Methods News

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Genetics in social sciences

Frank Dudbridge, Pathways, London School of Hygiene and Tropical Medicine

At first glance, genetics and social science lie at opposite ends of a spectrum. Our genes are fixed at conception and irrevocably determine our individual potentials for a multitude of physical, medical, and behavioural outcomes.

Social science, by contrast, is concerned with actions and results in a fluid world of human interaction, in which individual outcomes can be modified by judicious intervention. And yet the explosion of genetic data in the last decade has opened up many possibilities. Genetic data are available in many of the major cohorts that have been curated in social and medical research. What can genetics do for social scientists in the post-genomic era?

The two fields have long shared an uneasy common ground in heritability studies. These involve calculations expressing the correlations of a trait among relatives in terms of their stated relationships. With whole genome data we can now measure the exact genetic similarity between a pair of relatives. For example, siblings share half their genetic material on average, but a specific pair may by chance be up to 100% identical, and such siblings will be more similar for a heritable trait than the average. This leads to improved precision in heritability studies[1]. In epidemiological studies, genetic data allow us to build more complete models relating observations, and identify interactions between genes and social factors. For example, rural/urban environment is a possible effect modifier for the FTO gene in obesity[2].

The fact that our genes are random given our parents, and the known causal direction from gene to outcome, has led to much interest in genetics for inferring causal relationships, using the method of instrumental variables first developed in econometrics. If we are interested in whether a certain trait causes an outcome, and we know that a gene influences that trait, we can substitute the gene for the trait in the analysis.

An association between the gene and the outcome then implies a causal relation between the trait and the outcome. For example, we may be interested in whether increased alcohol consumption causes an increased risk of heart disease. An association between alcohol and heart disease could be seen if, say, people who smoke are more likely to drink, but this does not imply that drinking causes heart disease in itself. However, certain genes are known to influence the level of alcohol consumption through their action on metabolism: carriers of particular genetic variants have more severe reactions to alcohol and tend to drink less as a result. An association between those genes and the risk of heart disease would imply that alcohol has a causal effect on disease, since it is unlikely that the genetic association could be explained by, say, smoking behaviour. This "Mendelian randomisation" approach mirrors the random allocation of patients in a clinical trial, and is a promising method for allowing causal conclusions to be drawn in social research[3].

Through these new applications and common datasets, much greater collaboration between social scientists and geneticists is likely in the near future.

The Pathways node of the NCRM is running a series of courses to help social scientists become acquainted with the concepts and terminology of genetic and biomarker data. For details on upcoming courses please visit http://pathways.lshtm.ac.uk/

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IN THIS ISSUE

Measuring the impact of government interventions

Barbara Sianesi, PEPA node, Institute for Fiscal Studies

Economics has a long tradition of studying causal questions. Over the past few decades causal methods have been widely employed in measuring the impact of government policies.

The question of what difference government interventions in economic and social domains have made is a topic of great public interest, and particularly so in times of scarce funds and public demands for accountability. In "evidence-based policy making", it is evidence on programme effectiveness, rather than theory or ideology, which guides policy decisions on which programmes to keep, expand or terminate.

How should we go about finding out whether an intervention actually works?

To test whether a given intervention or programme has improved the outcomes of its participants we need to know the outcomes that these same individuals would have experienced had they not been exposed to the intervention or participated in the programme. But these counterfactual outcomes can never be observed: that is the fundamental problem in making causal inferences. The most widely used approach for establishing this counterfactual is to use a comparison group that did not participate in the programme. A robust evaluation is one which is successful in choosing an appropriate comparison group, thereby producing a good estimate of the counterfactual.

The best way to construct a comparison group is by randomly denying access to the programme to some individuals who have come forward to receive it (for voluntary programmes) or who are eligible for it (for mandatory programmes). In this experimental approach, randomisation ensures that selection into the programme and control groups is random; the two groups are statistically the same, except that only one has received the programme.

If this is not feasible, researchers will need to use a "non-experimental" design which relies on statistical techniques – and behavioural assumptions – to correct for differences between participants and non-participants.

How successful these methods are depends on how well they have managed to control for the "selection problem": since, in most cases, programme participation or eligibility is the result of deliberate decisions or specific criteria, the individuals who did not decide or were not eligible to participate are a selected group, so that their outcomes will not in general be a faithful representation of the counterfactual outcomes that the participants would have experienced in the absence of participation.

