in both these areas in its use of elicitation, presentation and analytical techniques. Such techniques might also help aid decision-making, learning and creativity. The use of ontologies, knowledge-based components and adaptive/personalised software methods might provide interpretations, guided help and opportunities for self-reflection.

The empirical research in this study has successfully applied methods and techniques used for expert knowledge to the capture and analysis of personal knowledge. A range of knowledge acquisition techniques has been shown to be able to capture personal knowledge and facilitate self-help. The nature of the help has been described in a number of places previously in this chapter. Figure 17 summarises the effects of the Personal Knowledge Techniques and the resulting knowledge models to provide an integrated view of the possible mechanisms of help.

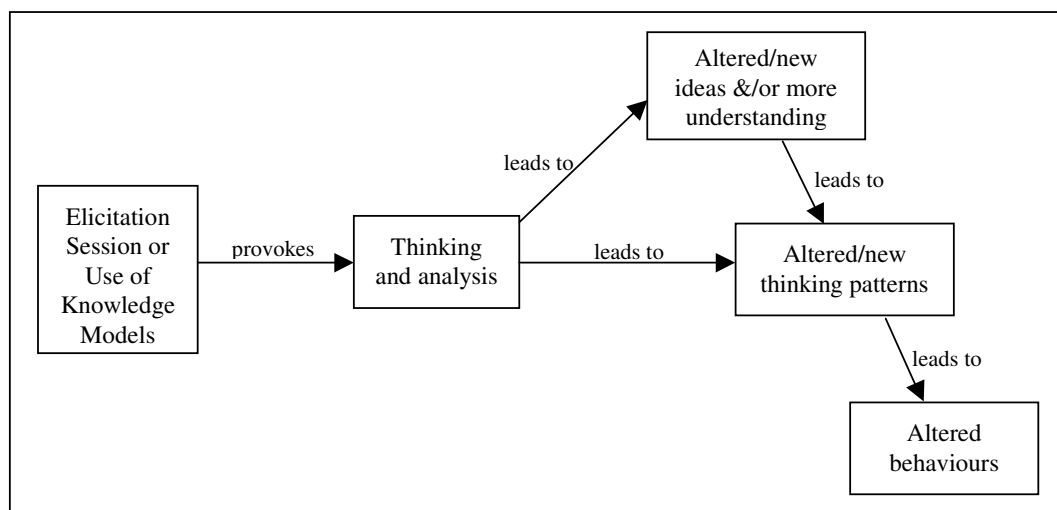


Figure 17: Possible beneficial effects of the Personal Knowledge Methodology

Results from the empirical studies indicate that the participants can gain more understanding and/or new ideas. These can be seen in terms of the person's past, present and future. Examples of these are shown in Table 64.

Areas of New Understanding or Ideas	Examples (based on the empirical studies)
The Past	<p>Better understanding of how and why life events had occurred, developed or impacted on other events or circumstances.</p> <p>Better understanding of how one has changed and developed over time.</p> <p>An improved feeling concerning past decisions or actions.</p>
The Present	<p>Better understanding of the emotional states one gets into and how one might deal with less desired states.</p> <p>Better understanding of relationships and how one is affected and behaves with different people.</p> <p>New (or renewed) perspective and priorities.</p>
The Future	<p>Better understanding of one's aspirations and what can help or hinder gaining what one wants.</p> <p>New (or renewed) motivation to take certain actions.</p>

Table 64: Examples of benefits related to the past, present and future

9.1.2.2 How useful might the methodology be for research purposes?

Evidence presented in the literature review concerning recent developments in qualitative research supports the notion that key aspects of the Personal Knowledge Methodology could help overcome problems with existing qualitative methods. Aspects that were supported were the tight loop of theorising and intervention, participants pre-coding the data, computers allowing many cases, an integrated set of various methods, and use of generic knowledge.

The usefulness of the knowledge captured by the Personal Knowledge Techniques for developing psychological theories has not been a prime focus of the empirical work. However, it is important to consider the issues of reliability and validity in this context. There are two ways of viewing these issues. First, one can take a sceptical view and question the legitimacy of using the notions of reliability and validity for the types of techniques being used. Second, one can take the view that reliability and validity are vital attributes of the techniques being used. The following two paragraphs expand on these two viewpoints.

Inherent in the design of the Personal Knowledge Methodology is the integrated use of

both qualitative and quantitative methods. The empirical work has aimed to do this by using what are essentially qualitative techniques within a comparatively rigorous experimental setting (e.g. the use of a random order of presenting the techniques, Likert-style rating scales and statistical analyses). Leaving aside the way in which the techniques were assessed (to be covered later), what remains are essentially qualitative techniques. As most qualitative researchers would point out, the notions of reliability and validity do not directly apply to qualitative techniques. Indicative of this are the views of one of the fathers of the constructivist movement, George Kelly who said “Reliability is that characteristic of a test which makes it insensitive to changes” and “Validity refers to the capacity of a test to tell us what we already know” (quoted in Fransella & Bannister, 1977). From this standpoint, the reliability of the techniques used is inappropriate, since one expects an individual’s personal knowledge to change over time. As for the validity, again this is inappropriate since by its very nature what people describe and express using the techniques is their personal knowledge, however erroneous and flawed this may be. The Personal Knowledge Methodology makes no claims to uncover any truths lying beneath an individual’s personal knowledge, although it does aim to help the person to arrive at a more truthful view.

From the viewpoint of quantitative research, reliability and validity are essential aspects of the methods used. Treating this viewpoint as appropriate for the Personal Knowledge Methodology, what can be said? First, the longitudinal, or diary-based aspect, of the methodology provides users with the opportunity to check, re-check and modify what they had previously expressed. Thus, the users themselves can ensure a certain amount of reliability, by constantly reviewing the models they produce, and making comments on what they still agree with, what they feel needs correcting or supplementing and what was true but has now changed. The interview review technique assessed in the empirical study is an example of how this might operate. As many people use this mechanism over time, analyses may start to reveal which techniques, used in which ways, may have reliability problems.

What then of validity? Again, the ability of users to check and modify what they have previously expressed is an aid to ensuring the validity of the knowledge captured. In addition, the use of multiple techniques provides a triangulation approach, whereby knowledge captured from one technique (e.g. the interview) can be cross-validated with that from another technique (e.g. the aspirations technique). Additionally,

allowing users to compare their models to those produced by other people may provide a means for a self-assessment of the truth and completeness of the captured knowledge. However, the notion of validity raises a key issue for the use and development of the Personal Knowledge Methodology: perhaps people do not want to model all of their knowledge and be as truthful (to themselves) as possible. The following paragraph makes some remarks on this.

People may have a need to hide certain knowledge from themselves. Goleman (1997) has described a range of ways in which people do not know about, or deceive themselves about, various aspects of their life. Cognitive psychologists have outlined many ways in which people are biased in their perception and memory due to the operation of heuristics that make these processes more efficient (Kahneman, Slovic & Tversky, 1982). Freud's theory is perhaps the most well known in this area, whereby people repress certain feelings and thoughts in order to protect themselves. Based on such ideas, it may be the case that it is actually detrimental to self-help to provide techniques that can capture personal knowledge in a fully valid way. This points to a possible inherent problem with the Personal Knowledge Methodology; that the dual aims of help and research may be contradictory. To test this, and possibly avoid it occurring, users' reactions and feelings when viewing their knowledge models needs to be monitored, captured and analysed. Possibly, the techniques need to include a way of allowing the user to hide knowledge when reviewing it. Perhaps, it would be beneficial for users to be able to create different versions of each model depending on their current mood. Some of the comments from the participants in the study hinted at this. The future use of longitudinal studies may be a useful method to examine this.

9.1.2.3 Will people want to use the methodology?

The popularity of self-help books certainly suggests that many people are keen to find out more about themselves and solve certain perceived problems. Studies of bibliotherapy and computer-assisted therapies demonstrate that there is no more drop out in these therapies than in therapist-assisted programs suggesting participants are motivated to continue. Analyses of the users of computer-assisted therapies show that they feel involved and empowered, and have increased self-esteem.

The empirical research found that the participants were interested and engaged by the techniques being used. Indeed, the term 'interesting' was the most prevalent on the

open-ended section of the post-session questionnaires. On the rating scales of the post-session questionnaires, the item *interesting* averaged 5.47 (on a scale of 1 to 7) across all the techniques being used, and for favoured techniques such as the state diagram and interview, the averages were 5.9 and 6.0. Another item on the questionnaire asked participants how much they would recommend that other people should use the technique. The ratings for this were again encouraging (mean=5.34). In addition, all the participants showed an interest in using some of the techniques in the future. These pieces of evidence, and the other encouraging remarks and responses made by the participants, all indicated that people would be motivated to use the Personal Knowledge Techniques. Additionally, the participants showed interest in seeing other people's transcripts, grids and network-diagrams of personal knowledge, as well as the kind of standard information presented in personality tests. This indicates that people would also be motivated to view the web-based information provided by the Personal Knowledge Methodology.

9.1.2.4 What ontology should be used?

The background literature led to the identification of a number of ontological elements. The literature on therapeutic help included such elements as psychological processes, resources for psychological processes, dynamic mechanisms and skills. Key ontological elements used in knowledge engineering include concepts, attributes, values, tasks and relationships. Traditional psychological research involving personal knowledge makes frequent use of notions such as attitudes and attributions, as well as basic processes such as attention, learning, memory and social interaction. A fundamental aspect of some qualitative approaches, notably grounded theory, is that there are no explicit ontological primitives in place prior to the research. However, other qualitative approaches do use ontological primitives, many of which take actions, events and behaviours as the central focus.

Use of these ontological elements, in combination with the knowledge classes identified in the empirical study, led to the development of a proposed ontology for use in the Personal Knowledge Methodology. This ontology included 20 high-level classes: people, events, incidents, event properties, life history, time periods, actions, states, transitions, characteristics, behaviours, decisions, aspirations, resources, abilities, beliefs, interests, places, jobs/roles and relationships. A number of relations

between these basic knowledge objects were also identified, such as ‘beliefs - affect - decisions’ and ‘events - part of - life history’. The ontology was tested by assessing the consistency between the basic knowledge objects and the elements used in various psychological theories and models. This proved successful, suggesting the ontology, while not complete and requiring further evolution, provides a promising start.

The ontology has a number of important uses within the Personal Knowledge Methodology. One important use is that of standardising the language across different users, so that valid comparisons can be made. One way in which this might operate is as follows. First, take the personal terms used by a user (their personal ontology) and attempt to match these to the top-level generic ontology (or a partially-generic ontology, as there may be sub-ontologies for specific types of people or situations). This ‘common-denominator’ model is then shown back to the person for comment, explanation and modification (based on a list of other generic elements). Disparities between what the person wanted to express and the vocabulary of the generic ontology would be highlighted, collated over people and time, and used to update the top-level generic ontology or partially-generic ontologies.

9.1.2.5 Can the methodology be computer-based?

Strong evidence for the efficacy of a computer-based methodology has been found. In many studies, computer-assisted therapies have been found to be acceptable to clients and as effective as therapist-assisted approaches. Use of computers by clients has also been found to increase autonomy and boost self-esteem. In addition, computers are potentially much cheaper to use than a therapist, do not judge and do not form inappropriate and maladaptive relationships with clients. Research that has developed knowledge-based systems for use by clients has found them to be both engaging to the user and provide a cost-effective means of therapeutic intervention. A possible limitation of computer-based techniques, indicated by the use of diary-based methods, is that paper-based techniques might still be required under certain circumstances. There are also ethical considerations that require careful development of software (discussed later).

