UNIVERSITY OF SOUTHAMPTON

FACULTY OF HEALTH SCIENCES

'Video-View-Point' - Video analysis to reveal tacit indicators of student nurse competence

by

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Thesis for the degree of Doctor of Philosophy

May 2014

UNIVERSITY OF SOUTHAMPTON

<u>ABSTRACT</u>

FACULTY OF HEALTH SCIENCES

<u>Nursing</u>

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'VIDEO-VIEW-POINT' - VIDEO ANALYSIS TO REVEAL TACIT INDICATORS OF STUDENT NURSE COMPETENCE.

Eloise Jane Monger

For over 30 years, the assessment of the clinical competence of student nurses has been the subject of much theoretical debate, yet the definition of criteria based on observable indicators of competence remains problematic. In practice, however, different assessors will judge and agree, relatively quickly, whether a student is competent or not; whether they have got '*it*'. Articulating what '*it*' is, is difficult; although '*it*' appears to be collectively, yet tacitly, understood. These judgements provide the key to the definition of competence. This research solves the dilemma of revealing and investigating these tacit understandings through the video analysis of students in simulated practice.

The findings of four initial exploratory studies confirmed that competence is an example of tacitly understood behaviour and identified the limitations of traditional research methods in this context. The practical challenges of analysing video were highlighted, leading to the development of Video-View-Point to solve these problems and to reveal the tacitly understood behaviours. This innovative hybrid research method combines analysis of multiple 'Think Aloud' commentaries with the ability to 'point' at the subject of interest. The analysis is presented as a time-stamped multimedia dialectic, a visually simple yet sophisticated collage of data which reveals relevant behaviours, including those which are tacitly understood.

A bespoke software tool (BigSister) was designed to facilitate the data collection, and was tested against the most similar commercially available technology, an eye tracker. The test of Video-View-Point successfully revealed four tacitly understood indicators of competence: communication, processing clinical information, being in the right place, and being proactive. Video-View-Point offers huge potential for behavioural analysis in other domains.

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DECLARATION OF AUTHORSHIP

I, Eloise Jane Monger

declare that the thesis entitled

'Video-View-Point' - video analysis to reveal tacit indicators of student nurse competence

and the work presented in the thesis are both my own, and have been generated by me as the result of my own original research. I confirm that:

- this work was done wholly or mainly while in candidature for a research degree at this University;

- where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;

- where I have consulted the published work of others, this is always clearly attributed;

- where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;

- I have acknowledged all main sources of help;

- where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;

- parts of this work have been published as: Gobbi et al (2008); Gobbi & Monger (2007); Gobbi & Monger (2009); Gobbi et al (2012) McDonald et al (2008a ; 2008b); Monger et al (2008); Simulation and Practice Learning Project Group (2007); Watkinson et al (2004); Watkinson et al (2006); Weal et al (2007) ;Weal et al(2009a; 2009b) and Weal et al (2012)

- all of the images in this thesis are used with the consent of the individuals depicted

- Signed: ....

Date:...

Acknowledgements

This thesis is dedicated to the memory of my father. His courageous decision to drag my brother and I around Florence as teenagers was more influential than he would ever have dreamt.

I would like to express my sincere gratitude to my supervisors, Dr Mary Gobbi and Dr Mark Weal, (and in the very early days Professor Val Lattimer) for their unstinting support, wisdom and patience.

My thanks to the MSc Computing Science students whose hard work provided the tools which met the challenging specifications that I set for them: Matthew Shepherd, Matthew Wilson, Thomas Barnard and Oliver Parson.

I must also thank my colleagues, the participants in the studies and the students who have participated in the simulated practice scenarios. Without their enthusiastic support for the simulation projects, none of this would have been possible.

Finally I would like to thank my family for their love and support on this very long journey. My enduring hope on the completion of this thesis is that my sons will be inspired, as my father inspired me, to work hard and achieve what they wish for in life.

1. Introduction

The first decade of the twenty-first century was notable as a period of rapid expansion in digital technologies. This thesis argues that the creative use of these emergent technologies is able to produce innovative solutions to some of the recognised limitations of established research methods. The consequent research approach to video data analysis is applied to the hotly debated issue of competence acquisition in student nurses. This is of particular importance in light of the intense and increasing scrutiny of the Health Care system in the United Kingdom over the same period. This work makes an important, original and innovative contribution to both nurse education and research methods. The primary purpose of any professional preparatory course of study is to produce competent practitioners. It is a completely reasonable and universally held expectation that newly qualified professionals (e.g. nurses, doctors, teachers, lawyers, therapists) are able to practice in a professional manner; to have attained competence at the point of professional registration. This seemingly obvious purpose becomes less straightforward when one embarks on the design of a course to achieve it. It is first necessary to define competence in the context of the professional group. Examination of the literature exploring the concept of competence, in the context of nursing practice, demonstrates that the definition of competent nursing practice has remained elusive despite more than three decades of academic debate. That said, nurses recognise competent or incompetent practice in others, but they struggle to articulate how they arrived at that judgement. Competence is an example of behaviour which is tacitly and collectively understood by those in the profession.

This research demonstrates that elicitation of student nurse competence, an example of tacitly and collectively understood behaviour, can be achieved by 'Video-View-Point' - a novel technological approach to the analysis of video captured data.

As a Lecturer in nursing, the primary objective of my role is to prepare student nurses to be competent and caring professionals. This thesis describes my research journey which began with the desire to improve the understanding of competence in order to facilitate the fulfilment of that primary objective. In my earlier clinical career as an Intensive Care nurse I used a broad range of technological equipment to fulfil my clinical role. Consequently, on moving to

education I was drawn to the use of technologically sophisticated patient simulators. Over time a group of educationalists within the Faculty, who shared my interest in simulation, began working together to explore the potential for simulated practice in the nursing curricula. By 2004, we had devised Virtual Interactive Practice (VIP™) as a 'brand' of simulated practice, based on real patient cases and incorporating real data from clinical practice (see section 2.1). As well as being a founding member of the VIP™ team, I was personally responsible for the development of an ethics protocol - the Programme of Research and Education/Ethics into VIP™ (PREVIP). This protocol continues to be used both in the Faculty, and more widely in the University research community, for research activity involving video captured data.

The research outlined in this thesis was undertaken in two phases. The first exploratory period of activity comprised four commissioned studies, which were designed pragmatically to meet the objectives for the individual studies and to incorporate the research objectives outlined in my initial research proposal. Alongside my roles a full-time Lecturer and post-graduate student, I assumed the role of Research Assistant for the four exploratory studies. I was responsible for co-ordinating the study design, gaining ethical approval, collating all of the documents and organising recruitment, consent, data collection and archiving, and contributed to the individual study analyses. The analyses of these data, with respect to the research objectives for this doctoral work, contributed to the evolution of the methodological approach (Video-View-Point) and technological tool (Big Sister) which became the focus of the main study. This constituted the second phase of this research.

Declaration of related publications

This doctoral research was conceived as a consequence of the development of Virtual Interactive Practice™. The first pilot of VIP™ was followed by a series of four exploratory studies (see Table 2). These studies were designed pragmatically to collect a data set which would meet the combined objectives for each of the four studies and this doctoral work concurrently. These data were utilised in different ways to meet the distinct research objectives. The analysis and findings in relation to the objectives described in this thesis have not been previously published, however the research undertaken for the pilot

of VIP™ and the four exploratory studies has generated the following fourteen collaborative papers/conference proceedings:

1.Gobbi M, Monger E, Watkinson GE, Spencer A, Weaver M, Lathlean J and Bryant S (2004) Virtual Interactive Practice : a strategy to enhance learning and competence in health care students. *MEDINFO 2004 in Fieschi et al (eds)* Amsterdam: IOS Press 874-878

2. Gobbi M and Monger E (2007) Using Web based multi-media, simulated and virtual practice to assess students professional practice skills. Unpublished Report to the Higher Education Academy

3. Gobbi M and Monger E (2009) Video assessment and simulation. Good practice tips and learning points. In, *The Higher Education Academy Health Sciences and Practice Workshop, Southampton, UK, Feb 2009.*

4.Gobbi M, Monger E, Weal M J., Michaelides D T, McDonald J W and DeRoure D C. (2012) The challenges of developing and evaluating complex care scenarios using simulation in nursing education. *Journal of Research in Nursing*, 17, (4), 329-345

5. McDonald J, Gobbi M, Michalelides DT, Monger E, Weal M, De Roure D. (2008a) Grid-enabled data collection and analysis – semantic annotation in skills based learning. In Conference Proceedings *4th International Conference on e-Social Science, Manchester, UK, 18 - 20 Jun 2008.*

6.McDonald JW, Michaelides D, Weal MJ, De Roure D, Gobbi M and Monger E (2008b) Visualisation of human-computer interaction within an interactive web-based learning environment. Technical Report, University of Southampton.

7.Monger E, Weal MJ, Gobbi M, Michaelides D, Shepherd M , Wilson M and Barnard T (2008) Video supported performance feedback to nursing students after simulated practice events. In, *DIVERSE 2008, Haarlem, The , Netherlands, 01 - 03 Jul 2008.*

8.Simulation and Practice Learning Project Group (2007) Simulation in Practice Learning Project: Outcome of a pilot study to test the principles for auditing simulated practice learning environments in the pre-registration nursing programme. Final Report. Unpublished.

9.Watkinson G, Spencer A, Monger E, Weaver M, Gobbi M, Lathlean J and Bryant S (2004) Virtual interactive practice™: Utilising healthcare information systems to contextualise the skills associated with clinical decision making within nurse education. In Fieschi M, Coiera F and Li J (Eds) *MEDINFO 2004: Proceedings of the 11th World Congress on Medical Informatics. 11th World Congress on Medical Informatics* San Francisco, USA, AMIA, 746-749

10.Watkinson G, Spencer A, Monger E, Weaver M and Gobbi M (2006) Case Study 17a Using technology to teach clinical skills. In *Nursing and Informatics for the 21st Century* . Weaver CA, White Delaney C, Weber P and Carr RL (Eds) Chicago.HIMMS.

11. Weal MJ, Michaelides DT, De Roure D, Gobbi M, Monger E and McDonald JW (2007) Semantic annotation in ubiquitous healthcare skills based learning environments In, *Workshop on Semantic Web in Ubiquitous Healthcare in conjunction with ISWC2007, Busan, South Korea, Nov 2007.*

12.Weal MJ, Michaelides D, Page K, De Roure D, Gobbi M, Monger E and Martinez F (2009a) Tracking and Annotation in Skills-Based Learning Environments. In, *PerEL 2009: IEEE International Workshop on PervasivE Learning as part of the Seventh Annual IEEE International Conference on Pervasive Computing and Communications, Galveston, Texas, US,* IEEE Press.

13.Weal MJ, Michaelides DT, Page KR, De Roure DC, Gobbi M, Monger E and Martinez F (2009b) Location based semantic annotation for ward analysis. In, *3rd International Conference on Pervasive Computing Technologies for Healthcare 2009,London, UK, 01 - 03 Apr 2009.*

14. Weal, MJ, Michaelides, DT, Page, KR, De Roure, DC, Monger, E and Gobbi, M (2012) Semantic annotation of ubiquitous learning environments. *[in special issue: on Semantic Technologies for Learning and Teaching Support in Higher Education] IEEE Transactions on Learning Technologies*, 5, (2), 143-156.

1.1   Identifying the focus

At the outset of this research journey, I was interested in the concept of nursing competence. In particular I was keen to explore the potential for simulated practice to accelerate student nurses' acquisition of competence. My approach to this research was shaped by my previous experience. I had

been a Lecturer in Nursing for three years prior to which I had been practicing as an Intensive Care nurse for fifteen years. My Intensive Care career had progressed to a senior level and I felt entirely comfortable with my nursing role within this predominantly positivist clinical culture. I was secure in my understanding of both the science and art of nursing practice; confident of my scientific knowledge base, and committed to the unique contribution to patient care made by nurses. I had also been a member of a Multicentre Research Ethics Committee for eight years which provided exposure to a broad range of research proposals and wide ranging discussions regarding the ethical conduct of clinical research.

Throughout my career, the use of advances in technology had been pervasive. The processes of assessing, implementing and evaluating technological tools and applications were an integral part of my daily work activity, and I was comfortable with exploring the possibilities which can be afforded by scientific advances. The detailed historical and physical contexts which set the stage and then influenced the evolution of this thesis are summarised in Chapter 2.

In order to explore the concept of competence, it was first necessary to understand the nature of the knowledge and behaviours under scrutiny and this was achieved during the exploratory study period and literature reviews. I spent approximately three hundred and fifty hours observing simulated practice, both directly and as video captured episodes. This period also involved experimenting with traditional research methods to assess their suitability for use with video captured data. It became clear that the traditional methodological reliance on the spoken word and the convention that qualitative data are textual was a serious problem, particularly as the behaviours being studied could not be adequately described in words.

The notion that competence was an example of tacitly understood behaviour led to a reappraisal of the literature written around competence (discussed in section 2.4). Analysing the literature through this lens, it became clear that the contemporary understanding of these behaviours was entirely theoretical. The difficulty of researching a behaviour which cannot be described in words had precluded the ability of researchers to identify the visible and practically assessable indicators of competence. The findings from the exploratory studies and the extensive experience of observation of simulated practice

activity, however, demonstrated that experienced nurse mentors were consistent in their judgments of students. Indeed the whole professional regulatory framework is based on the premise that there are standards of practice which are 'recognised 'by a group of peers. This suggests that it is therefore possible to 'see' competent practice; we are just unable to put what we see in to words. That said, the ability to video capture what can be 'seen' affords the potential to remove the need for words, by representing the characteristic behaviours in video form. This set of circumstances led to the realisation that in order to further explore the concept of competence, a novel methodological approach would be essential. Given my background, it was logical to look to advances in technology to provide the solution to these methodological problems. The formal literature review of the use of video analysis, presented in Chapter 3, confirmed that there was an increasing desire in the research community to use video as a data source, but the initial surge in interest evident between 2005 and 2010 had begun to falter. The literature, however, did uncover some innovative approaches to video analysis, where researchers were tussling with video captured data trying to make it fit within the constraints of conventional methodologies. These researchers acknowledged the potential of video captured data, but were frustrated by the lack of specialised methodological tools available to analyse it. Video-View-Point is a timely, innovative and creative methodological solution to the problem of researching behaviours which are commonly recognisable, but which have not been successfully defined in words; those behaviours that are tacitly and collectively understood.

This thesis argues that, by approaching long-standing methodological problems in novel ways, advances in technology can provide solutions. The development and testing of Video-View-Point is the result of the synthesis of empirical evidence from four exploratory studies with elements drawn from a comprehensive review of the published literature describing the methods/tools used to analyse video-captured data. The four exploratory studies and the final test of the Video-View-Point method utilize videos of student nurses engaged in simulated practice as the source of data, and judgement of the students' competence as the exemplar of tacitly understood behaviour.

Whilst student nurse competence, the exemplar of tacitly understood behaviour, situates the study within the discipline of Nursing, the

methodological challenge required the amalgamation of components from Healthcare Education, Social Science, Computing Science and Philosophy to generate this solution. Denzin and Lincoln (1994) in their Fifth Moment of Qualitative Research (see Chapter 4) identified six challenges facing the qualitative research community and these are representative of the problems faced in this research. The six challenges of the Fifth Moment are: the tension between postmodernism and positivism; the crisis of representation; the crisis of legitimisation; the 'emerging cacophony of voices and agendas'; the blurring of the borders between science and art; and the influence of technology. These are used as a framework throughout this thesis.

 The revolutionary methodological approach to the handling and analysis of video captured data and the incorporation of cutting edge computer science to produce a technological tool to do so, are both innovative and original.

1.2   The Thesis Structure

Having identified the underpinning concepts, it is necessary to outline the layout of the thesis which is used to illustrate the exploratory and inductive nature of this research. In general terms, the research approach adopted fits with the generic definition of qualitative research: multiparadigmatic in focus, multimethod in approach, naturalistic in perspective, and interpretive (Denzin & Lincoln 1994). In specific terms, the overarching research design is indicative of the inductive research process, but the design arrived at for the final study is a hybrid of quantitative and qualitative methods. The thesis is therefore structured to explain the requirement for, and the logical derivation of, this novel approach.

Chapter 2 provides the background and context which situates this doctoral work. This is followed by a comprehensive review of the research literature describing the analysis of video in Chapter 3. Chapter 4 summarises the philosophical premises which align with Denzin and Lincoln's (1994) Fifth Moment, and provide the underpinning of both the conduct of this research and the development of the method of analysis and technological tool which have been arrived at. Video-View-Point is proposed as a method of analysis, the product of an inductive process which incorporates hermeneutic principles

and uses video captured behaviours, presented by a technological tool, as its data source. Chapter 5 describes the inductive process which comprised four exploratory studies designed to identify the challenges of a) studying competence acquisition and b) using video captured data as the means to do so. The findings from this exploratory work led to the development of a bespoke technological tool (BigSister). BigSister was designed to address the practical challenges of eliciting tacitly and collectively understood behaviours and renders the video captured data amenable to analysis.

The main study, described in Chapter 6, outlines the formal test of the Video-View-Point approach to analysis using a three – arm cross-over design. The video is rendered accessible to the analysis by two tools: BigSister and the most similar available research tool, an eyetracker. The method and the tools are evaluated with respect to validity, reliability and ability to identify and represent tacitly understood indicators of competence. Chapter 7 reports the findings of the main study, the representation of which utilises time-stamped screen shots and transcribed commentaries, a further novel component of this research. Denzin and Lincoln's Fifth Moment is returned to as a framework for the discussion of the findings in Chapter 8, identifying how this research has addressed the six crises of qualitative research. The final chapter summarises the conclusions which can be drawn from this work, the novel contributions to the body of knowledge in the discipline of nursing and beyond, and finally makes recommendations for continuing research.

2. Background

The innovative nature of this research requires a preliminary explanation of its situated context. This chapter will provide a comprehensive introduction to the major influences which have shaped this research journey. The research activities are situated in both an historical and physical context. The historical context describes the set of chronological and political circumstances which prompted the commencement of the series of five studies. It also outlines how the Faculty's programme of investment in infrastructure and the research activity associated with simulated practice activities provided the platform for the four initial exploratory studies.

The physical context comprises a description of the simulated ward environment and the video recording system which enabled the collection of video captured data. This section also provides an outline of the simulated practice activity which was video captured as the focus of analysis for the fifth and final study.

This will be followed by a summary of the two fundamental concepts which underpin this research: nurse competence and tacitly understood behaviour. This will introduce and define the particular way these concepts are used throughout the thesis and expose the specific vocabulary which has emerged.

2.1 Historical Context (1990-2005)

In the early 1990s, political changes to the process of commissioning nursing students in the United Kingdom (UK) were beginning to have a profound impact on the NHS workforce. The number of nursing students in 1984 was approximately 75,000 and by 1994 the numbers had more than halved (Buchan & Edwards 2000). During this period, there had also been a radical change to nurse education in the UK. The implementation of Project 2000 (United Kingdom Central Council for Nursing and Midwifery 1986) was designed to improve nurse training and ensure that newly qualified nurses were adequately prepared to face the challenges of a rapidly changing health care system. There were five changes as a result of Project 2000 which were to

have a significant additional impact: standardisation of length of training to three years, supernumerary status for students, increased academic credit to diploma level (Level 5 National Qualifications Framework) as a minimum, increased entry requirements, and the move to early specialisation and registration in one of five branches (now re-named 'fields') of nursing (mental health, mental handicap – which is now learning disability, child, adult and midwifery). By 1999, this new way of educating nurses was being increasingly scrutinised. There was a growing perception that the newly qualified nurses educated by the Project 2000 programmes, did not have all of the competencies required by their prospective employers (Carlisle et al 1999).

Adams et al (2000) identified that the reduction in student numbers, alongside changing work practices, programmes of efficiency savings (Department of Health 2000b) and an ageing population were likely to have implications for the quality of care which could be provided in the NHS. By 2001, evidence was emerging that patient outcomes were significantly improved by the presence of experienced nurses (Blegen et al 2001), which implied that a lack of experienced nurses would be detrimental to patient care. This was recognised by the political establishment, and Local Health Authorities instigated an ambitious programme to commission far higher numbers of nursing students than had been seen in the previous 15 years. This is demonstrated by the increased numbers of Registered Nurses in the NHS in England from 298,650 in 1998 to 381,257 in 2005 (The Information Centre for Health and Social Care 2009). This was welcomed by the NHS and the nursing profession, however little was mentioned about the impact of the previous lack of investment and foresight. In reality, it could be predicted that 25% of the nursing workforce would retire by 2007 (Buchan & Seccombe 2002), that these would be the most experienced nurses and that the trend would continue (Jackson 2008). Continuing to train increased numbers of nurses would address the numerical shortfall, however this would not address the consequent dilution of the skill mix in the workforce.