Carefully planned and administered randomised social experiments do represent the "gold standard" evaluation method, but they can be costly, politically sensitive and fraught with operational difficulties. This partly explains why their use is still very rare in Britain, where the great majority of programmes have had to be evaluated using methodologically more controversial non-experimental methods.

Given their ubiquity, there is thus a pressing interest in assessing whether non-experimental methods can generate impact estimates that are sufficiently close to those obtained through randomised experiments, something known as "validation".

The Programme Evaluation for Policy Analysis (PEPA) node is about ways to do, and ways to get the most out of, evaluation of government policies. One of its projects will exploit a recent UK-based randomised experiment in labour market policy to learn about – and hopefully improve upon – the performance of non-experimental methods in evaluating policies in the UK. To date only a few of such validation exercises have been performed, and all limited to specific programmes in the US.

A UK design replication study

The Employment Retention and Advancement (ERA) demonstration, piloted in six parts of Great Britain between 2003 and 2007, was designed to test the effectiveness of an innovative package of time-limited support that combined job coaching and financial incentives to reward sustained full-time work and encourage training for those in work. Eligibility for the ERA offer was granted to those starting the New Deal for Lone Parents or the New Deal for the Long-Term Unemployed, and to lone parents already in part-time work who volunteered for ERA.

With over 16,000 individuals being randomly assigned, the study represented the largest randomised evaluation of a social programme in the UK.

The idea behind the validation exercise planned as part of PEPA is to simulate a variety of widely applied non-experimental approaches for estimating the counterfactual, and to compare the resulting non-experimental impact estimates to the corresponding experimental estimates.

The prototypical ways of constructing the counterfactual are to proxy it

- geographically (drawing the comparison group from a different geographical 'unit');
- temporally (e.g. drawing the comparison group for early participants from the group of future participants before the latter start ERA; or using participants' own experience before ERA to proxy their post-ERA counterfactual); or
- by combining both dimensions as done by "difference-in-differences" methods which compare a treatment and a comparison group (first difference) before and after the introduction of ERA (second difference).

Several statistical techniques can then be applied to correct for remaining selective differences between the participants and the chosen comparison group.

ERA offers the unique opportunity to perform these validation exercises both for the case when the programme of interest is mandatory (for those who were participating in the New Deal) and for the more methodologically challenging case when the programme is voluntary (for the lone parents who were working part-time).

This project will thus generate first-time understanding of the reliability of non-experimental methods that have been widely used to evaluate a whole variety of UK labour market programmes.

Text mining with Textal

Steven Gray, TALISMAN node, and Melissa Terras, UCL Centre for Digital Humanities

Text Analysis – the statistical analysis of patterns in text that allows researchers to understand textual structure and author motivation – has been a major academic methodology employed in the computational analysis of culture and the arts since the mid twentieth century.

Traditional text analysis relied heavily on a complex understanding of language and context, and was dependent on bespoke software to generate word lists and collocates of text (lists of words which appear next to each other). Text Analysis has, as a result, never really become a popular method, or one known by the general public: what can be done to open up this "Digital Humanities" technique to a wider audience?

Analyse and visualise text

Textal has been created under the NCRM Talisman node allowing analysis of textual based documents in real time from live data feeds. A new project at UCL Centre for Digital Humanities and UCL Centre for Advanced Spatial Analysis aims to bring text analysis to the general public via an easy to use, free iPhone application. Textal bridges the gap between text visualisation and text analysis: providing the statistics researchers need to analyse documents whilst providing a freely available way to create, explore, and share word clouds.

In recent years, Natural Language Processing tools such as Sentistrength[1] have made text analysis more accessible to researchers. This is juxtaposed with popular interest in "word clouds": in 2008 a tool named Wordle from IBM research gave rise to a visualisation that takes a text's most commonly referenced words and displays their size based on the number of times they feature in a particular document. Wordles quickly became used in advertising, on websites, and in print publication, but the problem with this type of visualisation is that the viewer is unaware of the frequency of words behind the word cloud and the raw statistics are lost: Wordles are therefore an inappropriate tool for any kind of serious text analysis.