There is increasing use of software tools to support knowledge engineering activities. Large projects are underway to develop intelligent systems based on large ontologies that can act as advanced web-based knowledge systems and that have the potential to

elicit knowledge directly from experts. Use of software tools to aid qualitative research is primarily in the area of analysis, the main use being to simulate and improve the efficiency of traditional paper-based methods.

Three of the eight techniques assessed in the empirical study made use of PCPACK, a specialised set of knowledge engineering tools. These were the people grid technique, the events/periods grid and the event diagram techniques. The use of this software was essential for the two grid techniques as it provides the required statistical analysis. The use for the event diagram technique is representative of how the user would interact with diagram-based techniques if computerised. The results for the use of software in this way were very encouraging, and reduced the time required for analysis.

When asked which of the techniques each participant felt could be fully computer-based, the Keirsev temperament technique and the two grid techniques were the ones most often mentioned. The techniques that were most regarded as requiring a human facilitator were the interview, the aspirations technique and the state diagram technique. In explaining the need for a facilitator, the reasons given were for the human to explain, facilitate, prompt and summarise. It remains a research question for future studies whether such actions can be performed by the use of an intelligent software system. Results from the use of knowledge-based systems for therapeutic interventions mentioned above indicate that this may be plausible.

What then of using automatic means for analysis and theory development? The literature review showed that computers have many uses to aid therapists such as data collection, information management, health education and clinical training. In addition, knowledge-based systems can aid diagnosis and decision-making. The fact that some therapists are using computers to help in such activities indicates opportunities to help professionals as well as their clients. Evidence showing that knowledge-based systems are as effective as clinicians at treating certain problems indicates that the use of knowledge-based technology within the analytical parts of the Personal Knowledge Methodology could prove useful in assisting direct help.

There has been little impact in providing software tools to automatically analyse data and help develop theories within qualitative research. Software that is available is almost all used to help the researcher code and catalogue the collected data. However, there are some moves in the direction of more sophisticated software, such as the use

of fuzzy logic and semantic networks to create and display putative theories. As yet though, such software is still in its infancy and requires much work.

There was no automated analysis performed in the empirical study. However, the results of the post-session questionnaires could easily be automated, especially if presentation of the questionnaire was computerised. Automatic analysis of the open-ended questions on the questionnaire, the interview and other knowledge models requires advanced language understanding software (discussed later) together with the Personal Knowledge Ontology. Development of automated analysis tools needs careful work through various stages of semi-automation. It is especially important to put in place a mechanism for ensuring that terminology used by one user is matched with terminology used by other users. Increasing usage of the ontology and standardised lists of answers and elements when using the techniques will help here.

Future work should also examine the use of other analytical methods, especially some of those being used in qualitative research and those employing computer-aided techniques. A number of analytical techniques mentioned in chapters 2 and 3 deserve consideration for future use. For example, sequence analysis could be assessed for the analysis of both structured knowledge (especially from event diagrams) and data from monitoring participants' use of techniques and web-based information. The use of multivariate and non-parametric statistics should also be assessed. These methods could be applied across people to test or discover hypotheses and correlations. For example, one could look for users who have parents with certain characteristics (from the people grid technique) that also have certain changes in their moods (from the state diagram technique).

9.1.2.6 What is the best way to develop the methodology?

There is a notable lack of information on how to develop a new methodology within the background literature on self-help and psychological research. However, there is some literature on the problems that can occur which can act to steer the way in which the Personal Knowledge Methodology is developed. Problems with self-help therapies include the inappropriate application of techniques and the risk of negative attributions towards self and others should things go wrong. The over-commercialisation of any techniques is also a problem. When developing computer-based techniques, certain ethical issues are of concern; such as the way certain people perceive information

conveyed by computers. For these reasons, it is essential that development of the Personal Knowledge Methodology be undertaken in a careful and systematic way, with the participation of potential users and evaluations at every stage of development.

An important issue arising from psychological research and knowledge engineering is the choice of using a top-down or a bottom-up approach. The strengths and weaknesses of these approaches rest on a choice between (1) having a pre-existing theory (classification framework, ontology) to guide and focus the research, or (2) having no preconceived notions and identifying concepts, themes, connections and theories from the raw data. Following the lead of many knowledge engineering methodologies, it was decided to use an abstract ontology to help provide some structure and focus. Use of such high-level categories as concepts, attributes, values, tasks and relationships is a compromise between a strong top-down approach and a strong bottom-up approach.

The empirical studies included a pilot study and a main study. The pilot study involved a group of psychologically literate people, all at post-graduate level and all females. This proved a useful population for the pilot study as it produced a 'safe' environment to help develop the initial methods used in a spirit of co-operative inquiry. Thus changes could be made as each participant was seen without worrying about introducing experimental confounds, and gaining some confidence that Personal Knowledge Techniques could be useful. For the main study, a much more representative section of the general population was involved and a rigorous, experimental design was used. One can view these studies as being part of two cycles around the analyse-design-apply-analyse loop of the Personal Knowledge Methodology, the pilot study being part of the first, the main study being part of the second. It is felt that this overall approach, of using the Personal Knowledge Methodology as a framework for the development of itself, was successful, and future development would consist of further loops around this cycle.

9.1.2.7 What metrics and assessment methods can be used to assess the effects and effectiveness of the methodology?

The literature on bibliotherapy (i.e. the use of self-help books for therapy) shows that researchers use seven dependent variables to assess treatment effectiveness. According to the literature, self-reported measures (i.e. questionnaires) were used for almost half

of all studies in this area. Objective and quantitative metrics, such as physiological measures and academic achievement, were used in 20% of studies, but only if the area being investigated was of a specific type. Given the holistic approach taken in the Personal Knowledge Methodology, there is no specific focus on any single problem or concern. Hence, objective metrics, such as weight loss or academic grades, are not likely to be useful for general assessment purposes. Self-reported measures, on the other hand, offer more promise as evaluation mechanisms. These might consist of standard scales or non-standard scales created to evaluate participant's use of new techniques and tools. When non-standard scales are used, care must be taken since these scales have been found to lead to larger effect sizes than those using physiological and self-reported behaviours.

A major problem in assessing the efficacy and efficiency of different knowledge acquisition techniques is the fact that knowledge is not easy to quantify. Hence, studies in knowledge engineering attempt to use a number of criteria to assess the effectiveness of approaches and techniques. If the knowledge acquired can be represented as rules, then the number of clauses can be counted. If the knowledge is represented as frames, then the number of frames acquired and the degree of inheritance can be counted. If the knowledge is represented using semantic networks, then number of nodes and the number of relationships can be counted. However, even when such quantified metrics can be used, studies still suffer from problems associated with the quantity of experts, the 'gold standards' to compare results against, the range of tasks and domains to cover, and the possible synergistic effects of multiple techniques.

The empirical evaluation of psychological research methods and approaches is very seldom if at all achieved. Indeed, any study that employed research methods to assess research methods is immediately in danger of problems of recursion, in that the methods employed for evaluation would themselves be open to criticisms. Since most research methods pay little attention to practical applications, there is no way of testing approaches pragmatically within interventions. Hence, arguments for one approach or method over others generally involve a mixture of common-sense appeals, listing the many pitfalls of competing methods and justification based on philosophical ideas.

Based on the literature summarised above, it was decided to assess the candidate techniques in this study using a range of methods to gauge the opinions of the participants. Two main methods were used for this: a questionnaire given directly after each technique was assessed, and a feedback interview conducted after all the techniques had been assessed. A mix of both quantitative and qualitative assessment methods was adopted in each. The questionnaire contained a section of open-ended questions and a rating-scale section; the feedback interview contained a section of open-ended questions and a ranking section.

The results from the questionnaire rating-scale items and the rankings from the interview allowed some statistical analyses to be performed, but this was limited due to the low number of participants. The results from the open-ended questions in the questionnaire and interview were analysed in a qualitative fashion (involving identifying key points, classifying these and summarising with examples). This use of multiple assessment methods allowed a triangulation approach to be taken. The results from the two quantitative methods were statistically tested for consistency resulting in a significant correlation. Although there was not enough time for a rigorous examination of the cross-consistency of the results from all four methods, a casual viewing shows that there is a consistency in the ratings, rankings, written and verbal opinions. Although most methods gained a good response from the participants, they were not averse to giving low ratings and negative comments for techniques they did not like. As such, one can probably discount any worries of participants giving high scores or positive opinions just to please the researcher.

Although the focus of the assessment was on providing a comparison between the techniques being assessed, some assessment also took place to compare the novel techniques to standard techniques. The main way was to include a control technique, the Keirsey Temperament Sorter, in a form that was consistent with the other techniques. Although the results demonstrated that this was one of the least preferred of the techniques being assessed, this must be treated with caution since one cannot discount effects of experimenter bias. In other words, even though every effort was made to treat and deliver the control technique in the same way as the other techniques, perhaps some unconscious biases were present. The use of researchers who are unaware of which technique is the control would obviously ameliorate this possible problem. As an additional comparison, a question was included in the

feedback session that asked the participants to compare the techniques to others of a similar nature that they had used or experienced. The results here were very encouraging.

9.2 Future Work

In this final part of the thesis, a plan for future developments of the Personal Knowledge Methodology will be outlined. New technologies that could be explored are suggested, as are other uses of the Personal Knowledge Techniques.

9.2.1 Future Developments

In this section, a plan for developing the Personal Knowledge Methodology is proposed. The plan assumes a sufficient research resource to enable a full version of the methodology to be developed. The resource required would be in the order of three researchers and two software developers working over a number of years. The development is broken down into 4 stages.

Stage 1: The focus of this stage is on an expanded version the main study described in this thesis. At least six of the more favoured techniques from the initial study would be enhanced and facilitated by a specialised set of software tools. An additional three or four techniques would also be included. The techniques would be used in 1-hour long sessions with the participants. As was the case for the initial study, a researcher would be present to facilitate the session. Perhaps certain techniques could be given an extra session, rather than just one. The sessions would involve a much larger pool of participants than in the initial study, and more representative of the population as a whole. A pool of around 200 participants would be appropriate. Two or three variants of each technique would be used. One possibility would be to use variants that differ in how top-down or bottom-up they are. For instance, a top-down approach would make use of pre-defined lists of elements that the participant can select from. It is envisaged that the same kinds of assessment methods are used as in the initial study to capture the participants' opinions of each technique (i.e. post-session questionnaires and a feedback session). Participants would be allowed to make use of the models produced during each session, and possibly models from other participants after the sessions in a longitudinal study. Their use of the models in this way would be monitored using a diary. Analysis of the results of this study would be similar to those

used in the first study and address similar aims. A much clearer idea of how each technique is used, the advantages and disadvantages of each, and differences due to demographic variables would be available.

Stage 2: The focus of this stage is on automating the techniques using specialised software. Modifications identified in the analyses performed in stage 1 would be made to the techniques. The software would be enhanced so that the techniques would be fully computer-based and be understood and usable by the participants. The study would be similar to stage 1, except the researcher's role in each session would be as an observer of the participant's use of the computer-based technique. The post-session questionnaire and feedback session would also be fully computer-based. Some semi-automatic analysis of the results would be made. Problems in the computer-based techniques would be identified.