These changes in the workforce were also having an effect on the workplace culture of health care institutions. Maben et al (2006) describe the concepts of 'professional and organisational sabotage'. They determined that initially

idealistic newly qualified nurses are adversely influenced by lack of support, poor nursing role models, the requirement to obey covert rules, time pressure, role constraints, staff shortages and work overload. The challenges to health care institutions and alterations to working practices during this period were not solely a product of political decision making. It was also necessary for nursing practice to respond to: technological advances in healthcare including an increase in the use of electronic patient data (Smith 1996); a perceived increased acuity of patients accessing healthcare by virtue of the ability of healthcare to prolong life expectancy and manage chronic disease states (Department of Health 2000a; Weinstein 1999); and the anticipation of the first of the post war 'baby-boomer' generation reaching retirement in 2011 (Hartman-Stein & Potkanowicz 2003).

The incremental political changes which had begun twenty years previously, coupled with rapid change in health care organisation had led to what was beginning to look like a 'perfect storm' for the nursing profession. The need for nurse education to respond and prepare nursing students for the changing roles which they would be expected to undertake was now urgent.

In order to address the need for change, it was first necessary to determine how and why the existing system was failing. The education of nurses in the UK is undertaken as a partnership agreement between Higher Education Institutions (HEIs) and Health Care Providers (HCPs). The competent authority responsible for registering nurses in the UK, the Nursing and Midwifery Council, stipulates that all nurses must undertake at least 2300 hours of clinical practice (hands on care of patients/clients) and 2300 hours of theory (HEI based learning activities e.g. lectures/tutorials/lab practicals/reading) during their training (NMC 2004; NMC 2010). The NMC Standards of Proficiency for Pre-registration Nursing Education (2004) set out a framework of competencies required for entry on the Nursing Register. These competencies were defined as "… the skills and ability to practise safely and effectively without the need for direct supervision" (The UKCC Commission for Nursing and Midwifery Education 1999), and formed the criteria which students and mentors were following from 2004 until they were updated in 2010. By necessity, there is a division between what is expected to be learned

in theory, in the HEI, and what will be learned in the clinical practice setting (the clinical placements) provided by the HCPs. In the analysis of nurse education programmes and nursing theory (e.g. Miller 1985; Schumacher & Meleis 1994), three significant confounding factors emerged:

1. Reduced exposure: As a result of the changes to work practices, it became necessary to reduce the number of clinical placements in the programmes, i.e. fewer placements but longer duration. Locally this meant that each student would have six placements, two in each year of the programme, including one community placement, and one High Acuity placement. When these restrictions are combined with the serendipitous nature of patient presentation, it becomes impossible to guarantee that every student experiences the full range of care expected prior to registration as a nurse.

2. Reduced mentor experience: When working in clinical placement, the students are guided by a qualified nurse mentor who is also their assessor. The identified decrease in the number of experienced nurses means that the mentors are themselves less experienced than in the past. Consequently, the students have less exposure to, and feedback from, experienced role models. This limits their understanding of, and aspiration for, the achievement of excellence.

3. The theory-practice gap: The conceptual divorce of nursing theory and nursing practice (the Theory-Practice gap) is perpetuated by 'professional and organisational sabotage'. An anecdotal example of this is the students' common response to being taught Evidence Based Clinical Skills in the HEI, - 'It's never done that way in practice, so why are you teaching us that?' There is a significant risk that the students' perception that nursing academics do not understand the real world of practice will erode their trust in all theoretical nursing knowledge

By the mid-2000s, Alinier et al (2006) observed that simulated practice had evolved as one solution to these identified difficulties and was becoming common practice in nurse education. The University of Southampton had been an early adopter of simulated practice and in 2003 established our own 'brand' of simulation, Virtual Interactive Practice ™ (VIP™) defined as:

> A real learning experience from an interaction, that has no steer or effect(s) on patients' or client outcomes, being separated from the event by time and or distance.

> (Watkinson et al 2004 p 747)

VIP™ varied from other examples of simulation activities by building scenarios with real patient data extracted from the Clinical Information Systems of the University of Southampton's National Health Service (NHS) Trust partners. The students were first introduced to the patient case or event through an eLearning activity prior to an associated simulated practice activity in the simulated ward environment (Gobbi et al 2004; Watkinson et al 2004; Watkinson et al 2006).

VIP™ addresses the three confounding factors:

1. Reduced exposure : The activities were designed to guarantee student exposure to events which a newly qualified nurse would be expected to be able to deal with, but which student feedback indicated were not always experienced in practice placements e.g. Intramuscular injection in children, reporting a drug error, telephone referral to medical staff, and dealing with aggressive relatives.
2. Reduced mentor experience: The activities were based on real patient events and data, and devised in partnership with senior NHS colleagues. The simulated practice sessions were facilitated by both academics and experienced clinicians, ensuring the students' exposure to, and feedback from, experienced and credible role-models.
3. The theory-practice gap: We established secondment opportunities for clinical staff from our NHS partners to mentor students in the simulated practice activities. The Clinical Skills Facilitators, working in partnership with academics, and by being overtly clinically credible ensured that students perceived the relevance of simulated practice to the real world of practice. Interestingly, the Clinical Skills Facilitators reported that they found their experiences with students in simulation informed the way they mentor students in real practice, and that they were often used as a resource by their colleagues.

The successful development of VIP™ was contingent on the availability of a realistic simulated ward environment. To this end, the Faculty supported an ambitious internal funding bid to upgrade and equip the existing skills facilities, including the installation of a video recording system. A description of this environment is provided in section 1.2.

VIP™ was first piloted in 2003, with a second pilot in 2004 taking the form of a week long experience for fifteen Year 3 child branch nursing students. This was evaluated using standard educational evaluation methods (Guba & Lincoln 1981) plus the collection of approximately ten hours of video captured data of the students in simulated practice. Between 2004 and 2006, these activities were developed and embedded in the branch (field) curricula.

In 2006, the Faculty engaged in a period of research activity comprising three studies:

1. The Nursing and Midwifery Council (NMC) commissioned 'Simulation and Practice Learning' evaluation which involved 18 Higher Education Institutions. This study was a multimethod evaluation of the student and facilitator experience of simulated practice contributing to the NMC's national review (NMC 2007). This included approximately 150 hours of video recorded simulated practice activity of 1062 students, the entire Year 1 and Year 2 cohorts.
2. A Small Grant application to the Higher Education Academy (HEA). This utilised a subset of the students (adult and mental health) to examine the utilisation of simulated activity for assessment, using an ethnographic approach, and engaging student participation in assessment design.
3. A collaborative study with the School of Electronics and Computing Science and the Social Statistics Research Institute, funded by the Economic and Social Research Council (ESRC). This developed a semantic annotation tool, and used grid-enabled technology to link and statistically analyse student data from their interactions with web resources.

These three studies were linked to one period of educational activity in the academic year 2006/7. From an operational perspective, a single overarching research proposal incorporating the objectives for the three studies plus the objectives for this doctoral work, was presented to and approved by the Faculty Ethics Committee. Meticulous planning and co-ordination of the period of activity facilitated successful data collection and completion of all research objectives; submission of the final reports to the Commissioning/funding organisations; and subsequent publication of the results (Gobbi and Monger, 2009; MacDonald et al, 2008; Weal et al 2007).

The NMC used the evidence produced by the 'Simulation in Practice' project to underpin a change in the regulations for nurse education, enabling up to 300 of the 2300 practice hours required for registration as a nurse to be undertaken in simulated practice activity (NMC 2007). This has prompted a more general acceptance of simulated practice as a legitimate technique for healthcare education in the UK.

This section has defined the set of circumstances which formed the rationale for this doctoral work. The key drivers for the selection of the field of study have been identified, as has the infrastructure which led to the use of simulated practice as the platform for the research and video as the medium for analysis.

2.2   Physical context

The successful application for internal funding in academic year 2002/3 enabled the upgrade of the existing skills facilities in the Faculty of Health Sciences. The facilities comprise two five bedded simulated wards. Each bed space is equipped as it would be in a real hospital environment. Both rooms have a wall mounted plasma screen which can be used to display live images from the video cameras, playback video recordings, or connect to a laptop computer or the internet. Pan-tilt-zoom video cameras are mounted in the ceiling to provide complete coverage of the ward. Each camera has a linked microphone which drops down from the ceiling at the head of each bed. The

rooms also have ceiling mounted speakers which can be used to play looped recordings of the background noises of a real ward environment e.g. talking, footsteps, equipment being moved, alarms sounding, phones ringing, doors banging etc.

Figure 1: The simulated ward environment.

The central control room houses the video recording control equipment. It also houses the infrastructure to supply the bed head services, compressed air and suction, and is used for the storage of consumables.

Figure 2: The control room.

Alongside the investment in the physical environment, the funding enabled the purchase of two additional sophisticated patient simulators. The simulated practice activities were based around these patient simulators and it was subsequently possible to run simulated practice activities in both wards simultaneously. The Laerdal Sim-man® patient simulators are full sized mannequins, which are controlled by a lap top computer. The mannequin is a linked to a dedicated air compressor which produces a realistic breathing pattern and carotid, radial and femoral pulses, and a patient monitor. Electronics inside the mannequin control eye blinking, pupil reaction and the production of realistic heart and lung sounds. The control laptop enables the operator to change vital signs during the course of the scenario, as prompts for student activity. The operator can also verbally respond to students as the patient by speaking in to a headset microphone, the sound from which is transmitted via a speaker in Sim-man®'s head.

Figure 3: The Sim-Man® patient simulator

As mentioned in section 2.1, the VIP™ simulated practice activities are based on real patients and events, and these are used to programme the Sim-man® patient simulator. The scenario is constructed to account for the expected student activity and is therefore broadly scripted. The students engage in the activity in groups of three or four and are supported by a qualified mentor from practice who responds to the students' progress through the activity. Members of the academic staff operate the Sim-man®, make distracting phone calls, and play the role of medical staff, relatives, porters etc depending on the scenario.

The script for the simulated practice activity used as the focus of the video recorded activity analysed in the final study is presented in Appendix 1. In summary, an elderly lady is being cared for on her return to the ward after a

hip replacement. She is dehydrated and as a consequence develops an abnormal heart rhythm. The students are expected to recognise and manage this relatively common example of patient deterioration. Following the activity the students are debriefed by the scenario facilitators. The students are guided through a reflection of events, pointing out links to theoretical understanding (Fanning & Gaba 2007). The students debrief generally takes as long as the scenario itself.

The historical and physical contexts define the set of circumstances and the environment which enabled this research to be undertaken. The use of technology is pervasive and overtly embedded within the structure of the methodological approach. It will be introduced and justified at relevant points as the thesis develops. The next two sections define the two fundamental concepts which constitute the rationale for the research.

This thesis is constructed upon the premise that competence is an example of tacitly understood behaviour. It is therefore necessary to define the concepts of tacitly understood behaviour and nursing competence as used in this research. Once philosophically defined, the research design is constructed to provide evidence of the validity of this premise, in addition to developing a solution to the identified problems of researching tacitly understood behaviours.

2.3   Tacitly understood behaviour

I have a childhood memory of being taken to see Michelangelo's *David* in Florence. Standing at the base of the statue, surrounded by a crowd of other tourists, there was a palpable shared but silent understanding of 'something'. Intermittently, conversations could be overheard, with individuals struggling to articulate what it was: beauty, perfection, awe, wonder. No-one was successful; no words seemed to capture it. However, it was obvious, even to a child, that whatever it was, it was universally but silently understood; unspoken.

Throughout history, philosophers have recognised and acknowledged the unspoken.

Descartes described this in his 'Discourse on Method' in 1637.

> And I thought that, in order to know their real sentiments, I should
> observe their actions rather than their words, not only because the
> corruption of our manners and customs makes most people unwilling
> to declare what they believe, but because many do not know it
> themselves: for the activity of thought by which we believe something
> is different from the activity by which we know we believe, so that one
> can exist without the other.
>
> (Descartes 1960 p53)

The recognition that the complexities of behaviour cannot be described in
words is the focus of Polanyi's (1966) 'The Tacit Dimension' where he states

> We can know more than we can tell.
>
> (Polanyi 1966 P4)

and

> All descriptive sciences study physiognomies that cannot be fully
> described in words, nor even by pictures.
>
> (Polanyi 1966 p5)

In 'Truth and Method' (2004), Gadamer discusses how images are just a
different type of language – one at which we are adept at reading, and need
new ways of understanding. However, many of the mid-20th century
philosophers focussed on the predominance of language and text, to the
exclusion of any other type of language, for example; Chomsky's Theory of
Linguistic Competence, and Habermas' Theory of Communicative Action.
Habermas even went so far as to consider that it would be possible to
generalise this proposition to a broader notion of communicative competence,
which is summarised by Outhwaite (1996).

> If we take generative grammar as a model for developing a universal
> pragmatics, why should we not be able to discover and reconstruct the

rule systems according to which we generate contexts of interactions, that is the symbolic reality of society?

(Outhwaite 1996 p65)

Habermas is suggesting that it should be possible to produce a universal code of society, in the same way we have grammatical rules in language. When considering research of tacitly understood behaviours and the potential of visual media for that research, it is significant that Habermas later abandoned this idea. He concluded that social theory should stand on its own and that it would be necessary to give up the search for foundations in a direct or indirect linguistic form. In other words, language alone did not provide the key to unlocking the nature of society. Habermas did however stand by his theory of communicative action as an expression of the interaction between individuals and the 'systems' of society.

Although not generally explicitly referred to, philosophers' propositions for the interpretation of meaning do not necessarily exclude tacit understanding. This is illustrated in Heidegger's 'Being and Time' (1962) where the concept of Dasein is proposed as the basis for understanding the primal nature of Being, where Being is always situated, that is 'Being-in-the-world'. The proposition is that in order to understand 'being', it is first necessary to accept the influence of the context in which the being exists; that the 'being' will be a product of the influences upon it. Heidegger's existential-ontological hermeneutic argues that interpretation does not lead to understanding, as proposed by Betti (1967 cited Bleicher 1980), nor is it that we acquire knowledge about what is understood about the 'world', but that we should search for the possibilities of what is known. Bleicher (1980) summarises Heidegger's hermeneutic as

Understanding is a fundamental existentiale that constitutes disclosedness of being in the world; it contains in itself the possibility of interpretation i.e. the appropriation of what is already understood.

(Bleicher 1980 p101)

This suggests that to understand the 'Being in the world', it is necessary to search for what is disclosed, which implies that the understanding exists and

that it is manifested in some way. Importantly, there is no pre-requisite for 'what is already understood' to have been articulated. Tacit knowledge constitutes an understanding which has been disclosed, but in a way other than articulation. The challenge is to understand this disclosedness; the indicators of which are recognisable and contribute to the knowledge of being in the world.

The discussion of these five philosophical perspectives on tacitly understood behaviour highlights an important distinction between knowledge and understanding. There is a consistent and implicit acceptance that one can possess knowledge without understanding, whilst it is also possible to understand without explicitly being able to articulate what is known. These phenomena are often alluded to but rarely explicitly addressed and often intertwined. To illustrate this point Carper (1978) identifies four types of 'knowing' in Nursing, as distinct from knowledge: empirical, personal, aesthetic and ethical. Empirical 'knowing' is identified as the knowledge of facts, with or without understanding. However, the remaining three types of knowing are implicitly described as understanding with or without knowledge. The situated nature of this conceptual argument is clear, although the absolute distinction between knowledge and understanding is not evident. The situated context of 'practical knowledge' is the means by which Usher et al (1997) argue their case for a post-modern interpretation of education practices.

> Practical knowledge cannot be universal because it cannot 'look away' from its context. Contexts are not particular instances of a universal characteristic because they have too many unique and indeterminate features. A context cannot be acted upon through the application of rules invariant across all contexts. Furthermore, practical knowledge is not knowledge of what is right 'in principle' or 'in theory', since it is not contemplative but performative knowledge – it is the enacted answer to the question 'How ought I to act?' It cannot, therefore, be knowledge which is external or 'objective' to the knower, rather it is knowledge 'with prejudice', where the knower is constituted through a set of pre-understandings through which to know the world and act within it.

(Usher et al 1997 p 128)

This quote illustrates the nature of the conceptual distinction they are attempting to articulate; the 'messy' nature of knowledge and the challenges of defining that knowledge as it is used in practice. They propose that a set of pre-understandings establish context, although it has not been possible to disentangle knowledge and understanding. However with tacitly understood behaviour, it is possible to make such a distinction. This behaviour is characterised by the presence of conscious or subconscious understanding, but in the absence of knowledge, i.e. the conscious recognition of fact.

Tacit understanding may be individual. As Descartes described, people cannot necessarily describe what they believe as they may not know it themselves, it remains in their subconscious thoughts. On occasions, however, there is a collective understanding of behaviours in the tacit dimension, as witnessed at the feet of Michelangelo's '*David*'. Where the tacit dimension is commonly understood in this way, those who have gained understanding must have recognised disclosed indicators. The problem is that it is not possible to find a form of words which describes the disclosed indicators, however the inability to articulate them does not necessarily preclude the ability to understand them. The disclosedness which has been recognised may be in a form other than linguistic e.g. sensory, emotional, musical, or even spiritual. In these cases, there is the potential to identify the indicators, not in words, but in the form in which they are recognised.

When considering the study of student nurse competence, the ability of assessors in practice to recognise whether students are competent or not - whether they have got 'it'- suggests that this is an example of behaviour which is collectively and yet tacitly understood. In order to establish face validity for this proposition, it is necessary to review the ways in which the study of nursing competence has been approached in the literature.

2.4   Nursing Competence

There has been academic interest in the study of nursing competence for more than 30 years. In 1988, Ellis wrote:

The observation and identification of nursing competence has, then, been tackled from a number of perspectives. Regrettably no single one of them seems to have been particularly successful, and the careful delineation of areas of specialised knowledge and skill needed for professional and educational purposes is not yet to hand. Progress can be detected, however, and it may be that some combination of existing methods would be profitable.

(Ellis1988 p129)

This quote succinctly summarises the state of theoretical understanding of nursing competence towards the end of the 1980s. Ellis accepted that progress in understanding had been made. This was most notable in Benner's 'From Novice to Expert' (1984), based on the Dreyfus and Dreyfus '5 Stage Model of the mental activities involved in directed skill acquisition' (1980), and still considered the seminal work on nursing competence. Benner describes a theoretical broad categorisation of five stages in the development of clinical nursing skill: Novice, Beginner, Competent, Proficient and Expert. In addition, Benner identifies 31 competencies in seven categories of activity. Although face validity can be identified, this remains a predominantly theoretical construct, describing 'practice capacities' as opposed to traits, talents or observable behaviours. Of particular interest to this thesis is the acknowledgement of the tacit nature of behaviours associated with competence acquisition. Benner (1984) says

When experts describe clinical situations where their interventions made a difference, some of the knowledge embedded in their practice becomes visible. And with visibility, enhancement and recognition of expertise becomes possible.

(Benner 1984 p36)

The description of the concept of visibility implies that this 'knowledge' is generally 'invisible'. Benner could have chosen many other words e.g. obvious, overt, evident, explicit, clear, but chose 'visible' as the one word which conveys the nature, and power, of observed behaviour. The proposition that verbal descriptions of observations of nursing practice can uncover invisible

behaviours becomes one of the fundamental elements of the technological tool which is described in Chapter 5.

In 1984, when Benner was conducting her research, there were limitations to the choice of methods available for behavioural research. There was little use of technology for research, other than audio recording, and therefore data collection was reliant on direct observation or interview techniques. In addition, as a pioneering nurse researcher, she was dependent on the application of traditional research methods to establish her credibility. She describes an interpretive approach to interview analysis, drawn from Dreyfus and Dreyfus (1980), which acknowledges the importance of situated context, and the intention and understanding of the participants.

> …. once the context of the actual situation is described, the number of possible interpretations or meanings is limited. Usually one or two 'best' interpretations emerge because the meaning of the situation is maintained rather than stripped away to objectified, context –free traits or behaviours (Dreyfus1979).
>
> (cited in Benner1984 p40)

The maintenance of the meaning of the situation to the participants is recognised as fundamental to the process of interpretation in this statement. It also warns of the inappropriateness of stripping the meaning away to leave 'objectified, context-free traits or behaviours'. Benner asserts that a benefit of this approach is the negation of the necessity of endless lists of tasks, but remains compelled to complete this work with the production of a list of 31 competencies in seven domains. This highlights one of the major difficulties in the notion of competence, which is that in describing an activity, it is entirely possible to reduce competent performance of that activity to an extremely detailed list of its component parts. Despite the philosophical reticence inherent in her writing, Benner's work (1984) led to a prolonged period of competency list production across the healthcare domain. These lists, in a variety of forms, remain essential components of nursing education and practice.