This image is a Textal visualisation of the words in this article. Textal generates statistics for a document, and the largest word in the visualisation - 'analysis' - appears 15 times in this article.

Textal allows the user to explore words used in books, documents, websites, or particular social media services such as Twitter. The tool allows users to create word clouds and interact with them, accessing further statistics that will help users understand the way language is used. What words are used most often? What words are used commonly in combination with other words? What patterns emerge when we visualise text in different ways? Textal allows you to generate a range of text analysis views, which can be shared through social media and on the Textal website.

Users start by either selecting a text from a large corpus of documents provided through Project Gutenberg[2] (an online repository of out of copyright books in electronic format) or by providing their own text. After tweaking various format options such as font, colour scheme and background, the user can explore the word cloud by the popular pinch-zoom paradigm and select a word in the cloud for further analysis. Textal provides various statistics about words inside the document such as the number of times the word appears in the document, how words are ranked compared to the other words in the document, and collocations (showing the words in context by looking at the words which commonly appear either side of it).

We collect the document text from all submissions: this allows us to make corresponding word clouds available online, building up a databank of texts that have been analysed. In the future we will be able to run a larger analysis over all words in all documents submitted, and understand how text analysis on the move is being used by people, and by different geographical distribution.

First release as iPhone app

Textal is funded through EPSRC and NCRM grants to bridge the gaps between digital humanities and new research methods. It plans to open up Digital Humanities to a broader audience. Textal will provide researchers with new tools and methods to examine large documents of text using Big Data retrieval techniques. Textal is primarily being built as an iPhone application but in the near future Textal will expand to a desktop application.

Textal launches early in July 2012 and will be freely available via the Apple App Store opening up new text based research methods to the wide public.

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1 http://sentistrength.wlv.ac.uk

2 http://www.gutenberg.org/

The paradata challenge

Gerry Nicolaas, NatCen Social Research

Survey paradata are data about the process of collecting survey data. They can include things like call record data, length of interview, interviewer characteristics, interviewer observations of the area and household, and keystroke files from computerised questionnaires.

The collection of survey paradata is not new but the range and detail of paradata being collected have increased substantially over the years, mainly due to the increasing computerisation of collecting survey data.

It is envisaged that paradata can be used to obtain a clearer understanding of the causes of survey error, to improve the design and management of data collection so that survey error is minimised within cost constraints, and to improve statistical adjustments for survey error. However, there are barriers that need to be overcome before we can exploit the paradata for these and other purposes.

First of all, tools and techniques are needed to harness and manage the vast amounts of paradata that could be made available, as previously highlighted by Couper[1]. Data collection agencies have introduced computerised systems that link the various stages of the survey process, thus capturing large quantities of paradata on a continuous basis. But the format and structure of the paradata can be quite complex and messy, and complex models are likely to be required to fully exploit the richness of the data.

There is a long history of analysing call records for tackling non-response in the field[2,3,4,5,6] but attempts to use paradata for minimising and adjusting for non-response bias have been limited. The main obstacle is identifying paradata items which are available for all sampled cases and are correlated with both the likelihood of participation and the survey variables of interest. Recent research in this field is focussing on the collection of interviewer observations that are correlated with key survey estimates.

It is possible that paradata could be used to replace more resource-intensive techniques, such as behaviour coding and digital recording, for identifying and understanding sources of measurement error. For example, question timings, keystroke files and audio-recordings can provide indication of respondent difficulty in answering questions. Paradata can also be used to examine the effects of interviewer characteristics on measurement. As well as identifying and describing measurement error, it is envisaged that paradata can be used to control for measurement errors at the analysis stage.

More recently paradata are being used in responsive designs which involve making interventions during data collection to improve data quality while controlling costs[7]. Although research using responsive design is still in its infancy, some encouraging results have been reported for example by the University of Michigan and Statistics Canada.

But so far responsive designs have been applied only at the survey level whereas survey organisations need to identify and distribute interventions across surveys being carried out simultaneously.

Academic research in this area is promising but survey practitioners still need to be convinced. The research needs to demonstrate clearly that paradata provide useful information that can be used in practice to improve decision-making about difficult trade-offs between cost and data quality. And this is the next challenge that we must now address.