Stage 3: The focus of this stage is on creating and running trials on a provisional version of the full Personal Knowledge Methodology. Participants would now be considered as users of the software system. A very large population of users, over 1000, would be provided with the software, perhaps by downloading a free version over the Internet. Those users who would like to view the models produced by others would have to agree to have their own models available for analysis and use by others. Precautions would be included for retaining anonymity and sensitive material. Each user would be free to use any of the techniques in any order, being guided by intelligent software based on the participant's demographic details, previous use of techniques and feedback. The software would automatically analyse the use of each technique and the feedback from the participants, and include automatic statistical analyses similar to those used in the initial study. The researchers would modify the guidance software and computer-based techniques in an ongoing manner based on the results obtained.

Stage 4: The focus of this stage is on using and assessing a full version of the Personal Knowledge Methodology. Lessons learnt in stage 3 would be designed into the full system. Ways in which various theories can be selected and tested would be developed.

9.2.2 New and Enhanced Techniques

As covered in the plan, a number of new techniques and technologies would be

included in the methodology alongside the techniques assessed to date. In particular techniques are needed in two areas: (1) techniques that focus more on the capture of tacit knowledge, and (2) techniques that can allow a comparison of an individual's personal knowledge and that individual's behaviour. These techniques might be developed from some of the latest advances in software technology. Use might be made of the following new technologies.

- Use of language-processing and language-generation technologies to provide a conversational element. In this way the user could have a verbal dialogue with the computer. Use of ontologies and knowledge structured by the user would help in the analysis of the user's speech and provide automation in the construction of provisional knowledge models (Cowie & Wilks, 2000).
- Use of speech recognition technology to allow the user to provide self-reports (i.e. a running commentary) of what they are doing as they think about and use the Personal Knowledge Techniques and the information presented.
- Use of physiological monitoring technology to measure key neurobiological indicators to assess emotional reactions as the user interacts with the Personal Knowledge Techniques. Such measures as heart rate, eye movement, blood pressure, breathing rate and even EEG might be used to assess the user's reactions and emotional state to capture subconscious thoughts and feelings (Pleydell-Pearce, Dickson & Whitecross, 2000).
- Use of technology used in research into subliminal perception might enable tacit knowledge to be accessed. For instance, words or images can be flashed on the computer screen at rates that do not allow conscious processing. Hence, only subliminal perception is operating. Evidence from existing research shows that semantic processing can occur for words flashed at rates beyond conscious processing (Draine & Greenwald, 1998).
- Use of the latest technology in ontologies and web-based search and presentation to provide personalised information. Open hypermedia systems present different information in different ways with different hyperlinks depending on the user's personal profile and their current requirements (Lowe & Hall, 1999).
- Use of mobile communication technology to provide off-line prompting using a

random bleep or message. For example, a message “what are you thinking about right now and why?” or “what state are you in right now and why?” could be sent at random times during a person’s day.

- Use of advanced communication technologies (such as video conferencing and emails) combined with information extraction technology to monitor the way the user interacts with others.
- Use of virtual reality technology (Earnshaw, Jones & Vince, 1995) to monitor the user’s reactions as they behave in virtual environments, especially interactions with other (virtual) people.
- Use of agent-based and simulation technologies (Conte & Castelfranchi, 1995) to model elements in a user’s social world (e.g. people, places, possessions) to provide simulation of future possible situations. Discrepancies between the simulation results and the user’s expected behaviour might help prompt for new knowledge. Accurate simulations might aid decision-making.
- Use of genetic algorithm technology (Winter, Periaux & Galan, 1995) to aid users in their creativity and decision-making. For instance, based on typical properties of concepts, various instances of the concept can be presented, the next seed instance being chosen by the user as interesting or accurate. This could be used to evolve profiles of actual or hypothetical concepts, such as people, jobs and lifestyles. Use of genetic algorithms to evolve knowledge models as a type of Personal Knowledge Technique is an intriguing possibility. For example, an aspirations diagram is evolved using typical elements and data on co-occurrence probabilities rather than being constructed from scratch.

9.2.3 Other Uses of the Personal Knowledge Techniques

As the research work proceeded, it became apparent that there may be a number of other uses for Personal Knowledge Techniques outside their use in the Personal Knowledge Methodology. First, there are potential uses for couples such as in relationship counselling and matching potential partners for dating agencies. Second, potential uses within organisations might include team building, training and personal development. The notion of personal knowledge might even be extended by applying an analogy between an individual person and an organisation. In this way, one might

develop Corporate Knowledge Techniques for various business uses. Third, there are many ways in which personal knowledge could mediate the communication between users and between users and researchers. A number of ways are shown in the diagram in Figure 18. In the figure, the box PK represents the personal knowledge of the users who are shown on the left of each box, the researcher being shown on the right.

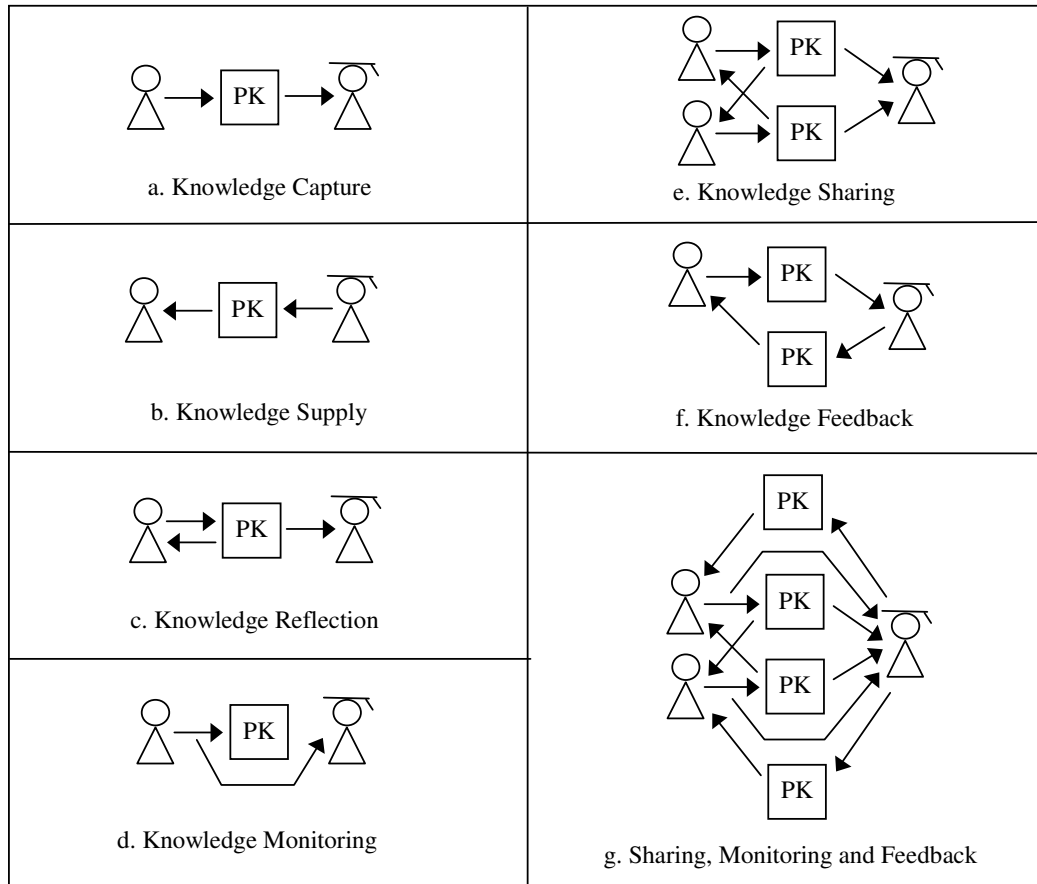


Figure 18: Possible uses of the Personal Knowledge Techniques for communication purposes

9.2.4 Final Thoughts

The research undertaken was relatively ambitious in attempting to assess the utility of applying methods used in the domain of knowledge engineering to the domain of personal knowledge. Creating the design of the Personal Knowledge Methodology was a major step towards this aim, since it provided not only a target for the research, albeit a very ambitious one, but also a framework for guiding the research in the development of the methodology. This helped focus the research on a manageable set of tasks associated with the assessment of various candidates for Personal Knowledge Techniques. One can view the research as a whole as taking two cycles around the

analyse-design-apply-analyse loop of the Personal Knowledge Methodology. The first cycle started by reviewing a wide range of background literature to assess the basic notions behind the Personal Knowledge Methodology and to provide guidance and direction for the empirical work. The pilot study explored and assessed a preliminary set of techniques. This completed the first cycle around the loop. The main study established a second cycle by assessing in a rigorous way the techniques developed from the first cycle. This final chapter has suggested some ideas on how further cycles around the loop might occur. The results, so far, are generally encouraging, and it is hoped that further work might develop the Personal Knowledge Techniques and Personal Knowledge Methodology to be of use for many types of people.

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APPENDIX A: Problems in the Study and Application of Personal Knowledge

As discussed in the first chapter, there are two routes to help, the direct and indirect. The direct route involves the delivery of help directly to those requiring help, whereas the work of researchers can be viewed as being an indirect route towards helping people. This appendix describes three problems with the direct and indirect routes to help that involve personal knowledge. These problems provide opportunities that an expertise-based approach may help to address.

The Bifurcation Problem

The two routes to help, the direct and indirect, treat people in distinct roles. This can be illustrated by following a particular line of enquiry from the perspective of the roles that lay people play. There are two distinct roles, one at the start of an enquiry, the second at its culmination in practical use. At stage one, people act as providers of personal knowledge in experiments and research studies. The knowledge they provide is either acquired directly from the person or is inferred by the researcher from the person's behaviour. At stage two, people are helped in some way by the implementation of theories based on the previously acquired knowledge.

By the very nature of the time and effort involved in developing, disseminating and implementing theoretical knowledge, it can be many years before the knowledge acquired at stage one finds itself being useful at stage two. There are a number of problems here. One problem stems from the fact that people and their social worlds can change significantly in the intervening time between stage one and stage two. Thus, theories can become obsolete if not general enough. On the other hand, if the knowledge gathered at stage one is treated at too general a level, the resulting theories may be too vague to be of any practical use at stage two. A further problem comes from the different professional roles involved between stage one and stage two. Since different professions make use of different conceptualisations and associated terminology, misunderstandings and misinterpretations can occur, such that the information acquired at stage one may become distorted when eventually applied at stage two.

Underpinning some of these problems is the compartmentalisation of professional

roles into theorist and practitioner. The gulf can be so wide between these roles, that within psychology it has led to a bifurcation of the discipline into two separate fields, pure psychology and applied psychology (Middleton & Edwards, 1985). In this view, there is a sequential model operating: the pure psychologist develops and tests theories, which are then used by applied psychologists to address certain problems. Although this sequential model has proved successful for the natural sciences where general, incontrovertible laws can be established, it has led to problems in the realm of personal knowledge. In discussing the application of psychological theories to practice, Duckworth (1981) has made the following comments:

It might be thought that this task involved the straightforward ‘application’ of relevant psychological theories. On the whole, however, existing theories do not immediately lend themselves to being assembled into the broader conceptual frameworks required for problem solving, nor to being amalgamated with other potentially relevant theories. (Duckworth, 1981, p237).