The NMC (2010) Standards for Pre-registration Nurse Education is essentially a list of competencies which students are required to provide demonstrable evidence in order to register as a nurse. Another and even more detailed example is the Royal Marsden Manual of Clinical Nursing Procedures (Dougherty & Lister 2011). This provides 'recipes' for the sequences required to perform a wide variety of nursing tasks and is routinely referred to by nurses in practice as the 'Gold Standard' in the UK. In the 1980s and early 1990s many tick lists for elements of nursing competence were developed (e.g. Alspach 1984; Dugger 1993; Robinson & Barbaris-Ryan 1995). As a method to objectively measure competence, these tick lists continue to have a place. However, the practical experience of assessing competence in this way highlights that successful completion of a sequence of activities is not necessarily comprehensive. It is possible to perform a sequence accurately but to do so in such a way that the meaning of the actions may not be regarded as competent e.g disrespectfully, arrogantly, nervously. This highlights an important distinction which influences the definition of competence. Competence is not only what is done, but how it is done. In later work, Benner (2004) recognised this and used Aristotle's distinction of 'techne'- the appropriation of scientific knowledge (the science, the what); and 'phronesis' - situated actions based on skill, judgement, character and wisdom (the art, the how). The literature on the assessment of competence in health care since the late 1990s demonstrates a growing acceptance that judgement of competence requires a subjective assessment of the performance of a task, in addition to a tick list or framework for task completion. (Allen & Rashid 1998; Ram et al 1999a, 1999b; Hobma et al 2004; Scalese et al 2008). Polanyi (1966) had recognised this phenomenon more than 30 years before when he suggested that the intense scrutiny of an activity leads to a loss in meaning. He used the example that when repeating a word concentrating on the lips and tongue, the word becomes hollow and loses its meaning. He then points out that this meaning can be regained when one stops examining the minutii. The literature review indicated a growing acceptance over time that the reductionist approach to the definition of competence was overly simplistic and insufficiently sophisticated to address the subtle 'meaning' inherent in the performance of a task.

More recent literature demonstrates a rejection of the reductionist approach and a return to the academic struggle to define a theoretical concept of competence. There is a predominance of literature reviews, (e.g. Watson et al 2002; McCready 2007; Yanhua & Watson 201), concept or critical analyses (e.g Axley 2008; Tilley 2008; Harper 2009; Garside & Nhemachena 2012) or discussion papers (e.g. Dolan 2003; Gonzi 2004; Fordham 2005). This serves as an indication of the continued importance of competence to the profession, but also the continuation of the lack of progress identified by Ellis, 20 years previously. Garside and Nhemachena's (2012) Concept Analysis of Nursing Competence confirms Ellis's (1988) assessment, and concludes that it is unlikely that a definition of competence will ever be achieved

This historical review identified that there is no universally accepted definition of competence, neither is there a comprehensive straight forward coding system to assess nursing competence. However, in order to accurately assess the potential for the production of a specific coding framework which could be used for research, it was prudent to amalgamate the categorisations which had been identified in the literature. This categorisation has face and content validity, but is lacking the objectivity which would be required for a useful research tool. This exercise highlighted that the majority of these dimensions, the dimensions identified in red font in Table 1, refer to behaviours which are professionally but tacitly understood.

Nurses express understandings of what these dimensions mean in the context of their own and other nurses' practice, but the articulation of how a nurse demonstrates for example: 'facilitating' 'helping' or 'comforting', is elusive.

Buller and Butterworth (2001)	Benner (1984)	Zhang et al (2001)
Relating and communicating	Helping	Interpersonal understanding
		Compassion
		Comforting
		Persuasiveness

Doing the Job	Diagnosis and patient monitoring	Information Gathering
	Administering and monitoring therapeutic intervention	Thoroughness
Managing and Facilitating	Teaching and Coaching	Commitment
	Effectively Managing rapidly changing situations	Responsiveness
	Ensuring the quality of Health Care practices	
Being Professional	Organisation and Work Role	Critical Thinking
		Self control

Table 1: Amalgamated Dimensions of competence

In conclusion, neither the theoretical nor the reductionist approach to articulate the nursing profession's understanding of competence have successfully defined specific indicators of competence, where competence is not only what is done (the science) but also how it is done (the art). Albert Einstein is purported to have said 'The significant problems we face cannot be solved at the same level of thinking we were at when we created them'. The perpetuation of the conundrum that is nursing competence appears to be an example of this phenomenon. Video-View-Point is a new way of approaching this problem.

3. Literature Review

During 2004/2005, periodic and informal searches of the healthcare literature had identified the predominantly traditional research methods used by researchers for the analysis of video. These methods (quantitative evaluation, thematic analysis, transcription, ethnography, and the attempt to produce a coding tool) were tested in the exploratory studies. The findings of the exploratory studies confirmed the potential for video captured behaviour to be used as the source of data. In addition, the advantages, disadvantages and limitations of existing research methods when applied to video captured data had been highlighted. The next logical step was to broaden the literature search to review all published research which reported methods of video analysis. This was necessary to establish whether a validated method from another discipline could be used or adapted to elicit tacitly understood indicators of student nurse competence. It transpired that no such method existed, however the comprehensive understanding of the 'state of the art' proved to be a major contributory factor in the development of Video-View-Point.

3.1 Literature Search Strategy

The formal literature search for methods of video analysis was undertaken in 2010, and updated in December 2012. The electronic search strategy employed ensured comprehensive retrieval of all relevant literature from the domains of medicine, health sciences, social science, behavioural science, computer science, psychology and education. The electronic databases relevant to these domains were identified. These databases could be efficiently searched through the Web of Knowledge gateway (which provides access to the Medline, Web of Science, Biosis, and Inspec databases) and the Cumulative Index of Nursing and Allied Health Literature (CINAHL) database. The list of studies incorporated in this review (Table 14) and categorised by year of publication and method of video analysis is presented in Appendix 2.

3.1.1   Web of Knowledge

Web of Knowledge is a Gateway to a number of databases facilitating access to a broad range of subject areas. The advanced search options allow for searches by date, publication type and general and specific subject fields. It was found that the order of the search term input led to different outputs, therefore three separate searches were used to produce comprehensive coverage of both subject area and methodological approach.

Search 1

The term 'Video analysis' was searched with no date restriction and resulted in more than 100,000 hits. This was filtered to include Behavioural Science, Psychology and Education/Education Research, only publications in English, and exclude editorials and meetings. This produced 60 results which were then searched by title. Forty five were excluded for the following reasons: fourteen used videos, whiteboards, webcasts, webcams and teleconferencing as tools for training or other research. Six used videos for self-reflection/illustration, four used the internet, MySpace and YouTube and eText, five used CT imaging, one used automated face recognition, two used cultural learning environments, eight used games and gaming, two used adverts and three were commentary and not research. The remaining fifteen are included in the analysis.

Search 2

The term 'Video analysis' was searched without date or subject area restriction and generated 67,851 hits (the reason for variation from search 1 is unknown) then Chinese language excluded - 62,659. Then meetings/editorials excluded – 25,523. Then the search term 'abstraction' was added with the Boolean operator AND, to identify the computing science literature where abstraction is the term used for extraction of content. This produced 44 results.

These 44 were searched by title/abstract, 40 were excluded for the following reasons: nine used computers to generate story board summaries, one used a neonatal information system, three used CT imaging, five identified regions of interest, ten focussed on computer architecture, six used automated image interpretation, two were chemistry experiments, one used video streaming, one was a political discussion, one used robotics, and one focussed on green energy. The remaining four are included in the analysis.

Search 3

The term 'Video analysis' was searched selecting subject areas Social Science, Arts, and Humanities and using the Boolean operator AND to include the additional search term 'method'. The purpose of inclusion of this term was to ensure that all methodological papers were identified. In addition the search was refined to include only publications in English, and to exclude meetings or other publication types. The previous searches informed the exclusion of the following domains: geology, food science, mathematics, agriculture, engineering, chemistry, meterology, radiology, nuclear medicine, material science, computational biology, microscopy, astronomy, optics, construction, environmental science, ecology, neurology, fisheries, business, forestry, physics, cell biology, instrumentation, ophthalmology, crystallography, biophysics, telecommunications, acoustics, automation and control, mechanics, geochemistry, geophysics, physical geography, robotics, spectroscopy, remote sensing, transport and reproductive biology.

This produced eleven papers, six were excluded for the following reasons: one used video as a tool, two used teleconferencing/telemedicine, one used spectral analysis, one used music, and one contained insufficient information to categorise. Of the remaining five, two had already been identified in other searches, leaving three to be included in the analysis.

3.1.2   CINAHL

CINAHL is a well-established (journals accessible from 1980 onwards) and sophisticated database with a variety of advanced search options, e.g. date, publication type, Boolean operators etc. The advanced search options were applied in a number of combinations to filter the search, as is standard practice. It became apparent that the variety of techniques used to analyse video, the variability of the terminology and lack of standardisation e.g. MESH terms, in this newly emerging field meant that filtered searches did not produce a comprehensive output. A less sophisticated approach was therefore employed.

The term 'Video analysis', was searched from 1980-date, which without exclusions generates more than 10,000 hits. Articles not in English and meeting reports were then excluded, reducing the number to 6,395. Previous

search attempts had identified the prevalence of the emerging field of motion analysis, used in physiotherapy and sports science. This involves the placing of markers, generally on limbs, and videoing the range of movements in different circumstances, and then using computer software to analyse the motions observed. Motion analysis was therefore excluded using the Boolean operator NOT. This search produced 252 hits. The titles of the 252 articles were then scrutinised and exclusion criteria applied.

The lack of standardised terminology resulted in 178 of these 252 being identified as forms of motion analysis, (not picked on the search exclusion because of differences in terminology e.g. gait studies, joint studies, range of movement, or specific conditions/sports,) and therefore excluded.

Of the remaining 74, seventeen were excluded for the following reasons: ten used video as a tool for other research e.g. stimulated recall, or teaching tools, one used video as a decision aid, one used a video conferencing application, three used video of Electroencephalogram (EEG)/Doppler studies, one used automated image analysis, and one chemistry experiment.

The abstracts of the remaining 57 were then scrutinised and a further nine were excluded for the following reasons: four used video as a tool for other research e.g. others perceptions of the use of video, two were motion studies, one EEG study, one was not published in English and one was a conference proceeding with insufficient information to categorise.

The remaining 46 papers are included in the analysis.

3.1.3   Secondary searching

The results of these searches were compared with the literature previously identified during previous attempts at searching the literature. There was considerable overlap, particularly in the earlier publications, which demonstrates comprehensive retrieval. There were however seven papers which had been obtained by secondary sourcing from reference lists, or which met the criteria from Google Scholar searches and were therefore worthy of inclusion in the final sample. These papers are: Digiacomo et al (2007); Xiao et al (2004) ; Roberts et al (2003) ; Walther et al (2002/3) ; Parmeggiani (2008) ; Koch and Zumbach (2002) ; and Pea et al (2006).

A total of 73 papers, published between 1986 and 2010, were included in the analysis.

3.1.4   Literature search update 2012

The previous searches in CINAHL and Web of Knowledge were repeated in December 2012. The searches were restricted to 2011 to date. For ease of reporting these searches have been combined. A further 147 articles were identified. 119 were excluded as follows: fifty one were motion analysis, six were review articles, sixteen used video as a tool, eight used graphics/animation, seventeen focussed on Video processing, eighteen used medical diagnostic or treatment tools, and three were not in English. The remaining 26 articles are included in the analysis. The 2010 and the 2012 searches produced a total of 99 papers and these are listed in Appendix 2.

3.2   Categorisation of the Literature by method

The first example of the use of video analysis for research was published in 1986. From 1986-2001, a period of fifteen years, there were thirteen relevant articles published in the field, less than one per year. In the subsequent five years (2002-2006) a further seventeen articles were published, increasing the rate of publication more than three fold. Between 2007 and 2009, the publication rate nearly doubled to a rate of approximately seven per year. In 2010, this rate had increased to twenty five, a further trebling. At this point the trend appears to have peaked with fourteen articles published in 2011 and twelve in 2012. This can be explained by an apparent change in the computing science community's focus in relation to video. All of the thirty eight identified computing science studies identified in 2011/2012 were excluded as they were concerned with automatic video processing/summarisation, surveillance and graphics applications.

In total, ninety nine studies were included in the analysis. The primary purpose of the review was to examine the methodological processes employed, and therefore the studies were categorised by method. It should be noted that this is based on the description of the methods provided by the authors. In some cases the stated method may be disputed e.g. stating the use of Grounded

Theory without evidence of how this was achieved, or the execution of the method described may not always be of the highest quality e.g. there was considerable variation in the quality of the evidence presented in the five studies purporting to use ethnography. Figure 4 illustrates the categorisation by method, and the number of studies in each category.

```
                    ┌─────────────────────────┐
                    │ Categorisation by method │
                    └─────────────────────────┘

┌──────────┐                                              ┌──────────┐
│ Counting │                                              │  Other   │
│  (10)    │                                              │  (14)    │
└──────────┘    ┌──────────┐   ┌──────────────┐           └──────────┘
                │  Coding  │   │ Transcription/│
                │  (42)    │   │ Textual (33) │
                └──────────┘   └──────────────┘
                                                    ┌──────────┐
┌──────────────┐  ┌──────────┐  ┌──────────┐        │ Thematic │
│Using a validated│ │Producing │  │ Grounded │        │ analysis │
│    tool      │  │a tool (2)│  │Theory (2)│        │and other │
└──────────────┘  └──────────┘  └──────────┘        │  (8)     │
                              ┌──────────────┐      └──────────┘
                              │ Ethnography  │
                              │    (5)       │
                              └──────────────┘
┌──────────┐   ┌──────────────┐   ┌────────────────────┐
│ Clinical │   │Communication │   │Discourse/Conversation│
│scoring tools│ │ codes (25)  │   │  Analysis (18)     │
│  (15)    │   └──────────────┘   └────────────────────┘
└──────────┘
```
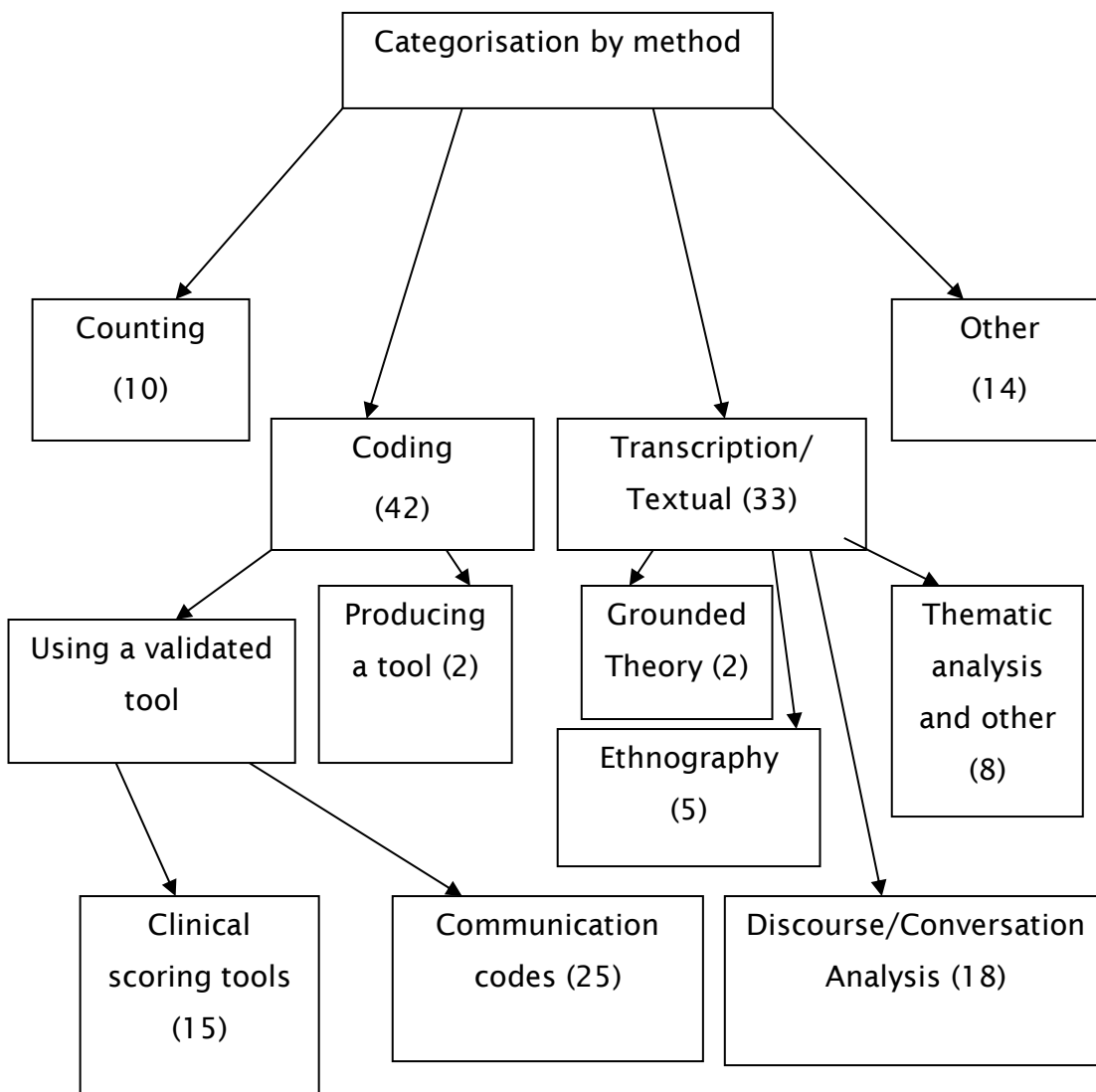
Figure 4:Categorisation of the literature by method

This categorisation is used as the structure for the literature review. The review is not intended to be a formal critique of the published studies. The objective is to evaluate the published evidence for potential solutions to the challenges of video analysis identified in the previous chapter: the difficulty of producing a coding system where behaviour is ill-defined or tacitly understood; the

challenges of transcribing multidimensional activity; and the technical problems of handling large volumes of data.

During the course of the 2010 review, the existence of Computer Assisted Qualitative Data Analysis Software (CAQDAS) programmes became apparent. Although only two studies stated that they had used a CAQDAS programme, there was a possibility that an appropriate tool for the analysis of video would be available. Therefore the final section of this chapter provides an overview of CAQDAS Programmes.

3.3   Counting

Ten studies describe counting as the technique for analysis. This is the simplest method of video analysis identified but it is an effective approach to measure frequency or duration of behaviours/interactions etc. Diagocomo et al (1997) counted the number of occasions Health Care Professionals put on gloves during resuscitations in the emergency department. Although straightforward, they comment on how time consuming the process was. They did recognise however that being able to take breaks, and to recheck, during the analysis was advantageous. Bagley et al (2009) wanted to know whether Physiotherapists accurately recorded consultation times with clients, and compared the physiotherapists written records with a video of the consultation. Unsurprisingly they found that the records were inaccurate. Couchman (1996) transcribed videos of clients with learning difficulties when carers were not present and counted and quantified episodes when interactions with other clients occurred.

Routasolo and Lauri (1998) explored expression of touch between nurses and five elderly patients. In addition to counting episodes and durations they also undertook a thematic analysis to categorise the types of touch. Cocks et al (2007) counted gesture rates during different types of communication in patients with Right Hemisphere damage when compared with gesture rates in a control group. Jenks and Higgs (2007) were interested in the influence of dieting on the smoking behaviour of women. They counted the number and duration of puffs, and also measured the length of the cigarette left at the end of the smoking episode. Aina and Olorunshola (2007) counted the occasions of substance and alcohol use in 479 Nigerian films in order to demonstrate the

potential to trigger or reinforce substance use in their audiences. The observers were the researcher and two adolescent secondary school children and the rigour of the process is questionable. Despite the very basic data produced, the researcher makes a number of assumptions and recommends censoring videos in the interests of public health.

Two papers specifically focussed on language impairment. Kot and Law (1995) studied language impaired children and counted their initiations of interaction associated with two different interventions. Hindhede (2010) examined audiological consultations with particular emphasis on the ritualistic nature and time structuring of the event. They describe the study as empirically based, although the main focus is social power variations, the judgements about which are subjective. The counting part appears to be an attempt to legitimise an otherwise subjective analysis.