Gerry Nicolaas is the Head of Data Collection Methodology at NatCen Social Research. In 2009 she held a Networks for Methodological Innovation project funded by the NCRM http://bit.ly/GXkTmW

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Spotlight on Longitudinal Data Analysis

Fiona Steele, LEMMA node, Centre for Multilevel Modelling, University of Bristol

The importance of longitudinal designs for furthering our understanding of complex social processes is well-known, and the UK boasts a world-leading portfolio of longitudinal studies which have yet to be fully exploited.

Phase 3 of the LEMMA (Longitudinal Effects, Multilevel Modelling and Applications) node is about building capacity in the analysis of longitudinal data. As in Phases 1 and 2, the LEMMA project has four interrelated elements: 1) development of statistical methods to better represent and understand social processes; 2) application of new methods to address a range of important social science questions; 3) development of user-friendly software to implement new methods; and 4) training courses and development of the LEMMA virtual learning environment. These activities are being continued in Phase 3, but with a new focus on methods for analysing longitudinal data.

Longitudinal research questions and study designs

There are many types of longitudinal study: previous studies have been set up to answer a variety of research questions using different types of study design. In LEMMA 3, we will be considering methods for two broad types of research question.

The first type is concerned with the way in which individual outcomes change over time, and possibly the impact of within-individual variation on a subsequent outcome - for example, a person's health at a particular time may be influenced not only by their current socioeconomic circumstances (SEC) but by previous fluctuations in SEC.

The second type of question concerns the effects of time-varying early-stage exposures on later-stage outcomes such as adult health. One of our projects will consider how children's educational outcomes relate not just to their current environmental context, but to their complete histories of family, neighbourhood and school moves.

The best-known UK longitudinal data resources are the large-scale Birth Cohort Studies, and British Household Panel Survey.

However, longitudinal studies come in a variety of shapes and sizes – for instance, the increasing use of digital data collection methods has allowed individual behaviour and experiences to be recorded in real time. Although usually available on small numbers of individuals over a short observation period, these high-frequency digital-data studies offer great potential for understanding the causal relationship between processes over time. Working with health psychologists at the University of Aberdeen, we are using data on telephone calls made to nurses working on the Scottish medical helpline NHS24 to study the determinants of occupational stress and its impact on cognitive outcomes; the study provides data on the timing of the calls made to each nurse, along with the nurses' heart rates.

Methods for longitudinal data analysis: bringing together developments from multiple disciplines

The expansion in the availability of longitudinal data resources has been accompanied by major developments in methods for their analysis. Causal modelling has been an especially active area with important contributions from econometrics and biostatistics. However, disciplinary differences in terminology and in ways of presenting models (in graphical or equation form) can make it difficult for researchers to decide which is more appropriate for their questions and data. One of the aims of LEMMA 3 is to review and synthesise a wide array of statistical methods, drawing out the links (and differences) between approaches and illustrating their use and interpretation in social science applications.

STAT-JR software for fitting models for longitudinal data analysis

Another potential barrier to using the latest statistical methods is that some models can be fitted only in specialist software or, in some cases, researchers may even have to write their own programs. As part of LEMMA Phase 2 and the Digital Social Research project, e-STAT, we have developed a new software system called STAT-JR. In this system, model 'templates' are written to allow researchers to estimate particular model classes. In LEMMA 3 further templates will be written for fitting new models for longitudinal data analysis via a user-friendly interface.

STAT-JR can also be used as a portal to other statistical packages, including MLwiN, WinBUGS, R, Stata and aML. This interoperability feature allows users to specify a model through a single interface, avoiding the need to learn how to use multiple software packages. STAT-JR then generates the code for the selected software (which the user can view), fits the model in that software, and displays the results.

Workshops and online learning

The LEMMA 3 training programme includes introductory and advanced workshops on multilevel modelling and longitudinal data analysis, and an 'analyse your own data' research workshop.

We also have new modules for our online course in the pipeline, including one on multilevel and structural equations modelling of longitudinal data and another on handling missing data.