Although there have been calls for theories to be built upon practical reality (Warr, 1987) and which offer co-operative rather than competitive models (Davidson, 1977), most published research from pure psychology still provides no consideration of the practical implementations that might result.

To alleviate these problems, it might be advantageous if the direct and indirect routes acted in a closer unison than at present, such that a tight feedback system is in place (Clarke, 1988). This would mean that the implementation of theories and monitoring of interventions could be used to rapidly adapt theoretical understanding and improve the help provided.

Problems with Research into Personal Knowledge

Alongside problems associated with the lack of unison between research and application, there are a number of problems within each of these areas. Within research into personal knowledge, two opposing camps have formed, each having a mistrust and scepticism for the paradigms and practices of the opposing view. The contrast between the two camps is so great that they have been described as being two different psychologies (Graham, 1986). The two camps are generally characterised as quantitative and qualitative.

The quantitative camp takes its practices from the natural sciences, favouring the hypothetico-deductive approach to examine small aspects of behaviour and experience. The use of controlled experiments, predefined metrics and multivariate statistics is commonplace. Opponents of this view argue that the results of such research lack validity due to the artificial nature of the experiments and that various biases are introduced by the experimenter and experimental environment resulting in conclusions of questionable value (Smith, Harré, & Van Langenhove, 1995).

The qualitative camp takes its practices from linguistics, sociology and the humanities. Researchers acknowledge the multi-faceted reality of experience, treating people as complex, self-reflective entities, inextricably bound to their social and cultural climate. They favour the collection of large corpora of data, usually linguistic, allowing themes and propositions to emerge, and always attempting to eliminate the imposition of their own constructs and biases. Opponents of this approach criticise the flexible, non-rigorous methods, the subjective interpretation of data and the highly contextualised nature of the studies. Thus, they question the rigour, reliability and validity of the findings. In addition, they note that studies are very expensive in resources, particularly the time needed from highly skilled psychologists and highly motivated participants (Miles, 1979).

Although many people conceptualise the quantitative-qualitative divide as the difference between the use of numbers and the use of words, some regard it as being better characterised as being theory-driven versus data-driven (Henwood & Pidgeon, 1992). However, there are differing opinions on this, and at present the jury is still out as to the distinction and commonalities between the two, their relative merits and the ability to integrate methods from the two camps (Hammersley, 1996). What is clear is that qualitative research is still relatively marginal to mainstream psychology and that a more expanded and pluralistic discipline would be beneficial (Smith, 1996). What is also clear is that both camps adopt methods with many problems and pitfalls. An approach that could make use of an integrated set of different methods to mitigate these problems would seem the best way forward. The danger of adopting a single method has been well expressed by psychologist Abraham Maslow: "It is tempting, if the only tool you have is a hammer, to treat everything as if it were a nail" (Maslow, 1966).

Problems with Direct Help that use Personal Knowledge

As mentioned previously, direct help has a number of mechanisms: information, advice, tools and environmental changes. A number of other factors characterise direct help: Does the individual interact with a professional, or are they using self-help material? Is the individual helped singly, or as a member of a group? When self-help material or tools are provided, are they passive or active, i.e. how much reasoning do they expect of the user? How localised and serious (emotionally, behaviourally) are the individual's problems? Is the individual treated as a patient, a consumer, an employee, an addict, a student, or are they in some other role? Is there a stigma or embarrassment felt by the individual to be treated in a particular role?

Depending on the particular person, problem and context involved requires use of the most relevant methods and theoretical background. However, limited resources, especially time from professionals for each case, inevitably leads to trade-offs being made (Dryden & Palmer, 1997). There are additional problems for the professional, many of which have been documented in the case of applied psychologists. The complex and copious range of knowledge, skills, attitudes, and values required of an applied psychologist makes the role an extremely challenging and difficult one (Gale & Chapman, 1984). Before specialising, applied psychologists have almost always taken a scientifically-oriented degree in psychology which can lead them to have oversimplified views of the structures and causality in the complex dynamic situations of real life (Davidson, 1977). The rigid boundaries of academic disciplines and subgroupings, with hostility to other disciplines, is another handicap for the applied psychologist concerned with broad, interdisciplinary subject areas (Heller, 1976). Another problem is the role image of the applied psychologist which can promote unrealistic expectancies of their capabilities to the public (Freyman, 1973) and which can be regarded less favourably than that of a theoretical psychologist (Maslach, 1975). A further problem stems from the importance of having to combine interventions with well-designed evaluations (Howarth, 1980), which can often be impractical and unethical in many real-life situations (Gale & Chapman, 1984).

APPENDIX B: PCPACK Tools

This appendix contains brief descriptions of 6 of the most useful tools contained in PCPACK (version 2.11). The Protocol tool, the Laddering tool, the Repertory Grid tool and the Control Editor tool were all made use of during the empirical studies (as described in chapters 4-7).

Protocol Editor

The Protocol Editor tool is used to analyse transcripts of interviews or any other text-based information, e.g. reports, specifications, or manuals. The aim is to identify the important aspects of the domain, for example, the concepts, attributes, tasks and relationships. The tool simulates the way someone would mark-up a page of text using highlighter pens. Each type of knowledge is associated with a different colour, for example, green for concepts, yellow for attributes. Using this tool, the user can go quickly through a document highlighting the important knowledge elements. If notes and comments are required for pieces of text, then this facility is easily invoked using pop-up cards. Once marked-up, the highlighted elements are committed to a centralised knowledge base so that they are available for use by the other tools in PC-PACK.

Laddering Tool

The Laddering tool enables the user to build various hierarchies of knowledge. PC-PACK provides four basic ladders: a concept ladder, an attribute ladder, a process ladder and a decision ladder. In addition, ladders can be created with user-defined relationships, such as a composition ladder (using the *part of* relationship) and causal ladder (using the *causes* relationship). Examples of ladders constructed with this tool are shown in Figures 3 and 4 (in section 3.1.13). Knowledge elements committed from the Protocol Editor tool are automatically displayed in the appropriate ladder and are easily moved around and re-named to create the ladder structures.

Matrix Tool

The Matrix tool is a way of associating attributes to concepts, as well as entering values. It does this by presenting a matrix of the concepts defined in the concept ladder on the vertical axis and the attributes and values defined in the attribute ladder on the

horizontal axis. A simple clicking operation associates attributes and/or values with the relevant concepts. Since the hierarchical structure of concepts is retained, assignment of attributes and values to concepts can be inherited down the hierarchy (i.e. to all members of a class), saving time and identifying contradictions.

Repertory Grid Tool

This tool provides comprehensive support for performing the four stages of the repertory grid technique described previously. Selecting concepts and attributes to use is a simple matter of dragging nodes from a list taken from the appropriate ladders. There is also support for triadic elicitation should this be needed. A simple clicking operation is used for the rating stage. The cluster analysis and production of the focus grid and dendrograms are fully automated. An example of the type of grid created was shown previously in Figure 6.

Control Editor

Unlike the previous tools that deal essentially with object knowledge, the Control Editor tool is used for acquiring and representing process knowledge, i.e. it is used for building process maps for individual tasks or groups of tasks. In a similar way to a flow chart, this tool has different symbols for tasks, inputs and outputs of tasks, decision points, data flow and control flow. It also has a number of specialised symbols including one for the agent (i.e. person, group, computer) that performs a task. An example of a process map drawn using the Control Editor tool is shown in Figure 8 (section .

A particular important feature of the Control Editor is the way a hierarchy of tasks can be built and displayed. This is achieved by using a kind of 3-dimensional feel, whereby double clicking on a task symbol will reveal a lower-level process map representing how that task is performed. In this way, one can start by modelling a task at a very high level (made up of a few sub-tasks), then double-click on each of these sub-tasks to build the next layer of the task hierarchy. This provides representations that are much clearer to understand than having a single, large 2-dimensional diagram, and allow the knowledge engineer to set the scale (i.e. specificity) of what knowledge is acquired.

Hyperpic Tool

The tools described so far have mostly supported activities such as analysis and codification. The Hyperpic tool allows a much more flexible approach to be taken by allowing a page of information to be created and edited for each knowledge object (e.g. concept, attribute, task) shown in the other PC-PACK tools. The user can enter text or pictures to annotate all that is known about that particular knowledge object. The tool is in a hypertext format, hence words can be highlighted and linked to other pages. This allows web-like knowledge-structures to be constructed that can be based on the hierarchies produced in the Laddering tool.

APPENDIX C: Methods Used in the Pilot Study

Semi-Structured Interview - Method for Pilot Study

The semi-structured interview format meant that a generic set of questions was developed and used for each participant. Questions in the interview were designed to cover three main aspects of knowledge: (1) Life Events, (2) Significant Others and Personal Qualities, and (3) Self-Knowledge. Before the interview session, and as part of the recruitment process, each participant was given the set of questions to look over. The interview was conducted by asking each question in turn and asking supplementary questions where appropriate to clarify and expand on the responses given. The interview was tape-recorded and transcribed in full. Analysis made use of the PC-PACK Protocol Editor tool (as described in Appendix B) to identify concepts, attributes, values and events. A detailed account of this method and how the interview questions were designed is included in chapter 5.

Laddering - Method for Pilot Study

Prior to the session, the concepts, attributes, values and events identified in the interview transcript were arranged into a number of hierarchies using the PC-PACK Laddering tool (as described in Appendix G). The resulting ladders were printed and shown to the participant at the start of the second session. Feedback on the ladders was elicited to correct any mistakes, re-classify, add or delete nodes.

Repertory Grid - Methods for Pilot Study

A number of different types of grids were assessed during the pilot study, differing in the elements used. A ‘self grid’ made use of various aspects of the participant (e.g. *me at 15, the ideal me, me as others see me*) as elements. Constructs (aka attributes) for these were selected from the attributes identified in the interview transcript. A ‘people grid’ took a selection of significant others (e.g. the participant’s parents, siblings, partner) as elements and used constructs identified in the interview transcript. A ‘relationships grid’ used the relationships the participant had with significant others as elements of the grid, with constructs being generated using triadic elicitation during the session. An ‘events grid’ took key events identified in the interview transcript as elements and used constructs generated using triadic elicitation. A ‘decision grid’ took

key decisions identified in the interview transcript as elements and used constructs generated using triadic elicitation. For each type of grid, a very similar method was followed during the session, as described in section 3.1.2.6. The PC-PACK Repertory Grid tool (as described in Appendix G) was used to enter values and create the focus grid. A detailed account of this method is included in chapter 6.

Process Mapping (Event Diagrams) - Method for Pilot Study

The PC-PACK Control Editor tool (as described in Appendix G) was used to facilitate this method. Prior to the session, events identified in the interview transcript were entered as process symbols. Events within a certain phase of the participant's life were included on the same diagram, so that a number of diagrams were produced. The situations before and after an event (e.g. *I lacked confidence, I had more friends*) were identified in the interview transcript and represented using the datastore symbols. Any attributes of an event (e.g. *enjoyable, dreadful*) were also identified and represented using the datastore symbol placed alongside the event symbols. Dataflow arrows were used to connect the situations before and after an event to the appropriate event. Control flow arrows were used to show the order of events. During the session each diagram was used to prompt discussion and modifications and additions to the diagrams were made as appropriately. Although this technique is based on process mapping, it will henceforth be referred to as 'event diagrams' as this is much more descriptive of the method employed and knowledge elicited. A detailed account of this method is included in chapter 7.