There is one final paper in this category which cannot be otherwise classified, an analysis of the frequency and intensity of movements in ballet dancers (Twitchett et al 2009). They also use coding for other elements of the performances and demonstrate rigour in the analysis.

Three important issues were identified in this category. Firstly, that the ability to be able to replay video is an advantage when considering accuracy. This enables not only the checking of findings, but also corroboration by a different observer. It was notable that even this simple form of analysis was time consuming. Finally counting was used to explore distinct definable elements of behaviour, e.g gestures, movements, initiation of interactions, touch.

3.4   Coding

This is the most common method. Forty two studies describe the use of a variety of coding tools in a range of situations/populations. This is an accepted methodology for direct observational research. All of these researchers have made a general assumption that video observation is equivalent to direct observation. The majority of the coding tools have been previously validated for the subject of investigation. There are three sub-categories in the coding studies – those using a procedural or clinical scoring tool, those using a communication tool, and those attempting to develop a coding tool.

3.4.1   Procedural/clinical scoring tools

Fifteen studies used existing tools to code clinical procedures or patient episodes. There are six examples of clinical task related scores: Apgar scoring of neonatal simulations (Nadler et al 2001); compliance with the accepted procedure for chest drain placement (Seagull et al 2006); compliance with ATLS protocols in Emergency Departments (Lubbert et al 2009); compliance with sharps handling procedures by junior surgeons (Tso et al 2012); coding for dispatcher-rescuer teamwork in a simulated cardiac arrest (Birkenes et al 2012); and coding the use of tools by dentists in relation to work practices (Jonkers et al 2011). Two papers describe symptom scoring tools; Hunt (2007) evaluates the inter-rater reliability of a pain scoring tool and compares the score with videoed patient observation and cortisol levels, while Thomas and Locke (2010) evaluate a somatic complaints scale.

There are two studies looking at childhood immunisations. Pedro et al (2010) used an established coding system to explore the similarities and differences between the interactions of the children with parents and nurses. Horton and Riddell (2010) were particularly interested in the mothers' facial expressions of pain and fear, and coded for the infants pain response during immunisation.

The final group of five studies code for physical activities; Stockel and Weigelt (2012) studied dexterity in basketball players, McDonald et al (2011) tested for reliability and accuracy in a code for core ability in elite athletes, Savage et al (2011) coded for the risk of injury by mechanism, and Dirks et al (2011) and Blauw-Hospers et al (2011) are the same group of researchers studying infant physical therapy.

It is of particular interest that in this group of studies, with the exception of Lubbert et al (2009), all of the interactions are relatively short; a matter of seconds or minutes. Lubbert et al (2009) comment that of the 1,256 eligible trauma patient videos over the two year study period, only 387 were suitable for analysis. Although no reason is given, this indicates that they experienced significant practical issues associated with the collection/analysis of the videos. In Birkenes et al (2012), only the first and tenth minutes of the video recording were coded. Overall, these points demonstrate the difficulties faced by researchers in relation to the volume of data to be coded, they either failed to complete the task or limited the coding undertaken.

3.4.2   Communication coding systems

Existing tools have also been used to examine communication in various guises. Bylund (2010) examined the effectiveness of their communication skills training curriculum in a group of oncologists, analysing 112 videos of oncology consultations and scoring them against the tool derived from the curriculum, while Campion et al (2002) examined the communication strategies of GPs. Ram et al (1999) also described video assessment of GPs performance by a scoring tool. Their stated aim was to test for the reliability and validity of video assessment. They concluded that the video assessment was reliable and valid, although this is questionable as they did not compare direct and video assessment. Roberts and Bucksey (2007) used two coding systems, one for verbal and one for non-verbal communications when examining the interactions between physiotherapists and patients with back pain. Sparrow and Hird (2010) explored communication repair strategies in patients with cochlear implants. Mendoza et al (2010) used a reaction time measure of implicit stereotyping with the intention of examining reflexive control. A slightly different approach was taken by Makoul et al (1995) who compared perceived communication in a doctor/patient consultation as measured by questionnaire, with the actual communication which occurred on the video.   Barron and Topping (2010) described reviewing adult/student interaction during disclosure of abuse, which is similar to the next group of papers which relate to the study of developmental disorders in that the population studied are a vulnerable group.

Video analysis using communication coding systems has been extensive in the fields of autism and other related syndromes of developmental delay. Barenek (1999) and Barenek et al (2005a, 2005b, 2012) use retrospective analysis of home videos of children to explore sensory motor patterns and object play in infants with autism and Fragile X syndrome. Clifford (2007) also used home videos, as did Crane and Winsler (2008) coding pre-diagnosis behaviour to explore whether autism can be detected earlier. Flenthrope and Brady (2010) specifically studied Fragile X syndrome and the relationship between early gestures and later language. Allen and Marshall (2011) coded parent child interactions in children with language impairment. Phelan (2009) used a number of existing performance measures in patients with development disorders to look at correlations and reliability between measures. Qvarfordt et

al (2009) focussed on two girls with Retts Syndrome and strategies to manage their eating behaviours, while Blomqvist et al (2005) looked at children with Attention Deficit Hyperactivity Disorder and their interactions during a dental examination. The nature of the research in this vulnerable population, where preverbal or non-verbal behaviour is the subject for investigation, explains the choice of video as the medium for research.

The remaining papers in this group are less easy to categorise. Two are educational in nature: Von Aufschnalter et al (2008) use 'video and audio documents' of small group and classroom discussions to investigate Junior High School students' processes of argumentation and cognitive development in science lessons. These researchers transcribed the recordings and analysed the transcript against a theoretical framework. In the methods section, there is a very short paragraph which states that in addition to the videotape, due to 'technical details', the sound was recorded on audiotape, and that the transcripts are primarily taken from the audio documents. The researchers demonstrate a desire to use video as a means to elicit more information on the processes in question. However it appears they were unable to practically achieve this. In effect, little or no video analysis occurred. Preston (2010) described the use of coding of video as a tool to teach teachers, this paper was a discussion of the technique and not primary research.

Three papers are related to games or sport. Schug et al (2010) videoed faces of individuals playing ultimatum games and analysed their expressions in relation to co-operativity. Andersen et al (2003) asked two experts to code Norwegian football matches, to examine the nature of events which cause injury. Bolton et al (2011) studied tennis players, coding activities by time period.

Finally Kaji et al (2008) compared an on-site survey, observation and video analysis of teamwork when evaluating hospital disaster preparation. This was interesting in that they attempted to compare the methods, and concluded that there was no congruence. As the methods all measured slightly different things, this conclusion was not surprising. The paper undervalued the mixed method approach adopted, and did not capitalise on the value obtained by the different perspectives elicited.

In common with the studies in previous sections, all of these examples focus on distinct definable elements of communication. The ability to replay video

can provide added value by enabling to elicitation of different perspectives on the same activity, as well as the ability to corroborate findings. It was also notable that the use of video is an established technique for the exploration of preverbal and non verbal communication, where the absence of language led researchers to use video as the medium for data collection.

There are two further observations from this group of studies. Firstly, some researchers use video as an alternative to audio recording, with little if any additional analysis. They focus solely on the spoken words and use conventional text based methods. There is a clear desire to utilise the additional dimensions afforded by video but when presented with the practical task they default to the standard methods. Lastly this group of studies highlight that time periods can be used as a framework for analysis, rather than an interview schedule, or defined list of activities.

3.4.3   Using video to produce a code

There were two papers which used video analysis to generate a code. Porter et al (1986), the earliest paper, used videos to analyse types of nurse/patient touch. Tait et al (2001) built on previous work (Tait and Lutman, 1997) to develop their coding of preverbal communication in cochlear implant patients. This is a subtly different use of video. The researchers have acknowledged the ability to identify behaviours on video and are using this format as the tool to generate their coding schemes. It should be noted that of the 42 examples of coding, only two are using video in this way, and neither are recent applications.

3.5   Transcription/Textual Methods

Several of the researchers in the previous categories also used transcribed data which they coded or counted. This group of 41 studies formally used established textual analysis in several of its forms. This section is therefore sub-categorised in to those forms: thematic analysis, conversation/discourse analysis, ethnography, grounded theory and other.

3.5.1 Thematic analysis

Four papers described simple thematic analysis of video transcripts. Daniel (1998) described a collaborative process with a sample of women with heart disease to generate themes illustrating their experiences. Bunning and Ellis (2010) generated themes of communication in classes of special needs children learning English. Virta and Eriksson (2008) used thematic content analysis to illuminate the profession/patient interaction during clinical interventions and comment that the process required further methodologic development, including computerised aids for transcription. While Zhang et al (2010) thematically analysed rap music videos for themes e.g. sex and violence with a particular focus on female body image.

3.5.2 Conversation/discourse analysis

This is the largest sub-group comprising eighteen studies. The first set of papers focus on communication and particularly in populations where there is a communication deficit. Parry (2004, 2005), a physiotherapist with a particular interest in stroke patients, first looked at the management of incidents of poor physical performance, and then communication more generally, using conversation analysis of transcribed video consultations. Waller et al (1998) used conversation analysis alongside a battery of formal tests to evaluate the effectiveness of the use of a software program (TalksBac) to enable aphasic adults to engage in conversation. Wilkinson and Wielaart (2012) also focussed on the conversation strategies of aphasic adults, while Bloch (2011) used conversation analysis to specifically explore augmentative and alternative communication. Emmerson et al (2001) also studied the use of facilitated communication, using a variety of methods including textual analysis although the precise detail of the methods used is elusive.

The second set of papers focus on physical activities. Pappas and Seale (2010) examined the processes of physical examination when undertaken remotely by telemedicine link, where the verbal communication is paramount. Pillet-Shore (2012) used conversation analysis to study interpersonal interaction when people greet each other. Williams et al (2010) used conversation analysis to examine the potential for the role of the personal assistant for people with learning disabilities. Heath et al (2007) briefly described two examples of

conversation analysis used to explore GP prescribing behaviour and the processes involved in teaching during a surgical operation, although this paper is more about promoting the techniques than the techniques themselves. Seeberger et al (2009) used conversation analysis, video analysis and eye-movement analysis to uncover the strategies being employed by a twelve year old girl with Dandy-Walker syndrome in a 27 second episode where she was struggling to read a text. This is a comprehensive multimethod analysis and demonstrates the volume of data that can be generated in 27 seconds.

Two papers from Sweden, both situated in education, use philosophical frameworks in their conversational analyses. Ohman (2010) uses Foucault's perspective on power to analyse the direction of socialisation in Physical Education lessons. While Lidar et al (2010) used Wittgenstein's perspective on meaning making and reactualisation as their focus on the analysis of children's understandings of gravity and the shape of the earth.

A further three papers describe the use of Discourse Analysis. Axelrod et al (2006) explored the Human Computer Interface and described the development of a sophisticated coding system derived from Discourse Analysis to identify communicative episodes and the categorisation of emotions generated by computer users. Muntigl and Choi (2010) used discourse analysis to examine the use of 'not remembering' as an interactional resource in Couples Therapy.

Roberts et al (2003) describe using Discourse Analysis to elicit elements of good and poor communication in medical students. The simulation activity recorded was seven minutes duration for each student; however the volume of data produced made it impossible to transcribe all 309 tapes. They transcribed 28 tapes and do not state how long it took to analyse this amount of data, but it can be assumed that their initial intention was to transcribe all of the tapes and they could only transcribe 28/309 in the allocated time (i.e. it took more than ten times longer than expected). It is also unclear what level of detail was transcribed. This highlights a significant practical problem in the transcription of video to text. deLeng et al (2010) used a Transcript Analysis Tool to explore the modification of a method to analyse on-line learning to face-to-face communication. They discuss the fact that transcription took two hours for a

twenty minute video, and that evaluation was more efficient when video was analysed directly as opposed to analysis of the transcript.

Although some of the researchers acknowledge the additional data provided by the video, they have all focussed on the spoken words: the conversations or discourses. The difference between video-recorded and audio-recorded discourses is not explicitly identified, and in most cases as identified in previous categories, video is being used as a novel alternative to audio recordings. The observation by deLeng et al (2010) that direct analysis of video is more efficient than analysis of a transcript suggests that direct analysis of video is different to analysis of the transcript taken from the video.

3.5.3   Ethnography

Five papers describe the use of ethnography or ethno-methodolgical approaches. Sirota (2010) described the use of ethnographic video and audio recordings of the family life of autistic children. The focus overall appears to be the narrative and discursive nature of interactions, and as such remains language focussed. Vehkakoski (2010) described the use of ethnomethodological conversational analysis to explore the feedback given to very young children learning a new language. Their focus is the verbal responses of teachers to errors and the tension between correcting inaccuracy and causing disaffection. Again using young children as the subjects, Nind et al (2011) used ethnography to describe the social constructions used in different environments. Frogett et al (2007) undertook a formal ethnography of transcribed video interactions between a poet and a young offender; they took a psycho-societal perspective to explore the outcomes in relation to restorative justice. Iedema et al (2012) used an ethnographic approach to the analysis of a new Ambulance crew to Emergency Department staff handover protocol.

It is particularly interesting that all of the examples of ethnography applied to video, focussed on the verbal component of interactions. As ethnography generates a narrative analysis,' a thick description', it need not solely focus on the spoken word but this is the traditional use of the method, and none of these studies deviated from the method as applied in direct observation.

3.5.4   Grounded Theory

Two papers describe the use of grounded theory approaches to analysis. Jost et al (2010) explored synchronised communication between people with dementia and their care-givers. They state that they used Video Interaction Analysis and Grounded Theory, although exactly how this was achieved in a practical sense is unclear. Xiao et al (2004) used grounded theory to examine adaptive leadership in trauma resuscitation teams. They coded observations in to text, and generated a database of codings against time from the video. Xiao et al (2004) concluded that the advantage of video over direct observation was that the same episode could be coded by a number of different observers at different times.

3.5.5   Other textual methods

One paper, Bickerton et al (2011), described the use of socio-phenomenology to elicit the lifeworld schema of video captured health care interactions. This is overtly interpretive, but suggests a move away from transcription.

Three papers describe the use of computer software solutions to facilitate textual analysis. Pea et al (2006) described the development of DIVER a computer supported collaborative video analysis tool. This allows text annotations to be made on the video, which can then be shared on the web for collaborative research. Oien et al (2011) transcribed physiotherapists negotiations and then applied a computerised process analysis. Parmeggiani (2008) who used Computer Assisted Qualitative Data Analysis Software (CAQDAS), in this case a programme called Transana, to teach research methods (CAQDAS programmes are discussed in detail in section 3.7).

The papers in this section identify that computer programmes which facilitate collaborative annotation of video exist. These CAQDAS programmes require closer examination to identify their suitability for the analysis of the videos collected in the exploratory studies. The work of Bickerton et al (2011) provides an example which demonstrates that other researchers have considered that transcription may not be essential.

3.6   Other Methods

The final group of fourteen papers use a variety of other methods. Two of the papers used observation. Hallgren et al (2005) used 27 hours of direct and 14.5 hours of video observed midwives interactions with women in childbirth. They did not comment on the differences or challenges associated with the different types of observation. Hrisos et al (2009) explored whether there are valid proxy measures of clinical behaviour. They categorised both direct and video observation as direct measures and compared them with proxy measures of behaviour defined as charts/records etc.

Three papers used case studies. De Letter et al (2012) examined videos of three aphasic patients, and Howard et al (2012) undertook a single case study of atypical language development. The final case study is Elberse et al (2011) who collected and analysed a variety of data from a dialogue meeting to explore patient participation in health care research.

Three papers describe pattern analysis. Walter et al (2010) work in the field of psychotherapy and described a method of detecting emotion abstraction patterns. They transcribed consultations encoding every ten seconds, and then analysed two minute intervals. This appears to be a sophisticated and very structured type of coding looking for patterns in changes in emotions. Although a type of coding, it is worthy of separate mention in this section as the units of analysis are time periods rather than the objects of analysis. Koch and Zumbach (2010) examined interaction patterns in task oriented small groups. This was one of only two papers explicitly stating the use of examples of CAQDAS. They used StudioCode and NVivo to organise previously coded behaviours to facilitate pattern recognition. Ferm et al (2012) used pattern analysis to study a communication interaction of a speech impaired child and her carer during a meal.

Jansson et al (2006) used video of train drivers to generate think-aloud protocols which were used to develop a driver interface using cognitive work analysis. The use of video was not the main focus of the study and is rather skimmed over in the paper but it is of interest that they suggest the process of 'collegial verbalisation' made the analysis representative of the observers' opinions. They state that the protocols do not need to be interpreted by the

researchers and that the Think Aloud data format provides more information without being subjective. The concept of 'collegial verbalisation' was defined as several similarly experienced train drivers watching a video and providing a commentary about someone driving a familiar route (Erlandsson & Jansson 2007)

From the field of Drama Research, Dunn (2010) described a collaborative technique where the researcher discussed and recorded conversations about the video, then layered this over the video or transcript. This then facilitated further collaborative analysis. The researcher described how the technique achieved the ability to see 'The Other' in video texts. [The concept of 'The Other' will be returned to and explained in Chapter 4]. This is the first description of 'video texts', and it implies that the video in itself is a text and can therefore legitimately be analysed. Two further papers described a similar technique, using video as the cue for interviews. Endacott et al (2012) examined clinical decision making by undertaking a reflective interview whilst watching a video, and Henry et al (2011) described the elicitation of tacit cues during an interview prompted by videos of Doctor–Patient interactions. This is the first and only mention of tacitly understood behaviour in the literature.

The final example in this group describes the use of a technological tool. Walther et al (2002/3) are oceanographers collecting large volumes of video data from remotely operated submarines. They developed an automated video analysis software tool to identify interesting episodes and filter out periods of inactivity, prior to human annotation. This illustrates a pragmatic solution to the acknowledged challenge of large volume data management and analysis. However, this is a very basic analysis tool providing a first level screen prior to human coding. It is also in a field where the video may have long periods of 'nothing' in the camera frame, which therefore lends itself to a reliable automated analysis.

In conclusion, this was probably the most influential group of papers. The studies overtly describe; analysis by time period or periods of interest, the use of Think Aloud and collegial verbalisation, the description of video 'texts', the consideration of 'The Other' , and finally the only explicit mention of the elicitation of tacit cues by video.

3.7   Computer-assisted qualitative data analysis software (CAQDAS)

The development and use of computer software to assist in qualitative data analysis began in the 1980s, with the term CAQDAS first described by Fielding and Lee (1991). CAQDAS programmes are designed to facilitate the process of coding qualitative data. The early examples are restricted to the coding of text, but the more recent programmes have been designed to facilitate the coding of multi-media data sources. The most sophisticated programmes facilitate multimedia data storage, transcription, searching and cross-referencing of video and other data files. They allow the researcher to code their data with text and/or coloured blocks and enable bookmarking, which is the provision of direct links to predefined points of interest in the data. Several of the branded products have been developed for the Market Research Industry and include additional functionality relating to the handling of survey data.

All CAQDAS programmes facilitate coding of data but require the researcher to provide and apply the coding system. As an illustration of the way in which these programmes work, one of the more sophisticated tools, ANVIL is used as an example. Figure 5 is a screen shot of the ANVIL user interface. In the centre of the top half of the screen, the video is played. To the left of the video is the control panel, which enables uploading of files, searching, saving etc. This control panel also features the video start, stop, pause, fast forward, and rewind facilities. To the right of the video is the transcribing pane which facilitates the automatic transcription of speech and allows editing. The bottom half of the screen presents speech wave form and pitch contour above the coding panel which uses coloured blocks to code the data according to the user-defined coding scheme.

Figure 5:Anvil Interface

The range of available programmes can be divided in to Freeware (programmes which can be downloaded from the internet free of charge) or branded products (programmes developed by companies or individuals for profit). The range and availability of these products changes relatively quickly, and in particular the branded products are continuously upgraded to new versions with increased functionality. The collation of CAQDAS programmes was undertaken in 2011 and is represented in Table 2: CAQDAS Freeware, and Table 3: CAQDAS Branded Products.