Details of the LEMMA 3 research programme are available in http://www.bris.ac.uk/cmm/research/lemma/3/

Further information about the workshops and the online course are available in http://www.bris.ac.uk/cmm/learning/

Families and food in hard times: methodological innovations for studying habitual practices in times of austerity

Abigail Knight, NOVELLA node, Institute of Education

Researchers of food practices are confronted with the thorny methodological issue of how 'to get at' habitual behaviour. Everyday practices including eating are often carried out unreflectively and so may be 'beyond discourse', that is difficult to recall or explain.

In retrospective accounts, especially in interview studies, it is also well-known that people tend to under-report 'bad' habitual behaviours and over-report 'good' ones. This is typically the case in food research because food and eating are steeped in normativity and accompanied by strong emotions such as shame, status, morality, guilt and so forth. Consequently it can be difficult for social researchers fully and accurately to investigate everyday food practices.

Previous research using secondary analysis of qualitative data to study food has focused on narratives that were derived from direct questions about food[1,2,3,4]. Yet research that relies on narrative data that has food as its primary focus does not address the problem of normativity in self-reported behaviour.

We at NOVELLA aim to further our knowledge about the habitual everyday practices of food and consumption that are embedded in wider narratives of family and social life.

Our research examines the 'disconnect' between behaviour and constructed meanings in habitual family food practices through narrative approaches, and addresses a number of questions concerned with research methodology. For example, what archival narrative material is available for the analysis of family food practices? What stories do people tell about food and eating and for which audiences? How do cultural and/or historical distance and proximity affect the interpretation of these data and what tales can and do we tell about our fieldwork practices? Our research also aims to examine the cultural meanings of food in particular contexts at particular historical periods.

We aim to examine the cultural meanings of food in particular contexts at particular historical periods. Reflecting contemporary concerns, as all reconstructions of the past must, the overall theme is food in an age of austerity.

We examine these questions through the secondary analysis of archived data. We propose to examine habitual food practices in different contexts, historical periods, and through the eyes of different social groups. We will draw upon three different types of narrative data including diaries, interviews and visual material.

Datasets will be identified that did not have food practices as their original focus, beginning with men's and women's diaries and responses to directives about everyday life collected by Mass Observation in the early 1950s, which was a time of considerable austerity.

The secondary analysis has been preceded by a review of the methodological strengths and weaknesses of a number of possible data sets. This is an integral and reflexive component of secondary analysis, a critical phase in carrying out 'fieldwork in the archives'[5]. Secondary analysis of these narrative data will be contextualised by reference to other forms of primary and secondary data relating to the specific historical period such as record office data, photography and domestic materials, such as objects or magazines.

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Photo: Men, women and children queue outside a fishmonger in London during rationing and food shortages in 1945. Copyright Imperial War Museum.

Researching embodiment in the context of digital technologies and environments

Carey Jewitt and Sara Price, MODE node, London Knowledge Lab, Institute of Education

Embodiment is a much debated term that broadly speaking refers to relationships between the body, the mind, cognition and action: how the body and its interactive processes, such as perception or cultural acquisition through the senses, aid, enhance or interfere with social and cultural development.

Embodiment is a key topic of study and theorization across the social sciences including philosophy, psychology, anthropology and sociology, as well as computer science and human computer interaction. There has been a surge of interdisciplinary interest in the body over the past 20 years, characterised as the 'Turn of the body'[1]. Interest in embodiment connects with advances in computing and the potentials for bodily interaction offered by complex digital technologies such as tangible, multi-touch, sensor-based and mobile technologies with new forms of interaction. Nintendo Wii, the Xbox Kinect, multi-touch tables, and touch interaction of the iPad are such technologies that offer opportunities for exploiting a wider range of perceptual-based experiences than traditional desktop computing. These technologies enable bodily-based physical experiences in new ways, for example, through manipulation of physical objects linked to a variety of digital augmentations; enhancing context-based experience in real world environments through mobile devices, fostering new forms interaction and new ways of thinking. These developments are important in explaining contemporary interest in concepts of embodiment, in the context of digital technologies.

What kinds of bodily-based interactions do digital technologies make available?

Beyond virtual augmentation and avatars, a range of bodily-based interactions of interest to understanding embodiment are made available in digital environments:

Manipulation of physical objects linked to a variety of digital augmentations. Tangible technologies make available physical objects that are linked to a variety of digital augmentations that can be manipulated.