Decision Tree - Method for Pilot Study

The participant was asked to think of a key decision in their life, either current or from the not too distant past, which had 3 or 4 alternative courses of action. Using a blank A3 sheet of paper, the decision was added as the top-level node and the courses of action as sub-nodes. For each of the sub-nodes, in turn, the participant was asked to provide 2 or 3 advantages and 2 or 3 disadvantages of taking that course of action. Ticks were places on the arrows representing advantages and crosses were added to represent disadvantages. Each advantage and disadvantage, in turn, was addressed to explore the underlying reasons. For instance, the participant was asked why the advantage was a good thing. The response was noted on the ladder, and the same

questioning technique used on the response repeatedly until the participant's responses became more abstract. These abstractions invariably led to fundamental emotional reactions (e.g. *it makes me feel happy*) or to life goals (e.g. *it would help me be more healthy*). A detailed account of this method is included in chapter 7.

Concept Map of Life Goals - Method for Pilot Study

The method involved the construction of a network diagram on an A3 sheet of paper representing the main goals in the participant's life connected to key concepts with labelled arrows. Initially this was done from scratch, however this was found to cause difficulties in creating nodes. In later session, this method was combined with the decision tree technique, so that the abstract ideas noted at the end of the decision tree were used as starting concepts for the semantic network of life goals. A detailed account of this method is included in chapter 7.

Concept Map of Attitudes - Method for Pilot Study

The method involved the construction of a network diagram on an A3 sheet of paper. The participant was asked to think of a particular aspect of their life and some major concepts associated with this (use of information from the initial interview was used as prompts for this). The participant's attitudes to the concepts were represented using labelled arrows (e.g. *I admire my boss*). Once a number of relationships had been created, these were used as concepts themselves and the participant was asked what their attitude to the original attitude was (e.g. the participant might be asked "what do you feel about the fact that you admire your boss?"). The response (a second-order attitude) were added to the diagram using labelled arrows. The attitudes of significant others were also explored and represented in this way (e.g. *my boss probably doesn't know that I admire her so much*). Where appropriate higher-order relationships (e.g. an attitude concerning an attitude about an attitude) were asked for and represented on the diagram.

State Transition Network - Method for Pilot Study

At the start of the session an explanation of a state transition network was given to the participant using the example of a telephone. The participant was then asked to identify states that they get into, such as emotional states, physical states, behavioural

states, or states of thinking. When a few states had been identified, these were added as nodes on a blank sheet of A3-size paper. Taking each pair of states, in turn, the participant was asked what happens to make them go from one state to the other. The response was added as a label on an arrow connecting the two states. This was repeated until all possible states and transitions had been identified and represented. A detailed account of this method is included in chapter 7.

Interview Review - Method for Pilot Study

Towards the end of the pilot study (about 12 months since the start), the interview transcript from the initial interview was given to the participant to read through and make marks or comments in the margin of their reactions when reading. A short subsequent session took place to address and clarify their comments and gain feedback. A detailed account of this method is included in chapter 5.

APPENDIX D: Post-Session Questionnaire

Firstly, can I thank you very much for taking part in the interview. To gain some feedback on what you thought of the interview, I would be most grateful if you could fill in this short questionnaire. If you would rather not, then that's fine.

What were your general impressions of the session? (2-3 adjectives, please)

What was good (if anything) about the session?

What was poor about the session? How can this be rectified?

Did any of the questions, or topics covered, make you think about things you hadn't (consciously) thought of before? Did any come close to helping promote a greater understanding of yourself? (Which ones and how?)

How willing would you be to take part in a further session?

Could you please circle the appropriate number from 1 to 7 for each of the questions below.

1. How interesting was the session?

1.....2.....3.....4.....5.....6.....7
Not Very
interesting interesting

2. How thought-provoking was the session?

1.....2.....3.....4.....5.....6.....7
Not Very
thought-provoking thought-provoking

3. How enlightening was the session, i.e. did it help reveal things that you hadn't consciously thought before?

1.....2.....3.....4.....5.....6.....7
Not Very
enlightening enlightening

4. How demanding / difficult did you find the session?

1.....2.....3.....4.....5.....6.....7
Not Very
demanding demanding

5. How open were you in describing very personal matters?

1.....2.....3.....4.....5.....6.....7
Not open Very open

6. How much would you recommend that other people do the session?

1.....2.....3.....4.....5.....6.....7
No High
recommendation recommendation

APPENDIX E: Information for the Interview Review

Please find attached the transcript of the first interview we had a few months ago. The final technique I would like to assess, involves you reading the interview and doing two things:-

1. As you read, to place comments in the right-hand margin to show what you think of what was said.
2. At the end of reading, to fill-in a questionnaire (see attached forms) to assess what you think of this "interview review" technique.

When you place comments in the margin of the interview transcript, I would be grateful if you could use the following symbols:-

- An **exclamation mark** to mean that you are surprised by what you said
- A **tick** to mean that you very much agree with what you said
- A **cross** to mean that you have changed your mind, and now disagree with what you said
- An **asterisk** to mean that what you said has revealed something interesting to you
- A **question mark** to mean that you don't know why you said what you said

You needn't place symbols after every statement, but a few per page would be appreciated.

Note, at some places in the transcript, you will see (?) or (??). This means that this part of the interview tape was inaudible and could not be transcribed.

Thank you.

APPENDIX F: Agenda & Materials for the Feedback Session

A final session of 90 minutes takes place with each participant to gain further feedback. The following agenda is covered:

(A) The format and goals of the session are explained, including a re-cap of the aims and objectives of the research (5 minutes). Stress will be placed on assessment of each techniques from the perspectives of the following:-

1. The process of knowledge acquisition (i.e. the time during the session)
2. The results of the knowledge acquisition (e.g. the transcripts, diagrams, grids).

The participant completes the post-study questionnaire. This is compared to the pre-study questionnaire. Any notable changes are highlighted and examined.

(B) A review of each of the 8 techniques is made (9 minutes each), using the post-session questionnaires as reference. For each technique, the aim is to elicit the participant's opinion on the following:

B1. How beneficial was the session?

What was revealed? How was it revealed?

What was useful?

What possibilities for change (active/passive) are there?

- At work e.g. job satisfaction, performance, opportunities
- At home

B2. How effectively and efficiently did the technique capture the participant's personal knowledge?

What was the percentage captured? What was missed?

What might the uses be of the knowledge captured?

- To the participant?
- For people at work (managers, HR)?
- For people outside work?

B3. What can be improved in the technique to make it more effective & useful?

(C) The following overall issues are to be addressed (15 minutes):

C1. How do the techniques rank in terms of their perceived usefulness? Would this be different at other times in life?

C2. Which techniques are most suited to automatic presentation using a computer? Do you need someone else there?

C3. How do other techniques known to the participant compare? (e.g. 360 degree appraisals, Belbin, Myers-Briggs, SWOT analysis)

C4. Would the participant be interested in using any of the techniques in the future? How and why?

C5. What was the overall impression of the project? (strengths, weaknesses, improvements?)

Materials Required for the Feedback Session

Printouts of documents:

- Summary table of information from the post-session questionnaires
- Keirsey answer summary sheets and relevant portraits

Diagrams created in the sessions:

- State Transition Network
- Decision Ladder
- Aspirations Network

Printouts from PCPACK:

- People Grid (Repertory Grid Tool)
- Events/Periods Grid (Repertory Grid Tool)

- Event Diagrams (Control Editor Tool)

Questionnaires:

- Pre-Study Questionnaire (filled-in)
- Post- Study Questionnaire (blank - to be filled in during the session)

APPENDIX G: Interview Material for the Main Study

Instructions & Consent Form

Thank you for showing an interest in taking part in this study. As you know, the study involves 8 interview sessions, one per month for the next 8 months. The first session is an interview lasting between about 60 and 90 minutes in which I will be asking some fairly personal questions. The interview will be tape recorded so that I can analyse what was said later. The results of the interviews will be used as part of my PhD which is attempting to create a computerised system which can aid people in understanding more about themselves and so help them to make better decisions.

Please note that all interview sessions are **strictly anonymous**, and no one other than myself will know who took part. No direct quotations will ever appear in any reports or presentations. If any information you give is used in a report or presentations, all information that could identify you to anyone else will be removed or altered to protect your anonymity.

All the information you give is **voluntary**, and if there are any questions which you do not feel happy about answering, please say so and we will move on to the next question. If at any time you would like to halt the interview then please feel free to do so. Any report based on the findings of this study will not identify individuals.

Should you agree to take part I request you to please answer the questions as openly and honestly as you can. There are no right or wrong answers. I need **YOUR** views.

The questions that I will be asking are shown on the attached sheets. Before agreeing to take part in the study, could you please look through them. If you feel that there are any subjects covered which may upset you, or which may later cause you to regret talking about, then **please do NOT agree to take part**. (If you do take part, and subsequently would like to seek help for any problems, then a list of contact information is shown on the page 4 of this document).

It would be greatly appreciated if you could spend some time thinking about the questions before the interview, since this is likely to provide me with more considered information. However, this is not essential.

If you would like to take part in the study, please sign and date the form below.

CONSENT FORM

This study has been explained to me to my satisfaction, and I agree to take part.

I understand that I am free to withdraw at any time.

NAME: DATE:

Interview Questions for Session One

A. Introduction

A1: Firstly, do you feel “yourself ” today - in any particular mood?

A2: Did you have a look at the questions I gave you? Did you spend any time thinking about them? Are there any that you’d rather me not ask?

A3: Now I need a few details about you. Your age? Your marital status? A brief description of your education and qualifications? Your position within the company? How long have you been at RR? Have you any main hobbies or interests?

A4: Before we start, are there any questions that you’d like to ask me?

B. Life Events

- B1: Firstly, I'd like you to give me a very brief description of your life so far. Just the major events.
- B2: Now, I'd like you to choose one of these events, and describe how you think it may have changed you.
- B3: During the time you've been working for RR, what events have shaped your career within the company?

C. Significant Others and Personal Qualities

- C1: How do you think you are similar and different to your parents? What effects, generally, do you think a person's parents have on them?
- C3: What expectations do you think people have of you? (e.g. parents, partner, close friends, boss, work colleagues).
- C4: What expectations do you have of yourself?
- C5: What qualities do you admire in people? Which of these qualities do you think you have? And which qualities would you like to have? How might this happen?
- C6: How do people try to change the people they know?

D. Self-Knowledge

- D1: I'd like you to think of yourself as if you were another person, and tell me as honestly as possible what this person is like and what you think of this person.
- D2: Do you think there are things that no one can really know about themselves?

D3: During your life, what have you discovered about yourself? How did this happen?

D4: If you knew more about yourself (the reasons for your moods, behaviours, etc.), how might this affect you? Do you think it might help you in any way?

Contact Information

If you have problems relating to any aspect of your life, then there are various people you can turn to:-

- Your supervisor or manager
- A member of Human Resources
- The company counselling service
- Your family doctor
- A priest, chaplain or other religious representative
- The Samaritans - (01332) 364 444 or 0845 790 9090

APPENDIX H: Responses to the Semi-Structured Interview

This appendix contains an analysis of the responses to the semi-structured interview described in the first part of chapter 5. Each heading denotes the question that was asked. For each question, the response categories are shown in the order of occurrence, i.e. those shown first were those mentioned by the most participants. A number of quotes taken from the interview transcripts have been included to illustrate the general categories.