	Developed by	Media focus	Operating system
Coding Analysis Toolkit (CAT)	University of Pittsburg/ University of Massachussets	Text	Windows/Mac
Digital Replay System (DRS)	DrESS node of NCeSS at University of Nottingham	Video / audio/ stills/ text	Windows/Mac
ANVIL	Michael Kipp	Video	Windows Mac Unix
ELAN	Max Planck Institute	Video audio	Windows Mac

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	for psycholinguistics		Unix
RQDA	Ronggui Huang	Text	Windows/ Linux/?Mac
MacShapa	University of Illinois	video	Pre Intel Mac (no longer directly supported)
Text Analysis Markup System (TAMS)	Matthew Weinstein	Text	Mac / Linux
Transana	University of Wisconsin	Video/audio	Windows/Mac/ Linux
Weft QDA	Alex Fenton	text	Windows Linux
AnSWR	Centre for Disease Control USA	text	Windows

Table 2: CAQDAS Freeware

	Developed by	Media focus	Operating System
Annotate	Textensor Ltd UK	Text/ images	Linux/Windows
Atlas-ti	Atlas-ti GmbH	Text/audio and video	Windows
Ethnograph	Qualis Research Colorado Springs USA	Text	Windows
Hyper RESEARCH	Researchware Inc USA	Text audio video	Windows/Mac
Hyper TRANSCRIBE	Researchware Inc USA	Audio video	Windows/Mac
Kwalitan	Kwalitan Advies NL	Text audio video	Windows
MAXQDA	Verbi GmbH	text	Windows/Mac
NVivo	QSR Int Pty Ltd	Text audio video	Windows/Mac
QDA Miner	Provalis Research	Text/ images	Windows (Mac and Linux with add ons)
Qualrus	The Idea Works Inc USA	Text audio video	Windows (Mac and Linux with

			add ons)
XSight	QSR Int Pty Ltd	Text	Windows
MiMeg	NcESS	Video	Windows
C-I Said	Code-a-text ltd	text	Windows
EthoVision	Noldus Information technology	Audio video	Windows
Interclipper Professional	Documat LLC	Audio video	Windows
Interact	Mangold Software and consulting	video	Windows
OCS Tools	Triangle Research Collaborative Inc	video	Windows
Qualitative Media analyser	CVS Information system	Video and audio	Windows
Sign Stream	Boston University USA	Video and audio (sign language)	Mac

Table 3:CAQDAS Branded products

3.8   Conclusions drawn from the literature review

The literature review demonstrates that studies using video captured data have been undertaken in a wide variety of disciplines. In the majority of publications, researchers were primarily concerned with the report of their study findings and comment little on the novelty or challenge of using video. The study of the verbal component of behaviour predominated, and it was often unclear why video had been used in preference to audio recording. In certain populations, the visual affordances of video are essential, i.e. in the vulnerable, pre-verbal or aphasic client groups. The researchers specialising in these client groups were early adopters of the use of video, applied established qualitative techniques and developed specific coding tools, but this process has taken many years.

Despite the recent proliferation of CAQDAS tools available to qualitative researchers, only two papers describe using them. This may because these were the only studies where the tool itself was the object of study, or because other researchers negated to mention that they had used these tools in their analyses.

This review did not identify a method of video analysis which would constitute a solution to the limitations identified in the exploratory studies. It did, however confirm that other researchers also struggle with the challenges of transcribing multidimensional activity and the technical problems of handling large volumes of video data. Some researchers proposed novel solutions to these challenges:

1. Transcription is not essential, and direct analysis of video is more efficient than analysis of a transcript (deLeng et al 2010).
2. The use of time periods as units of analysis (Birkenes 2012, Bolton et al 2011, Walter et al 2010).
3. The advantage of video over direct observation is that the same episode can be coded by a number of different observers at different times(Xiao et al 2004).
4. Limit the analysis to periods of interest (Walther et al 2002/3).

With respect to the use of video analysis where behaviour is ill-defined or tacitly understood, the review identified the following:

1. Elicitation of tacit cues in video captured data has been attempted once before (Henry et al 2011).
2. There is added value in obtaining different perspectives on the same activity (Dunn 2010).
3. The potential for the use of Think Aloud and collegial verbalisation (Jansson et al 2006, Erlandsson & Jansson 2007).

These seven elements (four novel approaches to video analysis and three points relevant to tacit behaviours) were incorporated in to the development of a novel solution to the problems identified when analysing video to explore collectively yet tacitly understood behaviours in the exploratory studies.

The review of the published tools and methods of video analysis provided an increased depth of understanding of the field of enquiry and led to two conclusions:

1. That video capture of student nurse behaviour in simulated practice can be used to identify indicators of competence. These indicators may be tacitly and collectively understood.

This defines the subject/reality being studied and is the basis from which the Ontology will be developed.   Chapter 4 formally defines the Philosophical foundations of Video-View-Point, i.e. the Ontology.

[Ontology in this sense will be written with a capital O, as opposed to the computer science term relating to a hierarchical list which will not have a capital –ontology]

2. That the points of interest identified can be combined to produce a technological tool to enable the analysis of video captured tacitly understood behaviour.

This defines the means by which the indicators of student nurse competence will be studied. This contributes to the epistemology for the final study. This is discussed in greater depth in section 6.7.

4. Philosophical Foundations

The definition of the Ontology of a study would normally consist of the researcher stating the philosophical standpoint from which they are viewing the field of research. In the majority of cases a researcher is able to subscribe to an established 'paradigm' e.g. feminism, positivism, interpretivism. The justification of the position can be clearly defined and founded upon a distinct body of previous research. In addition there are compatible epistemological and methodological approaches aligned to these paradigms. The Ontology for this study is less easily defined. A number of factors have influenced my philosophical journey and the consequent development of a hybrid methodological approach. The term hybrid is used deliberately. This approach integrates elements of quantitative and qualitative methods, and is distinct from mixed method research which undertakes the elements separately and later considers the results in combination. In order to make clear the sophisticated nature of the definition I have arrived at, the Ontology is described in terms of Denzin and Lincoln's (1994) 5th Moment of qualitative research. This chapter uses the 5th Moment as a framework to outline the influencing factors and my philosophical journey to the development of Video-View-Point.

4.1 Denzin and Lincoln's 5th Moment

The field of enquiry, tacitly and collectively understood behaviour, is compatible with the generic characteristics of a qualitative research study: interpretive and naturalistic (Denzin & Lincoln,1994). Historically, the exploratory studies were undertaken towards the end of a 'quiet methodological revolution' within the qualitative paradigm (Denzin & Lincoln, 2005). This 'revolution' is evident in the distinct change in style from the 2nd (1994) to the 3rd (2005) edition of this seminal textbook. The 2nd edition is an authoritative guide to the conduct of the range of qualitative methods. The concept of 'moments' is used to illustrate the evolving continuum of qualitative research. Denzin and Lincoln (1994) describe five moments of qualitative research: traditional (1900-1950), the modernist or golden age (1950-1970) , blurred genres (1970-1986), the crisis of representation (1986-1990) and post-modern (1990- 1994). In their 3rd edition (Denzin & Lincoln 2005) they add another 3 moments: post-experimental

enquiry (1995-2000), methodologically contested present (2000-2004) and fractured future (2005 onwards).

The 6th and 7th moments (post-experimental enquiry and methodologically contested present) demonstrate a movement towards freedom of expression and the defence of subjectivity. The fields of enquiry are overtly political in nature, for example: indigenous studies, race theory, queer theory, and neo-colonialism and the associated 'methods' demonstrate a radical shift away from 'science', for example; fictional ethnography, ethnographic poetry and multimedia texts (Denzin & Lincoln, 2005).

The explicit intention to use advances in technology in this study appears to align with the increasing use of multimedia in the 6th and 7th Moments. The political motivation and negation of method inherent in these moments, however, are philosophically irreconcilable with both my personal and the nursing profession's notion of practice, which is strongly influenced by Medical Science (Playle 1995).

This philosophical incompatibility led to a re-examination of Denzin and Lincoln's (1994) 5th 'Post-modern' Moment, enlightened by the understanding gained from the exploratory studies (described in Chapter 5). The 5th Moment is described as a period which faces six fundamental issues: the continued tension between postmodernism and positivism/post-positivism; the crisis of representation; the crisis of legitimisation; the 'emerging cacophony of voices and agendas'; the blurring of the borders between science and religion; and finally the influence of technology. The challenges, identified in the exploratory studies and the literature review, align with these six fundamental issues. There is one modification required; 'the blurring of the boundaries between science and religion' will be amended to replace religion with art, which then fits more comfortably with the discipline of nursing and accounts for the distinction between 'techne' and 'phronesis' as described in section 2.4.

This alignment led to the recognition that in order to define the Ontology for this research, it would not be possible to make a straightforward statement of paradigmatic allegiance. The overt use of technology, and video captured behaviours in particular, enable the development of not only a methodological hybrid, but a paradigmatic hybrid. The six fundamental issues of the 5th Moment provide a framework for the definition of the Ontology of this study, where the

Ontology is the nature of reality under scrutiny, that is the questioning and investigating which is directed to 'Be-ing' (Heidegger 1988).

4.2 The tension between positivism and post-modernism

The first challenge identified by Denzin and Lincoln (1994) relates to the conflict between research paradigms. This tension is admirably outlined by Bourdieu (1988) who argues:

> At the most general level, social science oscillates between two apparently contradictory perspectives: objectivism and subjectivism... [The first] relies on objectivist techniques of investigation (e.g. surveys, standardised questionnaires) and embodies what I call technocratic or epistemocratic vision in which only the scholar is able to gain a complete picture of the social world, which individual agents apprehend only partially. [The second]...is generally associated with the so-called 'qualitative' or naturalistic methods, such as participant observation, ethnography, discourse analysis or self-analysis. In the eyes of the objectivist or 'hard' social scientists, it represents the quintessential expression of 'fuzzy-wuzzy' sociology. Ironically though, this academically derogated manner of looking at the social world is generally closer to reality, more attentive to concrete and detailed aspects of institutions than is the objectivist approach. Moreover, this 'soft' sociology is often more inventive, imaginative and creative.....

(Bourdieu 1988 P781)

Here Bourdieu identifies the strengths of both approaches and continues to argue that the subjectivist and the objectivist stand in a dialectical relationship, (where dialectic is a form of reasoning, using theses and antitheses, during a dialogue to generate greater understanding, as practiced by Socrates and recorded by Plato). Bourdieu argues the benefits of both objectivity and subjectivity and does not hold back his anger at the indulgence of social scientists who discredit their opponents and struggle to achieve scientific credibility by archaic classificatory thinking. The implication being that the requirement to 'win' the argument has become all consuming, leading the

research community to be totally distracted from their primary function, the elicitation of knowledge and/or understanding. He also warned of the propensity of researchers to convert from one extreme to its opposite during their careers e.g. from blind scientism to irrational nihilism; or to religiously follow a 'founding father' in research application e.g. Weber, and suggests that it is necessary to use Weber against Weber to go beyond Weber. Bourdieu appears to be calling for a truce in the argument for paradigmatic supremacy, and proposes that social science should build upon its achievements rather than destroy them. In fairness, Bourdieu makes several comments about historicality and in 1988 was not in a position to predict the advances in technology which have the potential to enable a symbiosis between objectivity and subjectivity. In summary, I adopted the position that technology affords the opportunity to capitalise on the associated advantages of both objective (positivist) and subjective (postmodern) methods, in order to provide a robust and objective, yet innovative and creative elicitation of collectively and tacitly understood behaviours.

4.3 Blurring of borders between science and art

My clinical career as an Intensive Care Nurse conditioned me to accept and embrace new technologies. The process of questioning established techniques, in light of new technologies and treatments, is fundamental to the intensive care culture. This culture is strongly influenced by medicine and based on a body of predominantly positivist evidence. However the sub-culture and practice of intensive care nursing assimilates both science and art. Benner (2004), who was also an Intensive Care nurse, describes this in terms defined by Aristotle: techne - the appropriation of scientific knowledge; and phronesis - situated actions based on skill, judgement, character and wisdom. Working within the intensive care environment, where practice is routinely pushing the boundaries of field knowledge and conflict between medical science and holistic art (caring, compassion, intuition) is familiar, has significantly influenced my philosophical approach to research design. The intensive care culture accepts the constant conflict between art and science. In fact, expertise in intensive care practice (either medical, nursing or any of the allied health professions) is characterised by the ability to balance science and art. The methods employed in intensive care research demonstrate this divergence, encompassing both ends of the

research paradigm spectrum, 'subjective' and 'objective'. Exploration of the 'art' is predisposed to qualitative methods and generation of understanding relating to patient, family members and staff experiences, quality of life etc., whilst the 'science' requires quantitative eliciting of facts, rules and theories relating to physiological processes and treatment options. There is an acceptance at the expert level within the speciality that an holistic approach to practice is required. This is indicative of Bricolage, first described by Levi-Strauss (1966) as the product of using whatever tools come to hand to achieve a task.

The bricoleur, i.e. one who practices bricolage, will keep an open mind, utilise a multiplicity of skills and incorporate any relevant knowledge to solve problems. The recognition of the usefulness of all types of knowledge often transcends boundaries with the consequence of blurring the distinction between science and art. This approach is increasingly recognisable where scientific advances enable innovation but the impact of application cannot be predicted. In such circumstances, it is necessary to consider any relevant knowledge and all identifiable means to inform decisions. The acceptance, even if at a sub-conscious level, of the bricoleur approach has led to the development of evaluative processes for health care research, such as Evidence Based Practice/Medicine (Sackett et al, 1996). These processes have devised hierarchies to ascribe weight to types of evidence (Cochrane, 1972; Sackett et al 1996). Within the hierarchies it is generally accepted that the systematic review/meta-analysis is considered the best from of evidence, closely followed by the other positivist methodologies. Qualitative methods are all considered less worthy and rank higher only to expert opinion and anecdote. The development of methods which raise the hierarchical status of qualitative research within the positivist dominated health science community has the potential to add to the knowledge base and positively influence the cultural acceptability of 'meaning-full' research. Ultimately this will assist in the development of the understanding of the art of practicing science, and therefore lead to informed educational methods to teach it. The utilisation of new technologies could be used to produce research methods with objective and reproducible outputs, which could be applied to fields previously only amenable to qualitative methods. I therefore argue that the 'blurring' of the boundaries between science and art is not a threat, but an opportunity to move health

science research forward towards a position where understanding the 'art' of practice can be elevated in the established methodological hierarchy.

4.4   Cacophony of voices and agendas, and The Other

The research process in both positivist and post-modern studies of behaviour requires the identification of a study population. Denzin and Lincoln's (1994) issue with the cacophony of voices and agendas relates to the choice of population. The positivist researcher is concerned with looking at generalisable behaviour and therefore chooses large samples representing common phenomena. The post-modern researcher is not attempting to generalise and is therefore content to study minority groups or even individuals to elicit meaning pertaining to the field of enquiry. This confirms the complexities of the worlds in which we live, but is in danger of favouring 'interesting' minorities at the expense of the ordinary or common.

In the qualitative study of any population the researchers' task is to interpret and represent the voice of the study population, a rather more complex task than the positivist report of fact. The quality of qualitative research should be assessed in terms of credibility, dependability and transferability (Lincoln & Guba 1985). It is now generally accepted that when attending to these criteria, the relationship between the researcher and the subject must be explicit. This may be achieved by: subject selection, method of analysis, use of units of meaning, triangulation between co-researchers; participant verification; reflexivity; researcher qualifications, history and experience (Graneheim & Lundman 2004). In addition, Fine et al (in Denzin & Lincoln 1994) propose that qualitative researchers have:

> produced a colonizing discourse of the 'Other' ; that is the Other is interpreted through the eyes and cultural standards of the researcher.

> (Denzin & Lincoln 1994 P32)

Fine (1998) continues a feminist consideration of the Other, stating:

> The social sciences have been long on texts that describe some Others, preserve other Others from scrutiny and seek to hide the researcher/writer under a veil of neutrality or objectivity.

(Fine 1998 P73)

The crux of the argument proposed is that the objective representation of the 'Other' elevates an enquiry to a status higher than the subjective opinion of the researcher. The struggle to represent the 'Other', in the practical sense, has exercised the qualitative research community throughout the last five decades. Reflexivity and mirroring have increasingly been used as methodological attempts to verify the textual representation of the 'Other' and silence the essential criticism that researchers 'put their own words in to the subject's mouth'. These abstract methodological constructs rely on the researchers' justifications of truthfulness to assuage their critics. Thus reputation and experience may often define quality, whilst the delineation between interpretation and opinion remains blurred.

It must be noted that, although utilising the philosophical concept of the Other, the practical application adopted by the qualitative researchers is very different to that proposed by Levinas (1974). Levinas published his seminal work 'Otherwise than Being or Beyond Essence' in 1974. As a transcendentalist, his work is a discourse relating to the meaning of Being, using the antithesis, 'Other', as the means to provide definition of the thesis 'Being'. This complex philosophical text considers the accessibility of the 'Other' and Levinas proposes a difference between the said and the saying;

> It is not the inescapable fate in which Being immediately includes statement of being's *other* not due to the hold the *said has* over the *saying*, to the *oracle* in which the said is immobilised?

He elaborates

> Saying is not a game. Antecedent to the verbal signs it conjugates, to the linguistic systems and the semantic glimmerings, a foreward preceding languages, it is the proximity of one to the other, the commitment of approach, the one for the other, the very signifyingness of signification.

> (Levinas 1974 P5)

The concept of signification will be returned to in the next section, with the consideration of structural linguistics. The fundamental issue raised by Levinas

is that the subjective understanding of the saying, as opposed to the said, provides us with a clearer understanding of both 'Being' and 'Other'. He also argues that this subjective understanding is the 'essence', and it is not necessary to objectify that essence. This argument does not support the qualitative research communities' adoption of the 'Other' as a means to achieve objectivity.

This thesis explores the hypothesis that a collective understanding in the tacit dimension exists (in that tacit knowledge can be defined as collective understanding which cannot be articulated) and that the 'truths' in that understanding are shared. The representation of that shared truth, because it is shared, includes the 'Other'. The problem is not the representation of the 'Other' but the articulation of the collectively understood truths. Those truths will be subjective, however when considered collectively they contribute to the 'essence' of our understanding. I argue that the subjective nature of that understanding does not detract from its value, but is what makes it valuable. The ability to video capture tacitly understood behaviours also provides the means of representation. It is possible to see the behaviour (the saying) and agree its meaning without necessarily being able to put it in to words (being said), and the video endures as the representation of the collectively understood meaning.

4.5   The Crisis of Representation

The difference between 'the saying' and 'the said' has been described in the previous section. The discussion highlighted the difficulties in representing the 'saying' where words are not sufficient. This phenomenon has exercised societies for centuries: how to make others understand in the absence of descriptive words, either textual or verbal. Many societies have traditionally used art to convey 'the saying'.

> Works of art are believed to give physical form to ideas – to render meaning present and accessible to direct perceptual experience. The arbitrary signs of language distance ideas in the very process of referring to them: signifier and signified are different entities linked by convention. The interpreter must access a conventional code in order to think the signified.

(Hasenmueller 1989 P275)

This quotation succinctly describes Saussure's (2011) concept of structural linguistics, the broader constructs in semiotics and the contrast with the study of tacitly understood behaviour. Linguistics relates to the study of language and Saussure proposed that a word or phrase (the signifier) is linked to a mental concept of an object etc (the signified), which together constitute a sign. There may or may not be any causal link between signifier and signified, hence objects can have different names in different languages.

Semiotics relates to the general study of cultural sign processes and can be divided in to three branches: Semantics – the relation between sign and the entities to which they refer, i.e. their meaning; Syntactics – relations among signs in formal structures; and Pragmatics – the relation between signs and the effects they have on the people who use them.

Kress and Van Leeuwen (1996) in their work on images consider these as the three metafunctions of semiotics, categorising them as ideational (semantics), textual (syntactics) and personal (pragmatics). On returning to Hasenmueller's (1989) quote on the relevance of perception in art (images), the interpretation or perceptual experience of images can be broken down and studied in the 3 metafunctions of semiotics. In addition it can be argued that where the signified in the art/image/video is tacitly understood, the signifier is absent. Thus when researching the tacit through images/video, it is possible to study the signified, and more specifically the meaning of the signified (semantics), the relationships between signified entities (syntactics), and the effects of the signified on people (pragmatics), however we are unable to find the word/s which are the signifier/s. The interpretation of the sign, therefore, becomes problematic.

From the earliest cave paintings and throughout history thereafter, images have been used to convey meaning and accessibility to knowledge. In Plato's The Meno ,Socrates says of the images of Daedalus –

> I mean to say that they are not very valuable possessions if they are at liberty, for they will walk off like runaway slaves; but when fastened, they are of great value, for they are really beautiful works of art. Now this is an illustration of the nature of true opinions: while they abide with us they are beautiful and fruitful, but they run away out of the human

soul, and do not remain long, and therefore they are not of much value until they are fastened by the tie of the cause; and this fastening of them, friend Meno, is recollection, as you and I have agreed to call it. But when they are bound, in the first place, they have the nature of knowledge; and, in the second place, they are abiding. And this is why knowledge is more honourable and excellent than true opinion, because fastened by a chain.