These technologies are of interest for embodiment in relation to how the handling of objects and physical touch makes explicit relevant physical properties of objects and how this might facilitate knowledge construction[2].

Enhancing contextually based experience in real world environments. Mobile technologies (including GPS) are of interest in the context of the body as they exploit our physical space and perceptual interaction with the environment, and may enhance the physical experience of a space through making contextually relevant information available in-situ[3].

Kinaesthetic experience using whole body movements. Sensor technologies and wii motes exploit whole-body interaction and offer the opportunity for exploring whether and how digital technologies can promote kinaesthetic awareness[4]. These technologies can also be used to provide new and improved ways of archiving and analyzing movement-based activities for research. For example, 'Game Catcher' adapts the motion sensitive videogame controllers of the Nintendo Wii and Microsoft Kinect to create an application that allows the recording, playback, archiving and analysis of playground games in 3D[5].

Researching embodiment

The interest in embodiment across social science can also be understood in the context of the development of research methods that explore the full range of ways in which people communicate. A multimodal research perspective emphasizes the relationship between physical experience, through bodily form, gaze, gesture, body posture, facial expression, movement, as well as talk and other modes that shape the kind of interaction with the environment and meaning making[6]. Equally, media spaces and social practices are produced through the human body in its material form, the nature of the practices being, in large part, contingent on the forms, practices, and plasticity of the human body. A person can also embody an identity, or particular set of identities, by the way one moves, interacts, and communicates. Embodiment in this sense may be equated with represented bodies, like avatars, which offer a form of virtual embodiment.

Such environments offer new ways to embody a set of identities outside one's own physical being, where the virtual avatar acts a tool through which identity can be shaped. Multimodal concepts can be used to describe, create inventories and map forms of enactment - socially and culturally shaped resources, actions, materials and artifacts that we use for communicative purposes (what multimodal researchers call modes and semiotic resources). We also want to ask what ways does the use of these modes shape the meaning of the 'interaction'? What are the modal affordances, or 'potentials' and bodily 'constraints' of the different modes in use and how does 'bodily constraint' affect interaction? And how are these multimodal resources organized or orchestrated?

The mainstreaming of tangible, mobile, and sensor based technologies opens up new research directions to gain insight into the role of embodiment in digital learning environments.

New working paper on Embodiment http://eprints.ncrm.ac.uk/2257/

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Bookings open: 5th ESRC Research Methods Festival, 2-5 July 2012, Oxford

The National Centre for Research Methods (NCRM) is pleased to announce that the bookings for the 5th ESRC Research Methods Festival are now open.

This is the biggest social science research methods event of the year in the UK, with over 60 sessions, 200 presenters and 800 delegates over the four days.

This biennial Festival aims to engage social scientists across a wide range of disciplines and sectors and at different points in their research careers, and aims to stimulate interest, raise issues, highlight opportunities and showcase new developments.

The Festival offers over 60 sessions from introductory to advanced level, PhD student poster exhibition, inspiring keynote talks, and an exciting social programme for evenings.

Festival themes:

- The interface between social and natural sciences
- Methodological innovations
- Mixed and multimodal methods
- Career and skills development
- Interventions and evaluations

Fees:

- Students £8 on Mon 2 July, £25 per day on Tue 3 - Thu 5 July
- Others £18 on Mon 2 July, £35 per day on Tue 3 - Thu 5 July

For further information about the Festival programme and to book your place, please visit the Festival website http://www.ncrm. ac.uk/RMF2012/home.php

New methodological review paper from NCRM: How many qualitative interviews is enough?

Students conducting a piece of qualitative research frequently ask 'how many interviews is enough?' Early career researchers and established academics also consider this question when designing research projects.

In this NCRM Methods Review paper Sarah Elsie Baker (Middlesex University) and Rosalind Edwards (NCRM, University of Southampton) gather and review responses to the question of 'how many' from 14 renowned social scientists and 5 early career researchers.

The riposte to the question of 'how many' from most contributors is 'it depends'. In considering what 'it depends upon' however, the responses offer guidance on the epistemological, methodological and practical issues to take into account when conducting research projects. This includes advice about assessing research aims and objectives, validity within epistemic communities and available time and resources.

The paper is available for download in http://eprints.ncrm.ac.uk/2273/