I'd like you give me a very brief description of your life so far. Just the major events.

Analysis revealed six categories of events that participants described as part of their life story. First, events associated with **starting, ending or attending a place of education**, such as “left school at 16”, “doing my A-levels”, and “got a place at university”. Second, events associated with **starting, ending or moving job**, such as “I had a promotion”, “I was made redundant” and “I left the laboratory”. Third, events associated with **births**, such as “had our first child” and “my daughter was born in 1985”. Fourth, events associated with **deaths**, such as “my father dying” and “death of my grandparents”. Fifth, events associated with **marriages**, such as “getting engaged” and “I got married 3 weeks later”. Sixth, events associated with **separation and divorce**, such as “breaking up with ‘J’” and “I split with him”.

I'd like you to choose one of these events, and describe how you think it may have changed you.

Analysis revealed five categories of events that participants discussed concerning changes that had occurred. First, events associated with **relationships**, such as “my parents splitting up” and “my first marriage and separation”. Second events associated with **births**, such as “having a baby” and “the birth of my son”. Third, events associated with **illnesses**, such as “having bulimia” and “my mother’s illness”. Fourth, events associated with **education and career**, such as “getting very good O-level results” and “getting promoted”. Fifth, events associated with **deaths**, such as “my dad dying” and “a close friend of the family died”.

In examining the way in which such events had changed the participant, analysis revealed eight main categories. First, a change in **perspective, priorities and goals**,

such as “I modified my ambitions”, “I developed this enormous desire to win” and “I knew what I wanted; I wanted a family”. This category was particularly associated with events concerning the death of a parent or close friend, resulting in changes such as “it almost forces you to grow up a bit”, “a kind of re-prioritisation and emphasis” and “it’s changed my perception of how I fit into the world”. Second, a change in **traits**, such as an increase or decrease in independence, becoming less sociable, becoming less or more happy, a loss of confidence, and an increase in maturity. Third, a change in **attitudes to relationships**, such as “it made me more cynical about relationships”, “I’m more aware of people’s feelings” and “I find it’s very difficult to get attached to people”. Fourth, a change in **attitudes to a specific relationship**, such as “it made my relationship with my son extremely special”, “it taught me the difference between my parents” and “it caused a lot of resentment towards my wife”. Fifth, changes associated with **having a baby**, such as “realising how strong your feelings are for them”, “your life’s got to have some structure to it” and “it removed any vestiges of selfishness”. Sixth, a change in **experience**, such as “it taught me a lot about people and how to manage” and “I’ve learnt a lot more about myself”. Seventh a change in **thinking**, such as “it caused me to think about myself a lot” and “you start thinking more about what you’re doing all the time”. Eighth, an increase or decrease in **worries/fears**, such as “I stopped being worried about things that used to worry me” and “I’m now very wary of going anywhere on my own”.

During the time you’ve been working for Rolls-Royce, what events have shaped your career within the company?

Analysis yielded three major categories within the responses: **events**, the **causes of events** and the **outcomes of events**. However, classification of items into the latter two categories was difficult since often a train of events was described such that the outcomes of one event contributed to the causes of a subsequent event.

Analysis of the types of events described identified three main categories. First, events associated with a **change in job**, such as “I moved from a technical specialist to a professional” and “I moved from training to HR”. Second, events associated with **courses and qualifications**, such as “being sponsored to do a PhD” and “a Women’s Development course”. Third, events that led to a promotion associated with an exposure to high-level management, such as “giving a 5 minute talk or presentation or

discussion with a senior manager” and “organising an equal opportunities event”.

A combined analysis of the **causes of events** and the **outcomes of events** yielded seven categories. First, causes associated with **motivation and interests**, such as “I wanted to end up working in this department” and “I used to preach the gospel about the need for working in teams”. Second, causes associated with **giving a good impression to management**, such as “I did some work for someone... he had to go out to Germany and he chose me to go with him”. Third, causes associated with **assertiveness**, such as “when I’ve done something about it, rather than just let it happen”. Fourth, causes associated with **redundancies**, such as “I got in touch with another company and arranged my own transfer”. Fifth, causes associated with **acquiring knowledge**, such as “I gather as much as I can for my own purposes”. Sixth, causes associated with **one’s manager**, such as “I got on very well with the manager”. Seventh, causes associated with **drifting**, such as “I gradually drifted into a situation”.

How do you think you are similar or different to your parents?

Analysis revealed five categories of the ways in which participants compared themselves to their parents. First, a comparison associated with simple **trait descriptions**. The most widely mentioned trait was concerned with quietness and sociability, such as “quiet”, “reserved”, “chatty” and “craves company”. Other traits included, intelligence, rationality, honesty, motivation to work hard, arrogance and helpfulness. Second, a comparison associated with **perspective on life**, such as “broad-minded”, “down-to-earth”, “a pessimist” and “doesn't get caught up in petty things”. Third, a comparison associated with **emotion-related aspects**, which included emotional reactions (such as “got a real temper”, “highly strung”, and “laid back”) and level of emotions (such as “sensitive”, “doesn’t like people to be upset” and “doesn’t show his emotions”). Fourth, a comparison made by many participants with children was associated with **child-rearing practices**, such as “I’m a lot more relaxed with my children”, “I tend to be there much more for them”, and “my parents never took any interest in my education”. Fifth, a comparison associated with **interests**, such as “enjoys doing creative things”, “likes her cats and dogs” and “interested in things like nature and gardening”. Sixth, a comparison associated with **behaviours and decision-making**, such as “putting things off”, “in control of

everything” and “likes taking risks”. Seventh, a comparison associated with **motivation**, such as “always trying to improve herself”, “the achiever in the family” and “as long he’s comfortable, that’s it”. Ninth, a comparison associated with **opportunities**, such as “they didn’t have the opportunities I’ve had” and “they didn’t have the education that I have”. Ninth, a comparison associated with **roles**, such as “they were much more traditional in terms of man and wife” and “they were definitely a couple, and they had their roles in life”.

What effects generally do you think a person’s parents have on them?

In reflecting upon the effect of parents, many participants noted that parents have a large effect, whilst a smaller number suggested they had some effect. A number discussed the idea that children either follow or rebel against their parents, but either way they have a large effect. A number proposed that the effect was more complex and situation-dependent, such as “it does depend on the combination of parents and the child” and “obviously it varies from person to person, and family to family”.

Further analysis revealed four main categories of the ways in which people are affected by their parents. First, **morals and values** are affected, such as “they provide you with a set of values” and “they’re a conscience”. Second, **behaviours** are affected, such as “you can hear yourself saying things that your mother used to say” and “an awful lot of my habits and mannerisms I’ve picked up from my parents”. Third, **attitudes and perspective** are affected, such as “they definitely shape the way you view the world” and “the primary influence is on your attitudes and how you feel about yourself”. Fourth, **everything** is affected, such as “you’re a total reflection of your parents” and “they shape you into the people that you are”.

Analysis also revealed the mechanisms that were suggested to account for how children are affected by parents. Three main categories were identified. First, aspects of the **family environment**, such as “the environment I was in, and the way I was brought up” and “stability” and “a close family”. Second, aspects of the **parent’s behaviour**, such as “the way they respond to things”, “you do imitate them” and “by what I saw them do”. A further idea mentioned by a number of participants was how the effect of parents alters as the child grows. Some believed a particular age-related change in effect, especially how teenagers rebel and become more independent. Others noted a progressive change over the life course.

What expectations do you think people have of you? (e.g. parents, partner, close friends, boss, work colleagues).

Analysis revealed two main, and overlapping, categories of expectations from parents. First, expectations associated with **success** of their child, such as “to be successful in my career” and “my parents have always said that I can achieve a lot”. Second, expectations associated with **feeling proud** of their child, such as “mum and dad are very proud of me” and “whatever I do, my mum is so proud of me”.

Analysis revealed four main categories of expectations from partner and close friends. First, expectations associated with **morality**, such as “to behave”, “to keep the marriage vows” and “to be a nice person”. Second, expectations associated with being a **source of knowledge and advice**, such as “to provide a bit of common sense” and “a source of support and advice”. Third, expectations associated with **the relationship**, such as “to be there for them” and “to stop phoning them up and asking them to come and help me out”. Fourth, expectations associated with **achievement**, such as “to work hard” and “somebody that will always deliver”.

Analysis revealed four main categories of expectations from boss and work colleagues. First, expectations associated with **delivering**, such as “to deliver the things that I commit to” and “to keep coming up with the goods”. Second, expectations associated with **doing a good job**, such as “do the job to the best of my ability” and “a good standard of work”. Third, expectations associated with **doing more than the job entails**, such as “do a bit more than I’m asked to do” and “to think a bit for myself”. Fourth, expectations associated with **time-keeping**, such as “to come in on time” and “to be here when I should be here”.

What expectations do you have of yourself?

Analysis revealed five categories of expectations of oneself. First, expectations of **success in everything**, such as “to do the best I can” and “I want to make an impact”. Second, expectations of **happiness**, such as “being happy and content in what I do” and “having a happy environment in peaceful surroundings and a calming environment”. Third, expectations of being **honest, fair and nice**, such as “I just try to lead an honest and truthful life” and “to do the right thing”. Fourth, expectations of

progressing professionally, such as “to progress within the company” and “to continue to grow professionally”. Fifth, expectations of being **liked, recognised & respected**, such as “to continue to be trusted by individuals in the organisation” and “probably everybody likes to be liked”.

What qualities do you admire in people? What qualities would you like to have? How might this happen?

Analysis revealed nine categories of the qualities participants admired in others. First, admiration of other’s **tenacity and ability to cope**, such as “determination to succeed against all odds” and “getting through in the face of adversity”. Second, admiration of other’s **kindness, compassion and helpfulness**, such as “caring” and “friendly”. Third, admiration of other’s **social and relationship skills**, such as “an ability to listen” and “have an awareness and understanding of people”. Fourth, admiration of other’s **intellect**, such as “sharp-minded” and “intelligence, and use of it, rather than squandering it”. Fifth, admiration of other’s **balance**, such as “can run things concurrently” and “being realistic about how much to offer people”. Sixth, admiration of other’s **honesty**, such as “sincere” and “truthful”. Seventh, admiration of other’s **achievements and ability to achieve**, such as “people that have caused improvements” and “doing your best at everything”. Eighth, admiration of other’s **ability to be natural**, such as “genuine” and “manages to be themselves all the time”. Ninth, admiration of other’s **motivation and energy level**, such as “get up and go” and “vision of what he wanted to do, the drive to achieve it”.

Further analysis revealed six categories of the ways in which participants thought they might change to acquire the qualities they admired in others. First, change via **self-monitoring and self-control**, such as “reminding yourself and keeping it in the back of your mind” and “try to stop myself when I start worrying and chewing things over”. Second, change via **courses and techniques**, such as “training course” and “Presentation Skills course”. Third, change via **observing admired people**, such as “watching how people behave in situations”. Fourth, change via **experiences**, such as “through real experience”. Fifth, change via **a change in circumstances**, such as “if my circumstances change”. Sixth, change via **trying**, such as “you can try and be less agitated about things”.

How do people try to change the people they know?