(Plato 2009 P90)

Socrates uses the metaphor of works of art to illustrate the nature of opinion. There are two ways in which the use of this particular metaphor has philosophical significance to, and resonance with, a tool for the analysis of video captured data. When the metaphor is taken literally, Socrates describes the fastening of images. The 'fastening' of images and behaviour, once only possible in art, is now technologically possible by video capture. The ability to capture images which 'have the nature of knowledge' legitimises the use of video as data.

When considering the intended meaning of the metaphor, true opinions, Socrates offers 'recollection' as the means by which the fastening can occur. He names this process, 'anamnesis' – the idea that the soul is eternal, knows everything, and only has to 'recollect' to learn. Of course Socrates is talking about recollecting in ones mind, of fixing the idea by thinking about it. With video, however, we can record and replay – fasten and recollect- not only individually but with others who can contribute to the 'dialectic'.

4.6   The Crisis of Legitimation

Where the purpose of research is to uncover meaning, there is justifiable scepticism surrounding the ability of any researcher to 'prove' that what they have uncovered is more than just personal opinion.

The second crisis is the crisis of legitimation in which the classic criteria for assessing research are rejected for qualitative research or – following post-modernism – the possibility of legitimising scientific knowledge is rejected in general. The crucial point in these discussions is how far, especially in social research , we are still able to suppose a reality

existing outside subjective or socially shared viewpoints and on which we can validate its 'representation' in texts or other products of research.

(Flick 2009 P76)

This quote is taken from the Epistemological Background Chapter in Flick's (2009) Introduction to Qualitative Research 4th Edition. It summarises the fundamental discord which a qualitative researcher needs to address in their epistemology. In doing so, Flick says 'how far….   we are still able to suppose a reality…'. In other words 'How far' can we go with legitimation whilst on shaky ground? Therefore prior to considering the epistemology, it is logical to ensure that the 'ground' set for the research is as solid as it can be. In this quote, Flick also mentions 'other products of research' and this prompted a fundamental question; Is it legitimate to use video as data?   In the consideration of the nature of the reality of this research, the Ontology, unless there is a justification of the use of video as data, the entire thesis would, indeed, be on shaky ground.

The definition of data is in itself not straightforward. In general data are considered the lowest level of abstraction from which information and then knowledge can be derived (Beynon-Davies, 2002). However, what can be considered data is dependent on the field of research, e.g Computing Science considers images and video as data, but traditionally the Social and Medical Sciences do not (the data will be the report or transcription taken from the image e.g. photograph/scan/xray, or video). It is necessary therefore to consider the way in which video meets the criteria for inclusion as data in this research.

The historical development of qualitative research methods began in the early twentieth century (Denzin & Lincoln, 2002) before the technology to 'film' behaviour was sufficiently portable or inexpensive to facilitate its use in research. By necessity alternative techniques, such as direct observation, interviewing, questionnaires etc. were developed to undertake research in to behaviour. The only available means to represent the findings of these early researches was text, and therefore became the established data source for this type of research. Over time this has become a sophisticated set of activities, striving to demonstrate objectivity in order to compete for legitimacy in a Modern world dominated by positivism. Thus there is a reluctance to move beyond what is considered the traditional, and the concrete nature of text as the

data source endures despite the now common practice of audio and video recording in interviews.

Within this historical context it is interesting that the literature review (Chapter 3) demonstrates that video analysis is increasingly being used as a method of research. Due to the structured nature of the review, it was only possible to identify papers which were explicit in their use of video captured data. There are potentially other published studies, some of which were identified in secondary searching, which have used video but do not make this explicit in their title, methodology or search terms e.g. Digiacomo et al(2007); Xiao et al(2004); Roberts et al(2003); Walther et al (2002/3); Parmeggiani (2008); Koch & Zumbach (2002); Pea et al(2006); and Gaba et al (1998). This highlights a current dilemma in the research community: that videoed material is increasingly accessible and utilised for research, but that it is simpler to ignore the potential theoretical differences between indirect and direct forms of observation when the overriding aim is to generate the outcome of the research. Where the use of video has been made explicit, the reported methods of analysis are predominantly traditional observational techniques i.e. coding, counting and transcription. In the majority of these studies, the 'data' is actually the record of the counting activity, the coding or the transcription. The video, although a permanent record, plays no further part in the research and is not presented in the results. The video is not perceived as data, it is a replacement for a researchers field observation notes or an audio recording. The video is being used simply as a vehicle to make the process of observation more accessible. Researchers generally make the assumption that video observation is equivalent to an episode of direct observation. Whether this is a valid assumption has been the focus of debate and discussion in the Social Science community since anthropologists(e.g. Bateson & Mead, and later Rouch, Marshall, Gardner & Asch) in the 1940's first started using photography and film to record their observations (Sherman 1998). Emmison and Smith (2000) discuss how the camera records and transforms what we see. Kress and Van Leeuwen (2001, 2002) make distinctions between mode as 'the language of colour', and media as 'the material which is produced'. There is an implication that transformation by the camera is a distortion and a careful distinction is made by the use of the terms mode, media and material and the careful omission of the word 'data'.

There are examples where Social Scientists have attempted to philosophically justify the use of non-text forms of data. Dicks and Mason (1998), for example, explored the use of multimedia for research. Their approach to the challenge of non-textual data, was to present the raw data without analysis, allowing readers to interpret their own meaning. They liken this to naturalistic ethnography (Denzin & Lincoln, 2005) where political bias is considered to be accounted for as long as affiliations are confessed at the outset, and in those terms profess this as a legitimate qualitative research strategy. This demonstrates a radical approach to addressing the complexities of representing non-textual data, and an example of research undertaken in Denzin and Lincoln's 7th moment – methodologically contested present. This controversial approach does not align with the 5th Moment and can therefore be discounted, but the demonstration of a precedent for the presentation of raw video data is an important step in the justification of video as data.

In other branches of sociology, the method and legitimacy of the use of images as illustration continue to be debated (Goodwin 1994; Plowman & Stephen 2008; Fielding 2004). Images are used to 'throw light' on complex issues and utilise metaphor – such as 'reflecting the self' - describing the use of self portraiture, and video diaries as confession (Knowles & Sweetman 2004). This is psycho-analytic in nature and is preoccupied with the expressive and reflexive nature of the video. The purpose being to provide a personal and therefore subjective perspective, the implication being that the film-maker (who may be either the subject, the researcher or a third party) makes choices about the production, direction, editing etc. which add to the end result and is able to influence interpretations by the viewer. This is further illustrated in the consideration of film and pictures as an art-form, and the study and interpretation of the media as such. Researchers of film, as in the cinematographic art form, describe how the medium is seen to be manipulated to induce particular feelings in the voyeur (Altman, 1999). This is after all the art of the film-maker or artist, and their ability to do this, to a greater extent will determine their reputation. The vision of the director of a film requires expert manipulation of the media, and by design removes objectivity, which is incompatible with the tenets of observational research methods. As an alternative to film as an 'Art Form', it was worth considering whether the research of documentary film would be more focussed on objectivity – however researchers in this genre are also

predominantly concerned with production, and the manipulation that can occur in editing (Rosenthal & Corner 2005).

The manipulative and subjective nature of the editing process is clearly a significant hurdle when considering the use of video as data. In order to overcome this barrier, it is essential to outline the differences between the genres previously described and the type of video of simulated activity collected for the purposes of this research. The research videos are recorded from a static viewpoint in the skills laboratories, although it is possible to pan, tilt and zoom the camera to capture activity, and the same activity can be recorded from several viewpoints. The activity occurs in real time, in one take, and there is no editing. It is truly a 'fly on the wall' view. It is as if the researcher is sat in a chair observing the behaviour in the room. Therefore as long as the video is viewed in this situated context, it remains distinct from a 'film'. Under such controlled circumstances, I argue that video in context meets the criteria to be considered as data, an unabstracted set of symbols which can be interpreted.

4.7   Influence of technology

The last fundamental issue of the 5th Moment is possibly the most straightforward to discuss. The potential to use video captured data for research was one of the two themes identified at the outset of this research.

In consideration of the Ontology in the context of technology, Hubert Dreyfus (1979) in his critique of Artificial Intelligence discussed how we can choose to see activity as law-governed, in the same way as we can choose to see reality as a series of facts. However it is a huge leap to say that if we want to, or can, see things in this way, that it is a fact that they are. He used this as a philosophical justification of the fact that computers will never be able to function like the human brain. Very few have chosen to contradict him, although those that have, relied on Turing's earlier argument, that

> we cannot so easily convince ourselves of the absence of complete laws
> of behaviour … The only way we know of for finding such laws is
> scientific observation, and we certainly know of no circumstances under
> which we could say, 'We have searched enough. There are no such laws'.
>
> (Turing 1950 p 452)

Whilst the general consensus amongst the academic community is that these are opposing views, it can be argued that they are not mutually exclusive. Computers and technological advances can be used in new ways for scientific observation and the search for new understandings is not yet exhausted, particularly in the context of the field of this research. Care must be taken however to make a distinction between the elicitation of tacit understanding of a phenomenon gained from the perception/interpretation of what that phenomenon is, and the claim that a factual explanation of the phenomenon has been deduced.

In summary, the six challenges of the 5th Moment have been used as a framework to define the Ontology of this research. The field of enquiry, competence as the exemplar of a tacitly understood behaviour, has been shown to be a complex 'world', where the border between science and art is blurred. The Ontology is shaped by advances in technology which provide the ability to:

1. Capture tacitly understood behaviours as video data,
2. Combine the strengths of objective (positivist) and subjective (Post-modern) methods to produce a hybrid methodological approach, and
3. Facilitate the fastening and recollection of collectively understood truths to elucidate behavioural indicators where the signified is known but the signifiers are absent.

5. Methods and results of Exploratory Pilot Studies

By the middle of 2004, a small team of academics, including myself, had developed and defined VIP™ as a novel approach to clinical skills acquisition for student nurses. The project to upgrade the Faculty's skills facilities and resources had been completed. The plan for the implementation of the VIP™ approach had been agreed, and the governance processes for variations to the curriculum were in progress. This preparatory work had laid the foundations for integration of VIP™ in to the nursing curricula, and provided the opportunity to research the teaching and learning processes associated with simulated practice activities.

In order to provide the evidence for University Governance, the team's priority was to evaluate VIP™ as a novel educational technique, firstly in a second pilot with a small group of child branch students (n=15), and then during the process of scaling up to the whole nursing cohort. This presented an opportunity to capitalise on the Faculty activities by piggybacking a series of exploratory studies answering my research objectives without resource implications or the need for additional funding. A research proposal was developed for review by the Ethics Committee based on the two previously identified themes a) the potential to use advances in technology for research, including the newly installed video camera system and, b) the exploration of the competence acquisition of student nurses.

In common with the inductive research process, often used in education and health science research (Raths 1967), the research proposal identified a research question and associated research objectives designed to provide structure in the exploration of the field of study. This chapter describes the research process in the exploratory studies and identifies the evidence produced which influenced the design of the main study.

5.1   Research Question

Can VIP, a novel educational technique, accelerate competence acquisition in student nurses?

5.2   Research Objectives

Based on initial literature reviews, four research objectives were identified:

1. Establish whether there is an existing ethical framework which can be applied to research using video data, or develop a robust protocol.

2. Determine the most appropriate research methodology to answer the research question, and

   a. whether observation of video captured behaviour is equivalent to direct observation,

   b. an evaluation of the practical advantages and disadvantages of the use of technology for research in general, and in the analysis of video in particular.

3. Establish whether the dimensions of competence amalgamated from the literature can be 'seen' in videos of student nurses in simulated practice, and whether it is possible to identify specific indicators of competence.

4. Establish that simulation is an acceptable platform for the research of nursing practice. Explore whether or not simulation is equivalent to practice.

5.3   Over-arching exploratory study design

Two periods of simulated practice activity were used as the platform for these exploratory studies: a week long episode of simulated practice with Year Three child branch students in 2004, and the roll-out of simulated practice for years one and two of all branches (fields) of the nursing programmes in 2006.

The overarching design comprised four studies (A, B, C and D) undertaken during these two periods within which the research objectives identified in 5.2 were embedded. The activity in 2004 was the 2nd Pilot of VIP™, the educational evaluation of which constituted Study A. The activity in 2006 comprised three studies: Study B - The Nursing and Midwifery Council 'Simulation and Practice Learning' evaluation, Study C - The Higher Education Academy Small Grant Application to engage student participation in assessment design, and Study D

- The Economic and Social Research Council project on Semantic Annotation of video captured simulated practice scenarios.

As a member of the research team for each of these projects it was possible to ensure that all research objectives were met, that data was collected efficiently and spread equally across the study population. A summary of these studies is presented in Table 4. This table includes the sample size, the type of data collected, and the research methods employed in each of the studies. It also identifies where the Research Objectives identified in 5.2 are addressed in the overarching design.

	Sample size	RO addressed	Data Collected	Methods of analysis
A: VIP Pilot 2004	18	2 & 3	30 hours video – scenario and debrief Observation field notes Work produced by students and weblogs Electronic evaluation –student/facilitator/researcher	Transcription Quantitative evaluation Thematic analysis
B: NMC 2006	1062	2 & 4	Approx. 150 hours video scenario, debrief and focus group Observation field notes of 30 sessions Observation charts/ notes from students Record of signed competencies Electronic evaluation – student/facilitator 15 Focus groups	Transcription Counting Thematic analysis Coding Quantitative evaluation
C : HEA 2006	20	2 & 4	10 hours video/audio scenario, debrief and focus groups 2 focus groups Electronic evaluation Observation field notes 4 sessions	Transcription Ethnography
D : ESRC 2006	700	2& 3	Approx. 150 hours video User evaluations of annotation tool 700 Weblogs /Sim-man logs	Event History analysis Statistical analysis Data source combination

Table 4: Summary of the four exploratory studies

5.1   Reports of the individual studies

Each of the studies, A. B, C and D were completed as research projects in their own right. The research objectives for each of the studies were achieved and the findings were reported to the commissioning body in the appropriate format.

The evaluation undertaken for Study A, the 2nd VIP™ pilot, was reported to the Faculty Governance Committees and used as evidence for the embedding of Simulated Practice in the Nursing Curricula. Two papers presenting the use of different aspects of this evidence were presented at an International Health Informatics Conference (MedInfo 2004): Gobbi et al (2004) described the evidence in relation to the strategic approach to learning and competence in health care students, while Watkinson et al (2004) focussed on the use of data extracted from Health Information Systems to contextualise clinical decision making skills.

The report to the Nursing and Midwifery Council of the simulated practice evaluation (Study B) was produced, representing the data in the format stipulated in the commissioning document. The Project Steering group collated all of the data submitted by the 17 participating Higher Education Institutions and produced a Final Report of the outcomes at the end of 2007 (Simulation & Practice Learning Project Group 2007). The Final Report was presented to The Nursing and Midwifery Council who accepted all of the recommendations. Consequently, they published NMC Circular 36/2007 which changed the regulations for Pre-registration Nursing Programmes to allow 300 of the 2300 practice hours required for registration as a nurse to be completed in simulated practice (NMC 2007).

The findings of Study C were reported to the Higher Education Academy (Gobbi & Monger 2007). The project focussed on the elicitation of students' views of simulation feedback and identification of criteria that could form the basis for formative and summative assessments of performance. The report findings were used to develop an HEA sponsored workshop which presented Good Practice tips and Leaning points relating to the assessment of simulated practice activities (Gobbi & Monger 2009).

Finally study D was reported to the funding body, the Economic and Social Research Council (ESRC) and the findings were published in three papers (Weal et al 2007; McDonald et al 2008a, 2008b).

As well as contributing to this published work, the data were used to address the Research objectives outlined in section 5.2. The evidence collated is therefore reported by research objective in the following sections.

5.2   Research Objective 1: Ethics Protocol

In 2004, the increasing availability and use of digital data in general, and electronic patient data in particular, was a topic attracting considerable consternation and debate within the research ethics and clinical communities. It was essential to ensure that the proposed educational and research activities were both ethical and compliant with Governance procedures, from both the University and Healthcare Institution perspectives. In the generation of the scenarios with which the students would interact, there were significant issues around the extraction of digital data from the Healthcare Institutions. The scenarios would be virtual patient case studies, accessed by computer, with video of a patient, plus associated digital charts, notes, x-rays etc. The virtual case study would be explored by the students and their engagement with the resources would be collected as web-log data. The students would then be videoed engaging in a continuation of the scenario in the simulated activity. In order to address the first research objective, I developed the Programme of Research and Education/Ethics into VIP™ (PREVIP) protocol which was essential to guide the ethical collection, storage and use of real patient and student related digital data and images.

The first stage of the protocol development required a comprehensive search of the Healthcare, Education and Social Science Research Ethics literature to establish whether there were existing frameworks for research utilising digital images and data. In 2004, no such framework was identifiable.

The contemporary legal requirements (Data Protection Act 1998; Protection of Children Act 1999; Children Act 2004; Freedom of information Act 2000; Obscene Publications Act 1964; Human Rights Act 1998; Video Recordings Act 1993; Access to Health Records Act 1990) were identified as the legislative pre-

requisites. Thereafter a set of ethical principles relating to identifiable and anonymised data (DH 1999), appropriate approach to patients (Foster 1997), and elements of consent (DH 2001; DH 2002; GMC, 1998a; MRC 2004) were formulated and benchmarked against professional ethics guidelines (GMC 1998b; GMC 2002a 2002b; MRC 2000; Institute of Medical Illustrators 1996; British Educational Research Association 2004; British Sociological Association 2002).

These sources provided the evidence for the collation of a set of legal and ethical principles for the collection, storage and use of digital images and data. The future use of these data for education and research was the one remaining challenge. The adoption of the precedent set by the construction of databases for genetic material (Human Tissue Act 2004 ; Bain et al 1990), which use the principle of 'gifting of data', provided the means by which a database of digital material could be made sustainable.

The PREVIP protocol was submitted to University Legal and Research Governance offices for scrutiny, thereafter for National Health Service Research Ethics Committee (NHS REC) and National Health Service Governance review. The University Legal and Governance scrutiny determined that it was compliant with contemporary legislation. This process continues to be revisited at least biannually. The NHS REC response was that the protocol did not require review as it was not research. After consideration of this ruling, it was decided to submit the protocol for School Ethics Committee review. This Committee agreed to review the protocol as research and granted approval. The Protocol was subsequently subjected to individual Healthcare Trust Governance processes in order for Patient Identifiable data to be collected on their premises. The PREVIP protocol has been recognised as the 'gold-standard' framework for this field of research and has subsequently been adopted by a number of other researchers. It is notable that several applications for NHS REC review utilising similar data sources and the PREVIP protocol have also been returned as 'not requiring ethical review' by NHS RECs. This indicates a divergence in views between the research and ethics communities. In retrospect, this serves as a clear illustration of the 'cutting edge' nature of this research, and demonstrates the challenge of developing novel approaches utilising technology in research in general, and in health care research in particular.

The design of the main study was founded on the principles of the PREVIP protocol.

5.3   Research Objective 2: Methodological evaluation

An initial review of the literature identified research methods which had been previously used in the analysis of video captured behaviour. The methods identified were Counting (Digiacomo et al 1997; Kot & Law 1995), Coding (Ram et al 1999; Tait et al 2001), and Transcription (Daniel 1998; Emerson et al 2001). The overarching design incorporated these methods in order to assess their suitability for the on-going study of the competence of student nurses.

The evidence for each of the methods is considered in turn, and the points which informed the development of the novel approach to video analysis are identified.

5.3.1   Counting

The initial intention was to watch the videos of students engaged in the simulated practice activities and count occasions of competent behaviour, as Digiacomo et al (1997) had counted the instances of the application of gloves in videos of resuscitation attempts. During the data collection period it became clear that it was not possible to accurately count occasions when competent behaviours were observed, either by direct or video observation. Despite the identification of the dimensions of competence from the literature, the specific indicators of competence were not known and therefore it was impossible to count them. This was compounded by the fast pace of the student activities in simulation.