Before answering this question, many participants voiced attitudes to the subject of the question. Analysis revealed these attitudes fell into a number of categories of answers: people can't change somebody else; people can change somebody else; people shouldn't try to change somebody else; people should try to change somebody else; people should try to change somebody else if it's positive; people should try to change somebody else if it's wanted; people do change others, but in unpredictable ways; people do change others in a conscious manner; people do change others but not consciously.

Analysis of the direct answers to the questions revealed three high-level categories of the ways in which people try to change the people they know. First, people change others using **verbal** means. This includes openly talking (e.g. "reasoning", "persuasion", "in very straight, honest ways"), aggression (e.g. "shouting" and "threats"), subtle ways (e.g. "hint dropping" and "cajoling"), and other ways such as use of "blame", "blackmail", "discipline", "the way they speak to them", "constructive criticism", "they can lie", and "with humour". Second, people change others using **behavioural** means. This includes negative behaviours (e.g. "tantrum-like situations", "manoeuvring", "withdrawing friendship" and "being unpleasant"), leading by example (e.g. "role models and mentors" and "showing them by example") and other means such as "they act as if the person is the type of person they want them to be" and "people consistently act in anticipation of the other person responding in a particular way". Third, people change others using **non-specific** means which could include both verbal and behavioural aspects. As with the first two categories, these generally fall into positive and negative means. Positive means include encouragement, moulding, influence, rewarding, by sending them on special courses and somebody believing in you. Negative means include manipulation (which was mentioned by a number of participants), force and bullying. More neutral means included reinforcement and self-fulfilling prophecy (i.e. behaving in the way they would like you to be).

I'd like you to think of yourself as if you were another person looking from

outside at yourself. What sort of person does this other person think you are?

Analysis revealed 11 main categories of the ways in which people described

themselves from another person's perspective.

First, descriptions associated with being **helpful and caring**, such as “always willing to help somebody”, “a bit too nice” and “selfish”. Second, descriptions associated with **sociability**, such as “difficult to get to know”, “gives the impression of being socially confident” and “opened up a lot more over the time”. Third, descriptions associated with **assertiveness**, such as “prone to let people walk all over me”, “a softy” and “bossy”. Fourth, descriptions associated with **abilities**, such as “can't handle sudden change”, “good at listening” and “respected for my knowledge”. Fifth, descriptions associated with **behaviours**, such as “smokes too much”, “have some of the silly habits” and “won't admit my failures”. Sixth, descriptions associated with **worries**, such as “someone who worries in case she upsets anybody” and “someone who worries about her job and making sure it's done right”. Seventh, descriptions associated with having a **temper**, such as “quite quick to lose my temper” and “calm”. Eighth, descriptions associated with **motivation**, such as “hard working” and “too conscientious”. Ninth, descriptions associated with **relationships**, such as “reactive to people” and “annoying”. Tenth, descriptions associated with being **conventional**, such as “weird” and “resist lots of things”. Eleventh, descriptions associated with **honesty**, such as “honest with myself” and “someone you can trust”.

Do you think there are things that no one can really know about themselves?

Most people were in agreement that there was knowledge that one can never really know about oneself. However, some people did not know if there was or was not. Analysis identified six categories of knowledge that participants thought could not be known by people. First, **knowledge of the future**, such as how one would behave in a new or novel situation, what one will learn from future events, and what you are destined to do and discover. Second, **knowledge of the past**, such as how things might have been and how a person has specifically been affected by events. Third, **how one is perceived by others**, such as “you don't really know other people's opinions of you”, “you never really know how you come across to other people” and “I find it difficult to take another person's viewpoint”. Fourth, **unconscious motives and drivers**, such as “attributing causes to things” and “you can't ever know what made you think this or think that”. Fifth, **knowledge of things one does not want to know**, such as “things that a person refuses to know about themselves” and “people

end up knowing as much about themselves as they really want to know”. Sixth, **hidden or inexplicable knowledge**, such as “some things can be hidden quite deep” and “maybe it’s something I always knew and just never put into words”.

In addressing this question, a number of methods were also discussed of how one came to know about knowledge that was previously unknown. This included feedback and discussion with others, learning from experiences and self-analysis. A number of models of the self were also put forward to explain a lack of certain knowledge about the self. First, there was a **depth model** in which knowledge is viewed as being at varying depths, and the deeper the knowledge the harder it is to know about. Second, there was a **multiple facets model**, such that people have a number of facets, which means they think and behave differently in different situations. Third, there was a **constant change model** in which one is continually discovering knowledge about oneself and that there is always something new to learn about oneself.

During your life, what have you discovered about yourself? How did this happen?

The analysis identified ten categories of things that people had discovered about themselves. First, discoveries concerning **personality traits**, such as discovering that one is “aggressive”, “probably cleverer than a lot of people” and “I have more personal inner strength”. Second, discoveries concerning **behaviours**, such as discovering “what things not to do to upset people”, “I can be too wrapped-up in everybody attending to me” and “when I left [him] I did do it for me as well”. Third, discoveries concerning **reactions**, such as discovering “why I react in a particular way” and “I react much more than I plan”. Fourth, discoveries concerning **coping**, such as discovering “that I could cope”, “how to cope” and “I can handle most things”. Fifth, discoveries concerning **emotions**, such as discovering “I am more emotional than I thought I was” and “I have really strong feelings for my children”. Sixth, discoveries concerning **like, dislikes, needs and goals**, such as discovering “I enjoy making myself accessible”, “I don’t like being on my own” and “I have a ‘need to be needed’”. Seventh, discoveries concerning **relationships**, such as discovering “I don’t get on well with men” and “how much I rely on my friends”. Eighth, discoveries concerning **abilities**, such as discovering “I can combine being a mother and work”, “how to deal with people” and “realising what you can and can’t do”. Ninth,

discoveries concerning **psycho-physical** aspects, such as discovering “I have bad PMT” and “what it’s like to be really stressed”. Tenth, discoveries concerning **other people**, such as discovering “men and women don’t think the same”, “other people were different to me” and “people see me differently to how I see myself”.

The analysis identified five categories of the ways in which such discoveries were made. First, making discoveries via **conversations**, such as “talking to other people”, “from what people tell you” and “when someone points something out to you”. Second, making discoveries via **specific events or experiences**, such as “when my uncle died”, “when I went to university” and “being put in situations and how you’ve behaved in those situations”. Third, making discoveries via **thinking**, such as “when I’m walking along I’ll think about things”, “challenging yourself” and “really trying to face up to it however painful it is”. Fourth, making discoveries via **special courses and techniques**, such as “360 degree appraisals” and “women’s development course”. Fifth, making discoveries **over time**, such as “it took me a long time to realise..”, “I finally twigged” and “the whole life story is a discovery thing”.

If you knew more about yourself (the reasons for your moods, behaviours, etc.), how might this affect you? Do you think it might help you in any way?

Most participants were of the opinion that knowing more about oneself would be useful, with some believing there are advantages and disadvantages. A small number thought it would not be helpful to know about oneself.

Analysis revealed six main categories of how more knowledge would be beneficial, although there was some overlap and fuzziness in the categories. First, more knowledge would help in **recognition and change**, such as “if you can recognise that you’re actually performing that behaviour, and you know a way of getting out of it, then it can influence the way you behave”, “it would snap you out of that mode of behaviour that you’re in” and “I’d probably have more control”. Second, more knowledge would help in **dealing with difficulties**, such as “I’d probably handle things better” and “the more you understand about yourself or about the human condition generally, the easier it is to cope with someone being unpleasant or difficult”. Third, more knowledge would be help in a **general** sense, such as “wisdom comes from learning more” and “it might make certain things easier”. Fourth, more knowledge would help in **understanding other people**, such as “know how my

behaviour and actions affected others”. Fifth, more knowledge would help in **decision-making and planning**, such as “you're able to make decisions better”. Sixth, more knowledge would help to increase **motivation and confidence**, such as “I'd like to be able to know which sort of buttons to push within myself”.

In analysing how an increased knowledge of oneself would not be helpful, and may be detrimental, three categories were identified. First, even if you had more knowledge it would be **useless if you couldn't change**, such as “you can only prevent certain things” and “you can't change a personality - maybe some people can”. Second, more knowledge may lead to one becoming **too analytical or concerned**, such as “maybe you'd become too analytical about things” and “it might make you constantly think about your every move”. Third, more knowledge may **reveal bad thoughts**, such as “an individual protects themselves by only looking at those things they want to see” and “it's often bad to unbottle things without a way of getting rid of them afterwards”.

If you had more of an understanding of other people, how might this affect you? Would it be better than knowing more about yourself?

Analysis identified 6 categories of the effects of more understanding of other people. In brief, these categories were better relationships, better communication, better work performance, better support for people, more sympathy/empathy and the ability to handle people better.

In addressing the issue of whether more knowledge of others would be better than having more knowledge of oneself, participant's responses were spread evenly across three categories of answers. First, more knowledge of oneself would be better. Second, more knowledge of others would be better. Third, it is situation-dependent, such as knowing more about oneself is better for “your own personal goals” and understanding others is better for “career advancement”.

APPENDIX J: Keirsey Temperament Types

There are 16 Keirsey Temperament types, each defined by four dimensions. The following table shows the four dimension and the personality traits of those people who score highly on each pole of the dimensions.

Dimension	One pole	Other pole
Extrovert - Introvert	People scoring high on the <u>extrovert</u> dimension are: <ul style="list-style-type: none"> • Energised by other people • Happy to socialise • Talkative 	People scoring high on the <u>introvert</u> dimension are: <ul style="list-style-type: none"> • Private • Reserved • Good listeners
Sensing – Intuition	People scoring high on the <u>sensing</u> dimension are: <ul style="list-style-type: none"> • Down to earth • Observant • Factual 	People scoring high on the <u>intuition</u> dimension are: <ul style="list-style-type: none"> • Imaginative • Introspective • Interested in fantasy
Thinking – Feeling	People scoring high on the <u>thinking</u> dimension are: <ul style="list-style-type: none"> • Logical • Frank • Tough-minded 	People scoring high on the <u>feeling</u> dimension are: <ul style="list-style-type: none"> • Sentimental • Warm • Tender-hearted
Judgement - Perception	People scoring high on the <u>judgement</u> dimension are: <ul style="list-style-type: none"> • Ordered • Routinized • Serious 	People scoring high on the <u>perception</u> dimension are: <ul style="list-style-type: none"> • Spontaneous • Whimsical • Easy-going

Once a person has been defined along the four dimensions, they can be classified into one (or more) of 16 personality types that fall into 4 main classes. These are shown in the following table.

Main Types	Types	High scores that define the temperament types			
Guardians	Inspectors	Introvert	Sensing	Thinking	Judgement
	Protectors	Introvert	Sensing	Feeling	Judgement
	Supervisors	Extrovert	Sensing	Thinking	Judgement
	Providers	Extrovert	Sensing	Feeling	Judgement
Artisans	Crafters	Introvert	Sensing	Thinking	Perception
	Composers	Introvert	Sensing	Feeling	Perception

	Promoters	Extrovert	Sensing	Thinking	Perception
	Performers	Extrovert	Sensing	Feeling	Perception
Idealists	Counselors	Introvert	Intuition	Feeling	Judgement
	Healers	Introvert	Intuition	Feeling	Perception
	Teachers	Extrovert	Intuition	Feeling	Judgement
	Champions	Extrovert	Intuition	Feeling	Perception
Rationals	Architects	Introvert	Intuition	Thinking	Perception
	Masterminds	Introvert	Intuition	Thinking	Judgement
	Inventors	Extrovert	Intuition	Thinking	Perception
	Fieldmarshals	Extrovert	Intuition	Thinking	Judgement

APPENDIX K: Effect of Demographic Variables on Ratings

As described in section 8.1.3, a number of statistical tests were performed on the ratings from the post-session questionnaires to examine any effects of demographic variables. First, the effects of gender, age and qualifications were examined. To do this, t-tests were performed on all the ratings on the key items in the questionnaire (*interesting*, *thought-provoking*, *enlightening* and *recommendation*). This revealed two significant results. First, **female** participants' ratings of these items (mean=5.468) were significantly higher ($t=3.546$, $df=314$) than male participants' ratings (mean=4.948). Second, **non-graduates**' ratings of these items (mean=5.516) were significantly higher ($t=3.546$, $df=314$) than graduates ratings (mean=4.917). These results can be understood in two ways. First, females and non-graduates preferred the techniques more than did males and graduates. Second, females and non-graduates tended to provide a higher rating than did males and graduates for a similar opinion, i.e. they used the scales in different ways. Since either of these may be true, a set of normalised ratings was calculated for gender and qualifications so that the overall mean values were equal, i.e. females' ratings were each decreased (by 0.5198) to give the same overall mean as males' ratings, and non-graduates' ratings were each decreased (by 0.5595) to give the same overall mean as graduates' ratings. The use of these normalised ratings is described in the following sections.

Effect of Gender

Of the 10 participants in the main study, 4 were female and 6 were male. To examine the effect of gender in more detail, the ratings from these two populations were compared on each questionnaire item, and a combined average of all key items, for each technique. This was performed for both the actual scores and those that were normalised (as described above). Table J1 displays the significant findings of the t-tests that were performed. As shown in the table, the **people grid** technique was more favoured by females, although the differences for particular items proved non-significant when the data were normalised. The **events/periods grid** technique was also more favoured by females (on a group score of all key items), which remained significant after normalisation. There were no preferences for males more than females using the actual data, but after normalisation, males' ratings of the **aspirations technique** were significantly higher than females' ratings on a number of items.

Technique	Item	Significant differences due to gender (actual ratings)	Significant differences due to gender (normalised ratings)
People grid	All key items	Females more than males (means=6.125 & 5.0, $t=3.81$, $df=38$, $p<0.05$).	Females more than males (means=5.605 & 5.0, $t=2.05$, $df=38$, $p<0.05$).
Events/periods grid	All key items	Females more than males (means=5.375 & 3.958, $t=3.17$, $df=38$, $p<0.05$).	Females more than males (means=4.855 & 3.958, $t=2.01$, $df=38$, $p<0.05$).
Aspirations technique	All key items	No difference	Males more than females (means=5.583 & 4.543, $t=3.71$, $df=38$, $p<0.05$).
People grid	<i>thought-provoking</i>	Females more than males (means=6.5 & 5.0, $t=2.48$, $df=8$, $p<0.05$)	No difference
People grid	<i>demanding / difficult</i>	Females more than males (means=4.5 & 2.33, $t=3.77$, $df=8$, $p<0.05$)	No difference
People grid	<i>Recommendation</i>	Females more than males (means=6.0 & 5.17, $t=2.17$, $df=8$, $p<0.05$)	No difference
Aspirations technique	<i>Interesting</i>	No difference	Males more than females (means=5.667 & 4.80, $t=2.85$, $df=8$, $p<0.05$)
Aspirations technique	<i>Openness</i>	No difference	Males more than females (means=6.667 & 5.730, $t=2.84$, $df=8$, $p<0.05$)
Aspirations technique	<i>Recommendation</i>	No difference	Males more than females (means=6.0 & 4.980, $t=2.57$, $df=8$, $p<0.05$)

Table J1: Statistically significant results in questionnaire ratings based on differences in gender

Effect of Age

Of the 10 participants in the main study, 5 were less than 40 years of age (classed as ‘young’) and 5 were more than 40 years of age (classed as ‘old’). To examine the effect of age in more detail, a similar procedure was followed to that just described using these two populations. As describe previously, there was no significant difference in the total ratings for the younger participants compared to the older participants, hence there was no need for a normalisation to be performed. The statistically significant results are shown in Table J2.

Technique	Item	Significant differences due to age (actual ratings)
People grid	All key items	Younger participants more than older participants (means=5.850 & 5.050, $t=2.55$, $df=38$, $p<0.05$)
Keirsey temperament	All key items	Younger participants more than older participants (means=5.050 & 3.750, $t=2.66$, $df=34$, $p<0.05$)
Event diagrams	All key items	Older participants more than younger participants (means=5.90 & 4.80, $t=2.95$, $df=38$, $p<0.05$)
Aspirations technique	All key items	Older participants more than younger participants (means=5.70 & 5.05, $t=2.43$, $df=38$, $p<0.05$)
People grid	<i>thought-provoking</i>	Younger participants more than older participants (means=6.40 & 4.80, $t=2.92$, $df=8$, $p<0.05$)
State diagram	<i>demanding / difficult</i>	Younger participants more than older participants (means=5.0 & 3.40, $t=3.14$, $df=8$, $p<0.05$)

Table J2: Statistically significant results in questionnaire ratings based on differences in age

As shown, the **people grid** technique and **Keirsey temperament** technique were preferred by younger participants, whereas the **event diagrams** and **aspirations diagrams** techniques were preferred by older participants.

During the feedback session, each participant was asked “how the ranking of the techniques would be different at other times in your life”. Analysis of the results showed that there was little consensus on this issue except for the following two points. First, three participants felt that the **Keirsey temperament** technique would be ranked more highly by younger people. Interestingly, this opinion matches the statistical analysis describe above. Second, two participants felt the **events/periods grid** would be more favoured and more useful to older participants. This opinion does not match the statistical analyses.

Effect of Qualifications

Of the 10 participants in the main study, 6 were university graduates and 4 had not attended a university. To examine the effect of qualifications using these two populations, the same procedure was followed as that described above for the effect of gender. Table J3 shows the results. As shown in the table, the **interview review** and **events/periods grid** techniques were more favoured by non-graduates, although the differences for particular items proved non-significant when the data were normalised. The **people grid** technique was also more favoured by non-graduates (on a group

score of all key items), however this became non-significant after normalisation. There were no preferences for graduates more than non-graduates using the actual data, but after normalisation, graduates' ratings of the **aspirations technique** were significantly higher than non-graduates' ratings on a number of items.

Technique	Item	Significant differences due to qualifications (actual ratings)	Significant differences due to qualifications (normalised ratings)
Interview review	All key items	Non-graduates more than graduates (means=5.938 & 4.417, $t=3.73$, $df=38$, $p<0.05$)	Non-graduates more than graduates (means=5.378 & 4.417, $t=3.36$, $df=38$, $p<0.05$)
People grid	All key items	Non-graduates more than graduates (means=5.875 & 5.167, $t=2.16$, $df=38$, $p<0.05$)	No difference
Events/periods grid	All key items	Non-graduates more than graduates (means=5.813 & 3.667, $t=5.93$, $df=38$, $p<0.05$)	Non-graduates more than graduates (means=5.253 & 3.667, $t=4.38$, $df=38$, $p<0.05$)
Aspirations technique	All key items	No difference	Graduates more than non-graduates (means=5.458 & 4.691, $t=2.66$, $df=38$, $p<0.05$)
Interview review	<i>thought-provoking</i>	Non-graduates more than graduates (means=6.250 & 4.333, $t=2.42$, $df=8$, $p<0.05$)	No difference
Interview review	<i>Recommendation</i>	Non-graduates more than graduates (means=6.50 & 4.667, $t=2.12$, $df=8$, $p<0.05$)	No difference
People grid	<i>enlightening</i>	Non-graduates more than graduates (means=6.250 & 4.333, $t=2.95$, $df=8$, $p<0.05$)	Non-graduates more than graduates (means=5.691 & 4.333, $t=2.09$, $df=8$, $p<0.05$)
Events/periods grid	<i>thought-provoking</i>	Non-graduates more than graduates (means=5.750 & 3.667, $t=2.43$, $df=8$, $p<0.05$)	No difference
Events/periods grid	<i>enlightening</i>	Non-graduates more than graduates (means=6.0 & 3.333, $t=3.82$, $df=8$, $p<0.05$)	Non-graduates more than graduates (means=5.441 & 3.333, $t=3.02$, $df=8$, $p<0.05$)
Events/periods grid	<i>Recommendation</i>	Non-graduates more than graduates (means=5.75 & 3.833, $t=3.05$, $df=8$, $p<0.05$)	No difference
State diagram	<i>Recommendation</i>	Non-graduates more than graduates (means=6.25 & 5.0, $t=6.32$, $df=8$, $p<0.05$)	Non-graduates more than graduates (means=5.691 & 5.0, $t=3.49$, $df=8$, $p<0.05$)
Aspirations technique	<i>Interesting</i>	No difference	Graduates more than non-graduates (means=6.667 & 4.441, $t=2.94$, $df=38$, $p<0.05$)

Table J3: Statistically significant results in questionnaire ratings based on differences in qualifications

Effect of Personality Type

As covered in chapter 2, there is some evidence in the literature that use and efficacy

of self-help techniques may be mediated by personality type. To test this, the scores and temperament types taken from the session using the Keirsey temperament technique were used as demographic variables in a number of statistical tests (see Appendix I for details of the temperament types). A first set of tests revealed that participant's opinions of the **interview review** technique, and no other technique, were associated with Keirsey temperament types. A number of ratings from the post-session questionnaires were significantly higher for **Guardians** than for the other Keirsey temperament types for the interview review technique. These are as follows:

- Guardian's ratings for *interesting* (mean=6.2) were significantly higher ($t=2.78$, $df=7$) than non-Guardians (mean=4.25) for the interview review
- Guardian's ratings for *thought-provoking* (mean=6.2) were significantly higher ($t=3.52$, $df=7$) than non-Guardians (mean=3.75) for the interview review
- Guardian's ratings for *enlightening* (mean=5.0) were significantly higher ($t=2.66$, $df=7$) than non-Guardians (mean=3.25) for the interview review
- Guardian's ratings for *recommendation* (mean=6.6) were significantly higher ($t=5.66$, $df=7$) than non-Guardians (mean=3.75) for the interview review

The distinguishing feature of the Guardian type is that they are higher on **sensation** than intuition, and higher on **judgment** than perception. To examine this in more detail, the scores on the four Keirsey scales were subjected to statistical analyses. Two significant correlations (using Pearson's product-moment tests) were found for scores on these scales and rankings of the **interview review** technique from the feedback session: (1) scores on the **intuition-sensation** scale to the rankings for the interview review technique ($r=-0.779$, $N=9$), and (2) scores on the **judgment-perception** scale to the rankings for the interview review technique ($r=-0.808$, $N=9$). In addition, a number of significant correlations were found for scores on the Keirsey scales and ratings for the interview review technique on the post-session questionnaires. These fall into two groups. First, scores on the **intuition-sensation** scale and ratings for *thought-provoking* ($r=-0.677$, $N=9$) and *recommendation* ($r=-0.716$, $N=9$). Second, scores on the **judgment-perception** scale and ratings for *thought-provoking* ($r=-0.701$, $N=9$), *recommendation* ($r=-0.786$, $N=9$), and for an average of the key items ($r=-0.724$, $N=9$).

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