Although it was not possible to evaluate the counting method when applied to video captured behaviours of competence, it was possible to count a proxy measure of competence. In Study B, the incidence of the practice mentors signing competence statements was counted. In real clinical practice, the mentors are responsible for the assessment of a student's competence and sign competence statements as a record of attainment. The simulated practice activities had been designed to provide the opportunity for a range of competence statements to be achieved. In the briefing for the simulated practice activity, the mentors were told that they could sign off competence

statements if they wished, but to be sure that the students had met the same requirements as they would be expected to in practice. All of the mentors were experienced, but none had been involved in simulated practice before. There was therefore no expectation that they would feel sufficiently comfortable to sign any competence statements, but they did on 123 occasions. As well as a general count of competence statements signed, it was possible to identify the mentors who did sign competence statements, and those who did not. It was also possible to identify and count the individual competence statements which were signed, where some were signed relatively frequently and others never achieved, and the spread of that incidence across the groups. In relation to the evaluation of the pattern of competency document sign off, it was notable that in some groups several students had competencies signed and in other groups no students did.

This straightforward application produced a significant amount of detail. Despite the failure to apply this method to the videos, the experience had demonstrated that it is possible to produce a surprisingly sophisticated level of analysis from a simple counting technique.

5.3.2   Coding

In addition to ensuring efficiency, the overarching design enabled an iterative process where elements of the earlier studies would be utilised to inform the later ones. This was particularly evident in the examination of coding. The first experience of coding a video occurred in Study A. This was to form the basis of a code, or taxonomy, which could then be incorporated in to a computerised semantic annotation tool, the primary research objective of Study D.

In Study A, the dimensions amalgamated from Benner (1984), Buller and Butterworth (2001) and Zhang et al (2001) (see Table 1) were used to code one of the videos. Essentially, it was possible to code for the dimensions observed and produce a time stamped list of where the types of behaviour occurred. However the coding produced was subjective and unreliable. This can be illustrated by the following example: the student nurse asked the patient if she was thirsty, and the patient replies that she is. This can be coded as 'communication', but it can also be 'gathering information', 'helping, 'compassion' 'effectively managing a rapidly changing situation' or critical

thinking'. The code allocated will be dependent on the opinion of the observer. A similar episode of behaviour may be coded differently, even by the same observer, depending on the context of the behaviour in the overall scenario. The reliability of such a coding scheme for dimensions of competence is therefore problematic.

A second attempt at coding the same video for the identification of specific nursing behaviours, e.g. touching the patient, verbal explanation, washing hands, proved to be more objective and reliable. This was therefore chosen as the coding scheme to be incorporated within the annotation tool.

The aim was to produce an annotation tool which would enable the coding of video captured behaviour in real time. The tool therefore needed to allow researchers to rapidly access codes via a computer interface as soon as they are required. Speed was particularly important as it had already been noted that simulated practice activities were fast paced.

The coding scheme was organised as a hierarchy, with top level buttons for Words and Sounds; Movements; Looks; and Actions, in the centre of the interface. Thereafter one or two additional mouse clicks enable the selection of the specific code required. The annotation tool interface is illustrated in Figure 6. The centre button 'Movements' has been selected. The selection of the top level then produces the display of the second level of the hierarchy in the left hand pane. In this example 'communication' is selected, and this displays the final, most detailed level in the right hand pane. In this example 'touches patient' is selected which is then logged in the pane at the bottom of the interface.
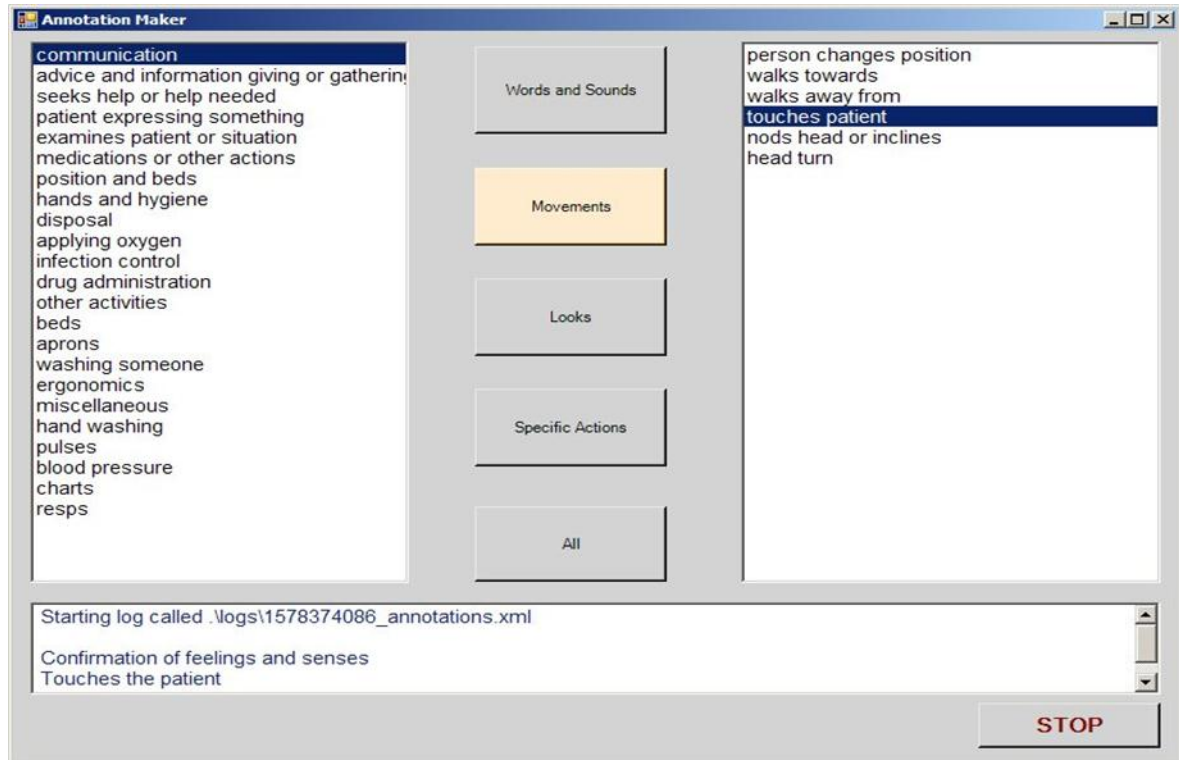
Figure 6: Annotation tool interface

In addition to producing a log of the codes, the tool uses semantic annotation technology (Weal et al, 2007) to electronically mark the video data with searchable electronic tags. These tags enable the video to be searched for individual examples of codes, e.g. to identify every occasion where the 'Touches the patient' code was selected. The annotation tool also superimposes the text annotation of the code on to the video when it is replayed. This is illustrated in Figure 7.

Figure 7: Example of annotated video

The annotation tool was tested in Study D. Two nurse researchers annotated two episodes of simulated practice activities as they were being video recorded. The two researchers' codings of the same activities were compared. Both researchers had found that the use of the interface was intuitive and enabled relatively rapid coding, but their coding was not identical. It was possible to identify slower paced periods where coding was relatively consistent, but there were also episodes where the complexity and rapidity of transition between observed behaviours made accurate and consistent coding impossible in real time.

There were four findings from these 'coding' studies, which were influential in the design of the main study. Firstly, it demonstrated that there was no existing coding system for the indicators of competence and secondly that the dimensions of competence amalgamated from the literature could be used to code video, but this was sometimes subjective and unreliable. The development and testing of the annotation tool demonstrated that the real time annotation of selected elements of behaviour is possible, but finally and crucially although coding for elements of behaviour was reliable, it became so detailed that subtle indicators of competence were lost. It was clear that breaking episodes of behaviour down in to their constituent parts only served to mask the nature of the practice observed. In order to study these tacitly understood behaviours it would be necessary to view the episodes in their entirety, context intact.

5.3.3   Transcription

Study A provided the first experience of transcription. One of the videos of the students in simulated practice was used as the focus for an audio-recorded discussion between three academics about the feasibility of video analysis. The conversation was then transcribed. The transcript was first subjected to a thematic analysis, from which a coding tool was developed and applied to the transcript, and finally an attempt was made to use Discourse Analysis (after Marquardt and Wadhill 2004). These activities provided practical insight in to the skills and time involved in accurate transcription, including an appreciation of the techniques used to code for the characteristics of speech. In addition, the review of the different techniques applied to the same transcript highlighted the

volume of data and the complexity of the analysis required to develop an understanding of the meaning of qualitative data.

Study B presented the first experience of the analysis of video captured data and this raised two fundamental issues. The first was the consideration of whether video can be treated as data and this has already been discussed in section 4.6. The second issue arose as a consequence of watching 180 hours of video captured behaviours. The phrase 'a picture paints a thousand words' developed a new significance. The prospect of comprehensively transcribing video captured behaviour brought the complexity of the task, and the nature of the skills which would be required to achieve it, in to sharp focus.

The practicality of achieving comprehensive transcription was questionable, as was the value of doing so. Therefore although transcription and textual analysis, in their varied forms, are the conventional data handling techniques, their application to the handling of video captured data had the potential to 1). be prohibitively time consuming and 2). would be too coarse a tool to elicit the subtleties of observation required.

To illustrate this point, the still photograph, Figure 6, was taken during one of the simulated activities in Study A. There are seven participants plus the 'Sim-man®' mannequin. Each participant is undertaking a different activity. For each participant it is possible to describe a) their position in space, b) their relationship to each other and the equipment and/or task with which they are engaged, and c) their conversations, body language and facial expression (Bales 1979). To accurately describe and then analyse the fine detail of what is happening in this one still photograph in text is complex and time consuming.

Figure 8: Still from simulated activity, Study A, Summer 2004

An attempt was made to transcribe the activities in Figure 8, it took more than 8 hours and the result was not comprehensive. The inability to produce a multidimensional transcription of a still image, confirmed the conclusion that the comprehensive transcription of 180 hours of video was an unrealistic expectation. A practical and achievable alternative to multidimensional transcription was needed. It seemed entirely possible that direct interpretation of the video captured data could be at least as valid as the interpretation of the textual transcription abstracted from it.

Although multidimensional transcription had been discounted in Study A, it had been relatively straightforward to produce a transcription of the spoken content of the videos. The examples of research using video identified in the literature used transcription in this way (see section 3.5). This technique was therefore undertaken in Studies B and C. In total, the spoken content of the video recordings of 30 scenario debrief sessions and 14 focus group discussions were transcribed. In Study B, the transcripts were thematically analysed, and in Study C, an ethnographic approach was taken.

5.3.4 Thematic Analysis

In Study B the videos were first observed as 'live events' and observational notes taken, the videos were then reviewed as individual cases, further notes taken and the debrief discussions transcribed. Further review of sections where the transcripts were unclear then followed, to validate first impressions, and to ensure that account was taken of the paralinguistic cues, e.g. where students could be seen to be tacitly agreeing or disagreeing with comments made by others. This process confirmed that video allows for greater insight in to behaviours than transcription of the conversation alone, even when accounting for pauses, hesitation, intonation etc. The transcriptions of the individual cases were then combined to identify common themes which were: student expectations of simulation, reality of the simulated environment, physical assessment skills, being watched, the input of mentors, perceptions of the theory/practice gap, demonstrating professionalism, the post event debrief, and feelings.

5.3.5 Ethnography

Study C used an ethnographic approach (based on Hammersley and Atkinson 1995) to the analysis of the video/audio captured behaviour of the focus groups to elicit the student perspective on using simulated practice as a means of assessment. The techniques for the observation and transcription of the video captured data were similar to those used in thematic analysis. Thereafter the transcribed responses were analysed according to the predetermined prompt questions. Paralinguistic cues were considered in the analysis to account for discrepancies between verbalised accounts and the responses of both speakers and listeners. The potential strength of agreement by collective nonverbal cues was included in the production of a thick description of the issues relating to assessment and simulation from the students perspectives. Although still focussing on the transcribed spoken content, the ethnographic approach allowed for greater flexibility in the production of a meaningful analysis. The results of this study highlighted that the students demonstrated clear insight in to the subtleties of 'practice', prompted by the fact that they were considering the prospect of their practice being examined. It was also clear that these subtleties were not easy to articulate, although when several perspectives were collated the underlying meaning became clearer. The students concerns related

to the effect of being watched on their performance, and the ability of the assessor to accurately assess.

In summary, the experience of the use of ethnography highlighted the limitations of the use of a research method wholly dependent on words, particularly where subtleties of meaning are difficult to articulate. Importantly, the collation of different perspectives of an understanding provided a useful strategy to uncover these subtleties of meaning, and this was a major influence in the methodological design for the main study.

5.3.6   Direct vs video observation

In Study A, observation field notes of the simulated activities were taken by three observers. The observers were watching the activity live but on the video screen in the control room (see Figure 2). Although the three sets of field notes were not analysed in a formal sense, a basic comparison demonstrated wide variation in the quantity and quality of the notes recorded. The three set of notes showed general agreement in the identification of 'significant' episodes of behaviour, (e.g. When the students called the doctor, when the student with the blonde ponytail recognised the patient had stopped talking), but the level of detail and interpretation were markedly different. The field notes of the recorded activity were then compared with the recollections of the participant observers in the scenario, i.e. those who were directly observing, and identified the same 'significant' episodes of behaviour, as the indirect observers.

There was also no apparent difference in the practical application when using the annotation tool, live or on a replayed video. It must be acknowledged, however, that the method of video capture (see section 4.5) is crucial for video and direct observation to be considered equivalent. The video must be continuous and unedited. Any manipulation of the video would lead to an alteration of context and equivalence to direct observation would be lost.

5.3.7   Advantages/disadvantages of the use of technology

These exploratory studies provided extensive exposure to video recording, archiving, observing, annotating, analysing, and transcribing. The technologies utilised in these processes were the video recording interface, the video replay software (Windows MediaPlayer), a DVD writer, the annotation software,

Microsoft Word, Microsoft Excel, Microsoft PowerPoint. This experience enabled the compilation of a list of the advantages and disadvantages of the use of these applications.

Advantages

1. Video captured behaviour can be replayed. Each time the event is replayed, it is possible to "see" things missed previously.

2. Video captured behaviour can be observed and analysed by different observers.

3. The analysis of video captured behaviour can occur during the recording and/or at any time after the recording has been made.

4. The video is a permanent record of the events and can be reviewed to corroborate the interpretation.

5. The video recording can be used to illustrate the findings of the analysis.

6. The exposure to different technological applications, which facilitate the handling of video captured digital data, demonstrated that good user interface design has the potential to both simplify and improve the efficiency of what are otherwise labour intensive activities.

Disadvantages

1. The volume of digital data produced by video recording is very large which presents challenges for data storage and data handling.

2. Video recordings can be produced in a variety of digital formats. Not all formats are compatible with other software programmes. Format conversion, where possible, is time consuming.

3. Where an annotation file is 'attached' to the video file, the synchronisation of the two files must be accurate and consistent. If the two files "slip", as occasionally happens with television, i.e. where the pictures and sound are mismatched, the analysis will be flawed.

4. The video captured behaviour of students in simulated practice often contained students with very similar characteristics. E.g. all girls in

uniform dresses with blonde ponytails. Identification of people or objects in the transcription and analysis processes was often problematic.

Although the evaluation has identified a list of disadvantages, consistent with the research objective, this is more accurately described as a list of challenges. These challenges make the application of technology more difficult, but they are not insurmountable. The depth of understanding gained by the practical experience of attempting the different methodological approaches led directly to the specification of the bespoke BigSister tool used in the main study.

5.4   Research Objective 3: Assessment of Competence

The evidence already presented has identified that no established coding system for competence could be identified from the literature. The dimensions of competence, amalgamated from Benner (1984), Buller and Butterworth (2001) and Zhang et al (2001) (see Table 1) were used to code a video in Study A. This attempt at coding demonstrated that the dimensions of competence could be used as a code, but that they were subjective. When applied, the codes for the dimensions were often overlapping and occasionally interchangeable e.g. thoroughness and professionalism, communicating and information gathering. The dimensions were too broad to be used as indicators of competence, and they were not able to distinguish the subtle cues which the observers employed to inform their coding decision.

As the dimensions of competence were too broad, a code with the narrower focus of the elements of behaviour was tested, e.g. touching the patient, taking a pulse, oxygen administration. This was also successfully applied, but the deconstruction of interactions to their component parts, led to a loss in meaning. This confirmed the findings of the literature review relating to competence summarised in Chapter 2.

The evidence from the studies did, however, establish that observers agreed on the significant events during the simulated practice activities which they had used to inform their judgements of competence. Although they could not describe the observed indicators of competence precisely, there was collective agreement on the interactions which were important e.g. when the student moved the bed table, when the others left one student stayed with the patient.

There was also evidence that these interactions could be 'seen' in the videos as well as during direct observation. The collective agreement of observers, about the episodes which informed their judgements of competence, suggested that it would be possible to focus analysis on these episodes. By developing an understanding of the observed behaviours which were triggering the judgement of competence, it may be possible to identify the observable indicators of competence. This observation forms the rationale for the methodological design in the main study; the analysis would focus on the judgements of competence and the events that trigger them, rather than the events themselves.

5.5 Research Objective 4: Simulation as a platform for research

In Studies A, B, C and D, standard educational evaluation strategies (Guba & Lincoln 1981) were used to determine the students' perceptions of the simulated practice experience. The evaluation questionnaires were structured to elicit information about their preparation for the session, views on session structure, realism, relevance to practice, team working, confidence and learning. Each question asked for an indication of the respondent's level of agreement (5=strongly agree, 4=agree, 3=neither agree nor disagree, 2= disagree, 1= strongly disagree) to each of 32 statements. The evaluation questions were first tested in Study A, and refined for the data collection for Studies B, C and D. The evaluations were administered on-line using a software programme (Perception™) which analyses data automatically to produce simple descriptive statistics in a variety of report formats.

	Yr 2 Adult (n=277)	Year 2 Child (n= 53)	Year 2 Mental Health and learning disability (N=18)
Overall rating 5=excellent 1=poor	91% rated 4 or 5	85% rated 4 or 5	50% Rated 4 or 5
I learnt less than I would have in practice	6%	6%	12%
I have learnt to work in a team	53%	41%	50%

I have been able to practice without fear of making mistakes	83%	92%	61%
It is more stressful than practice	18%	6%	18%
The scenario was realistic	82% Agreed or strongly agreed	90% Agreed or strongly agreed	72% Agreed or strongly agreed
The scenario was relevant to my practice	85% Agreed or strongly agreed	83% Agreed or strongly agreed	83% Agreed or strongly agreed

Table 5: Selection of evaluation data from Study B: Simulation in Practice Report. (Unpublished 2007)

Table 5 provides an extract of the evaluation data from Study B which demonstrates that more than 70% of students felt that the scenario was realistic and relevant to practice. There was a noticeable difference between the Adult and Child branch (field), and the Mental Health branch (field) students' perceptions of realism which may be attributed to the difference in the scenarios undertaken. It is notable that the Adult and Child Branch (field) scenarios utilised the Sim-man® mannequin, but that this was not used for the Mental Health scenario. It should also be noted that the Mental Health student group (n=18) was the smallest. Overall, however, the data indicates that students view learning in simulation as very similar to learning in a clinical environment, but that it incurs less stress and removes the fear of making mistakes. This indicates that the students' actions in simulation may be less inhibited than those in a clinical environment, but there is no indication that the behaviour would be significantly different.

The focus group transcripts indicated that the students were able to recognise that the environment was not 'real', but in the majority of cases conveyed that it was 'real enough'. The students frequently made comparisons with their experiences in practice, highlighting both similarities and differences. This indicates that they were using the same set of 'evaluation' criteria for simulated practice as they use for real clinical practice. It is notable that this evaluation strategy does not include any mention of the tasks undertaken, but instead

focuses on processes, professionalism, practice, and feelings/attitudes. The students appear to understand the achievement of 'competent practice' as the overall purpose of their practice experiences. There is also a insinuation that they fear being judged incompetent, although no examples of this happening were provided.

In summary, these findings suggest that simulated practice is a credible platform to research student nurse competence. In the same way that a wind tunnel can be used to test a prototype aeroplane, it would not be unreasonable to used videos of simulated practice to test a new methodological approach to examining practice based behaviours, prior to use in the 'real' world. In addition, the students' perceptions of competence contribute to the argument that competence is a tacitly understood behaviour. The students demonstrated that they understood what competence meant to their professional development, but they were unable to describe what competence was, or how they would achieve it.

5.6   Summary and Conclusions

The experience of conducting these exploratory studies led to a greater understanding of the challenges of a) researching student nurse competence, and b) using technology to do so. The findings identified that that all of the methodologies tested had limitations when applied to the exploration of competence. The findings also identified that competence appeared to be collectively and tacitly understood. The observers recognised episodes of behaviour which contributed to their judgement of competence, and students recognised that their primary objective is to achieve competence in practice. Neither group were able to articulate what competence was, and in fact did not even attempt to do so. It was accepted that everyone knew and understood what competence meant.

The exploratory studies also identified the advantages and disadvantages of the use of video as the data source for research and the inherent difficulties in the process of video analysis. In combination with the literature review these formed the factors which shaped the design of the bespoke technological tool, BigSister, and the methodological approach to the analysis of video, Video-View-Point, undertaken in the main study.

6. Methodology – Main Study

The exploratory studies, literature review and definition of the Ontology generated a profound understanding of the problem: the inaccessibility of tacitly understood behaviour to research. The aim of the next step in this research journey was therefore to develop a means by which tacitly understood behaviour can be made accessible. This chapter outlines the test of Video-View-Point, a hybrid method derived from the evidence base presented thus far, to enable the reality, as defined in Chapter 4, to be studied. Two methodological considerations (experimental design; hermeneutic approach), two techniques (The Think Aloud Method; Sensus Communis) and two tools (The bespoke Big Sister tool; Eye Tracker) constitute the epistemology underpinning the final study. These six fundamental elements are embedded at the appropriate points within the formal report of the method.

6.1   Overview of the method

The following sections describe the methodological approach applied to the testing of Video-View-Point, the main study in this research. An experimental 3 Arm design with cross-over in Arm 3, was used to evaluate the ability of the Video-View-Point method of video analysis applied to the data collected via two technological tools (Big Sister and an Eye-tracker) to identify tacitly understood behaviours. For the purpose of this experiment, competence was used as the exemplar of tacitly understood behaviour. Purposefully selected participants were briefed on the use of the relevant tool and then instructed to identify behaviours which contributed to their judgements of competence by recording Think Aloud commentaries whilst observing videos of student nurses in simulated practice.

In relation to the ability to identify tacitly understood behaviours, the points where observers identified the same excerpts of behaviour via both tools, points of congruence, were collated and the commentaries were transcribed and organised by time periods to generate a dialectic of the participants' judgements of student competence. The dialectic was analysed to assess whether the 'signified' could be identified, whether it was possible to visualise communis sensus, and identify whether there were differences between the dialectic generated by each of the technological tools.

The evaluation strategy incorporated the audio recording and transcription of post observation semi structured interviews to compare the observers' perceptions of the usability, advantages, disadvantages, and limitations of the two tools. The participants were also asked to identify the episodes of behaviour which they felt were pivotal in their judgement of competence, and to provide their summary judgement, competent/incompetent, of the individual students observed on the video. The triangulation between the output of the Eyetracker, BigSister and the interview data provides additional information with respect to the reliability and validity of the tools. It also provides the means to evaluate the impact of the hermeutic approach adopted with the use of both tools when compared with a standard semistructured interview technique.

6.2   Research Question

Can a technological tool, either an Eye tracker or the bespoke BigSister tool, in combination with Video-View-Point, a method of video analysis incorporating the use of multiple synchronised Think Aloud commentaries about focussed elements of video-captured behaviour, reveal tacitly understood behaviour?

6.3   Aims

In order to answer the research question, there are 2 identified aims.

1. To test whether technological tools can validly and reliably elicit tacitly understood behaviours.
2. To identify tacit indicators of competence

6.4   Objectives

There were 6 research objectives to be addressed in the testing of Video-View-Point;

1. Test the hermeneutic approach and the BigSister/Eye tracker tools using the principles of experimental design with a number of purposively selected but randomly allocated observers.

2. Determine whether the tools facilitate the identification of the 'signfied' in addition to the 'signifiers in the Think Aloud commentaries' i.e. can they identify tacitly understood behaviours which are not amenable to articulation in addition to those which can be described in words.

3. Determine whether it is possible to use the commentaries to produce a dialectic which articulates collectively understood truths.

4. Use the technological tools to present the analysis whilst maintaining the context and truthfulness of the data.

5. Assess the Eye-tracker and Big Sister tools with respect to validity, reliability and usability, by comparing the outputs with each other, and triangulation with the transcripts from the semi structured interviews.

6. Determine whether it has been possible to identify specific indicators of competence.

6.5   Ethics

The proposal for the test of Video-View-Point was submitted to and approved by the Faculty Ethics Committee: FoHS-ETHICS- 2010-035

The fundamental principles of the PREVIP Protocol (outlined in Section 5.2) were explicitly referred to and incorporated in to the study design. The previous approval of the PREVIP Protocol by both the Faculty Ethics Committee and the Research Governance Office enabled this application to be approved without substantial clarification.

6.5.1   Data Protection

The rights of the two groups of 'participants' i.e. the subjects who have been video recorded, and those who observe the video recording, are equally important. The management of both sets of data using the principles of the PREVIP protocol (see Section 3.5) ensures the protection of the rights of the individuals and complies with current legislation. The principle of data guardianship ensures the ongoing responsibility for, and management of, the

secure storage of data. The two technological tools comply with the PREVIP Protocol restrictions on data storage and use, and provide the means to efficiently archive data.

6.5.2 Identifiable data and consent

The use of video and audio recording presents challenges relating to anonymity. The intention for the use of data was clearly defined and explicitly consented for during the recruitment of the participants. This is particularly relevant to the subjects of the video, as the intention to use the video as the representation of the behaviours identified, requires their images to be used in the representation of the analysis. To a lesser extent the observers may also be identifiable in their audio recorded commentary. The explanation to both sets of participants during the consenting process emphasised the inability to completely anonymise the data collection and representation.

6.6 Sample Selection, Recruitment and Randomisation

The experience in the Exploratory Studies regarding the volume of multimedia data required to reach data saturation informed the sample size. Eight participants plus four reserves (i.e. a total of 12) were purposively selected from academic and clinical colleagues as a group of experienced clinicians and mentors. The reserve strategy was incorporated to cover four eventualities –

1. If any of the eight participants declined the invitation to participate.
2. Where a participant is unable to be eye tracked despite the initial screening (see below).
3. To act as additional participants if data saturation was not achieved.
4. If unanticipated confounding factors were uncovered during the data collection which could be controlled for by additional data collection. This would be treated as a separate fourth arm and would be subject to Ethical approval as a protocol amendment.

A group of clinicians and academics had been involved in the simulated practice activities undertaken in the School since 2003. This group were aware of the research activities surrounding the simulation sessions and without solicitation, twenty of them had expressed an interest in further involvement. The group provided the pool from which the participants were purposively selected for this

experiment. The subjects were matched as closely as possible for years of experience, previous exposure to simulation, and expertise as a mentor. The participant demographics are summarised in Table 6. One participant (E), has significantly fewer years in practice than the rest of the group, but was included because she was equally experienced in simulation and had reached the same clinical grade. They were approached via their known contact details (email address) and asked if they would be interested in participating in this research experiment during a stipulated 2 week time period. The email also asked screening questions, necessary to establish likely success with the eye tracker. The exclusion criteria for use with the Eye tracker were collated from a number of previously published studies as the best evidence available to predict the success and accuracy of the eye tracker data collection (O'Driscoll et al 1999; Mastropasqua et al, 2006; Guastella et al 2008; Sweeney et al, 1998). The conditions are:

- The presence of ocular pathologies; cataracts, peripheral field deficits, glaucoma, uveitis, nystagmus, unusual corrective lenses. III,IV or VI Cranial Nerve palsies;
- Previous history of brain/eye/facial tumours;
- Major head injury or stroke;
- Photosensitivity or uncontrolled epilepsy;
- Personal or family history of schizophrenia;
- Previous electroconvulsive therapy;
- Alcohol or other substance abuse within the previous 6 months;
- Pregnancy.

As some of these conditions are potentially sensitive and the sample were all qualified nurses and known to the researcher, the decision was taken to make this a self-screening exercise i.e. the participant decided whether they should be excluded and if so they declined to participate without stating the reason. This occurred on one occasion. They were asked to reply by email either positively or negatively, within one week, and if they were interested in participation to provide some demographic details , i.e. years qualified and number of years' experience as a mentor, field of practice, plus a telephone number and a date/time which would be convenient to receive a telephone call. Each respondent was contacted by telephone at the date/time they suggested. The randomisation process was undertaken during this call. The activities had been

placed in eight envelopes, numbered 1-8, and the participants were asked to choose an envelope from those numbers remaining at the time of the call. E.g. the first participant had a choice of eight, the second had a choice of seven, etc. Both the order of participant contact and the participant's choice of envelope were outside the researcher's control ensuring a legitimate randomisation strategy.

Once randomisation had been undertaken, an appointment for data collection was made for the appropriate duration i.e. one hour (Arms 1 and 2) or two hours (Arm 3), at a mutually convenient time. Participants were reminded to read and consider the Participant Information Sheet and Consent Form and that they were under no obligation to participate and could withdraw at any time up until they leave at the end of the data collection. A confirmation email with directions to the University and meeting arrangements was also sent, reiterating that they were under no obligation to attend the appointment if they changed their mind.

The four reserves had been sent a slightly different email asking if they would be prepared to participate as a reserve, and that this would potentially require contact from the researcher for them to cover a shortfall in recruitment over the data collection period. If they were required a suitable time would be negotiated, but this may have been only a few days in advance. It was stressed that participation could not be guaranteed but that the contingency of the reserve group was extremely important to ensure that the data collection could be completed. All four of the reserves replied positively, one was asked to make up the eighth participant slot, and after some technical difficulties two were asked to come as repeats for two of the participants as the data collection had been incomplete (on one occasion the Big Sister software refused to save, and on the other, the Eye tracking was found to be unsuccessful after the event).

6.7   Method

6.7.1   Experimental design

Throughout this research journey, an inductive and pragmatic approach has been adopted. This was primarily determined by the nature of the two pervasive themes identified at the outset: a) the potential to capitalise on recent advances in technology for research, and b) the exploration of student nurse competence

in simulated practice. Hammersley and Atkinson (1995) discuss how qualitative methodologies in general, although they were concerned with ethnography in particular, set out with the intention of studying a particular case study or setting. Then the nature of the setting, or pragmatic considerations which unfold during the conduct of the research, influence the research question and /or design. This proved to be the case at the conclusion of the exploratory studies outlined in Chapter 5.

The exploratory studies had been designed to identify the most appropriate method to explore student nurses' acquisition of competence in simulated practice. The intention was to find the most appropriate method and then apply it to elicit the indicators of competence. At the conclusion of the exploratory studies, however, it was clear that none of the traditional methods were ideal. As a consequence, the previously identified aims required re-evaluation. The re-evaluation of the aims of the research at the end of the exploratory studies also required a re-evaluation of the approach which would be taken.

Ashworth (1997a, b) discussed the differences between positivist and naturalist enquiry and made clear that although often perceived as methodologies at the opposite ends of the research paradigm spectrum, they are not mutually exclusive. Ashworth described how positivist researchers often use qualitative exploratory techniques to start a study, focussing thereafter to quantitative techniques (including experimentation) to generate rules or theory. This sequence is considered accepted practice. When taking a post-modern approach, where the aim is to develop understanding rather than generate theory, it is equally rational to perform the sequence in reverse, exploratory experiments and then formal qualitative method. The use of an experimental design in qualitative research is unusual but not unprecedented. Hammersley and Atkinson (1995) note the use of 'natural experiments', in particular when wishing to research events such as disasters. The exploratory studies had characteristics in common with a natural experiment whereby the use of a series of experiments provided the opportunity to take advantage of emerging situations, allowed for the testing of different methodologies, and facilitated a pragmatic solution to the absence of funding and stable infrastructure.

The exploratory studies constituted a series of 'natural experiments' and used episodes of video captured behaviour taken from simulated practice. Such

experimentation in a real world environment would have posed serious and potentially irresolvable ethical difficulties including: the ability to consent all parties when video capture is occurring (patient, staff, relatives); the unpredictable nature of the hospital environment (e.g. a previously stable patient may become acutely unwell at any time) ; the inclusion of real patients who may be deemed to be vulnerable and whose consent may be considered invalid (either temporarily or permanently) due to their illness; the legal and ethical status of the video once recorded (e.g. there have been instances where patients have requested video taken for research purposes, in order to prove negligence). The availability of simulated practice episodes in a controlled and predictable environment had provided a solution to these problems. The use of simulation as the platform for the experimentation, however, does call in to question the 'reality' or legitimation of the behaviours which will be observed. Whilst this must be acknowledged, it can be likened to using a wind tunnel or a test track to test a novel engineering solution, where such innovations can be transferred to the real world once proof of concept has been established.

The main study, the test of the Video-View-Point method, therefore builds upon the experience of using experimental design in the exploratory studies. The previous success of this approach identified the potential to produce a hybrid method, which would capitalise on the benefits of both positivist and post-modern principles. The intention is to utilise a formal post-modern approach to develop depth of understanding from the data, in keeping with the similarity to a natural experiment. In addition, the principles of experimental design will be even more formally incorporated, by utilising a standard cross over design to test the new tool/method against the most similar technological tool/method for undertaking research using video captured data.

An experimental design comprising three arms, with a cross over design in arm 3 was constructed, utilising scientific principles as a means to control confounding variables: exposure to one tool or both tools, fatigue in the two exposure group, sequence of exposure to the tool, sequence of exposure to the video, and bias by video content. The cross-over design is summarised in Table 6.

Two videos of the same simulated practice scenario, but with different student participants were chosen as the subjects for analysis. These videos were

selected from the data collected in the exploratory studies (Faculty Ethics Approval SONAM/006/2006 which included consent from the participants for the videos to be used for research purposes in the future). The twenty eight approximately 20 minute videos of the adult year two scenario were reviewed. The videos were screened to exclude groups where distracting incidents or extreme behaviours were observed, then two considered to be representative of the activities and average scenario duration were selected. These two videos were then converted to the format which provided the optimum resolution to be viewed via the Big Sister and Eye tracker interfaces. These were then uploaded to the computer being used for data collection.

All eight data collection episodes occurred in the room where the eye-tracker is situated, and used the same computer. The individual data collection episodes were as follows:

Table 6: Cross-over design allocation and participant demographics

	Participant	Tool	Video	Post Obs Interview	Tool	Video	Post Obs Interview	Years Practice	Years Mentor	Field of Practice
Arm 1	A	BS	1	√	-----	-----	-----	30	20	Neuro Rehab
	B	BS	2	√	-----	-----	-----	27	26	Critical Care (R)
Arm 2	C	ET	1	√	-----	-----	-----	30	20	Neuro rehab
	D	ET	2	√	-----	-----	-----	14	10	Critical Care
Arm 3	E	BS	1	√	ET	2	√	3	2	Elderly Care
	F	BS	2	√	ET	1	√	16	15	Critical Care (R)
	G	ET	1	√	BS	2	√	15	11	Critical Care (R)
	H	ET	2	√	BS	1	√	9	8	Emergency Care

Key: ET – Eye Tracker   BS - BigSister R – Reserve

When the participants arrived for the agreed appointment they were briefed, re-presented with the Participant Information Sheet and asked to sign the Consent Form. Both systems require the participant to watch the video on a computer screen and utilise a familiar computer configuration; a screen, a keyboard and a mouse, with the addition of a microphone, either via a headset connected to the computer, or sat on the desk in front of the participant depending on the system being used.

6.7.2   The Bespoke Big Sister tool

The understanding achieved from the exploratory phase of this research, informed the development of a bespoke tool for the analysis of video captured data. The elements required in the development of the tool can be categorised in to five domains:

a) The physical attributes i.e. what the tool needed to do;
b) The user interface – the functionality available to the user on the computer screen and the way that it looks and is arranged;
c) The ability to use the tool in several different modes;
d) Future-proofing; and
e) The technical considerations of media storage.

a) Physical Attributes

The most obvious criterion in this category is that the tool must be able to playback video files. However, even this seemingly simple requirement is not straightforward. There are many electronic file formats for video, and there are compatibility issues when integrating some file formats with other computer programmes, e.g. Word, Powerpoint, and CAQDAS applications. It is necessary to consider the operating and recording systems alongside the format of digital file storage to ensure that a compatible and serviceable tool results.

Whilst watching the video, observers will provide a verbal commentary which must be synchronised with the video. Video and audio commentary asynchrony would render the method invalid because it would be impossible to prove that the commentary related to a specific episode of the video data. Therefore it is essential that the synchronisation of a video file with multiple audio files in both recording and playback modes is rigid and precise.

The initial attempts at transcribing video indicated that it would be helpful to record points of interest that an observer would normally 'point at', for example 'she is touching him, there'. Additionally, there was often difficulty in differentiating between individuals e.g. 4 blonde uniformed students with ponytails, and the ability to 'point' at 'that student' would easily identify about whom commentary was being made. These points of interest should appear on the video when replayed with the associated commentary. They should be time limited, so that they disappear after a set number of seconds. It would also be useful to have a visual representation of all the audio recordings and associated 'points' made, even when watching and listening to another observer's commentary. This would enable the researcher to identify points on the video where several observers are talking and 'pointing' at the same time i.e. possible activity of interest.

The proposed method obtains commentaries from a number of users, as a way of finding congruence in the interpretations. Therefore all the commentaries would need to be synchronised with the video, and it would be necessary to switch between the commentaries for comparison. For the researcher it would be useful to add written notes during the analysis phase, and the textual annotation should also be synchronised and accessible when watching the video playback.

b). The User Interface

The interface should be easy to use, particularly for the observer to record their commentary, as it would not be desirable to have to undergo prolonged training for a one off event. It should have the ability to start, stop and pause, and the ability to 'point' with the mouse by a single click. The researcher would need more functionality, but again this should ideally be simple. It would be useful to skip to any region of the video or the commentary, the 'points' or the text notes – without losing the synchronisation. So selection of any element of interest would allow the researcher to skip to every instance of that element, much like the 'find' function used in Word documents. It would be useful to bookmark areas for future playback, and also delete the bookmarks should the focus of analysis change. The ability to mute the sound on the video, to facilitate concentrated attention to the non-verbal activities, may also be useful.

c). The ability to use the tool in different modes

It was clear, when considering the interface, that different groups of individuals would use the tool in different ways. The simplest form would be the recording of observers' commentaries. This requires the playing of the video, with start , stop and pause functions, with a built in synchronous recording of the observer's verbal commentary and 'pointing' by mouse click The researcher requires greater functionality, allowing bookmarking; skipping backwards and forwards - in time and between commentaries; and synchronised textual annotation. Finally, there should be a playback mode, which can be used in the representation of the findings, but could also be used by educators to give feedback to students. The use of the tool for feedback is not necessarily a research activity but nevertheless would be a useful additional application. The work on feedback from the ESRC project led to the consideration of students using the tool for self-directed learning. This type of student use could be achieved in the researcher mode to enable the students to annotate and reflect upon their own videoed performance.

In the playback mode, the ability to extract identified episodes of behaviour as a 'video clip' allows for the representation of the 'fastened' tacitly understood or ill-defined behaviours. The different observer perspectives can be collated from the commentaries to identify the 'video clips' where important behaviour is noted and/or commented upon. The commentaries can also be used in the production of a dialectic which, alongside the 'video clip', provides a representation of the collective understanding. The findings may be represented alone, textually augmented, and/or by the use of opposing or contrasting examples i.e. an example of competent practice versus incompetence, or a series of examples showing the stages in a developmental continuum. The choice of representation will depend on the focus of study, and its accessibility to articulation, given that the method may provide greater understanding than previously available.

d). Future proofing

The ESRC project required the development and testing of an annotation system for use in real time. The plan was to be able to use this to inform the student debrief /feedback. However, the ontology (used in the Computing Science sense – a hierarchy or list, and identified with a lower case 'o') developed was rudimentary. Although this first attempt at generating an ontology was useful

for the purpose of testing the annotation system, it was clear that it would need to be improved. The testing also demonstrated that any ontology embedded in the tool would be dependent on the focus of analysis of the particular study, Thus it is unrealistic to expect that a single comprehensive ontology can be developed to encompass all potential research questions, and therefore specific ontologies will need to be developed for specific research questions. The proposed tool may inform the development of these ontologies. In the future the incorporation of the annotation system with an embedded research question/field specific ontology may add a further dimension to the method of analysis. The tool should allow for the addition of such extra functionality.

e). Technical considerations of media storage

The volume of digital data storage required to enable the tool to function is extremely large. The video file is very large (180-200MB), and every associated audio file is also large (25-40MB). In order to make the system reasonably fast, even when using a high specification computer, it is necessary to compress some of the data and to automatically delete areas of silence in the audio commentary without losing the synchronisation.

From these broad categories, it was possible to construct a specification which was sufficiently detailed to enable communication of the requirements to computer scientists who would be able to build the tool. The opportunity arose to commission a group of MEng Computing Science students who were required to undertake a real project enabling them to demonstrate their ability to identify a client's needs, interpret the requirements correctly, liaise with the client appropriately and deliver an appropriate product on time. This mutually beneficial project was based on the specification presented in Appendix 3.
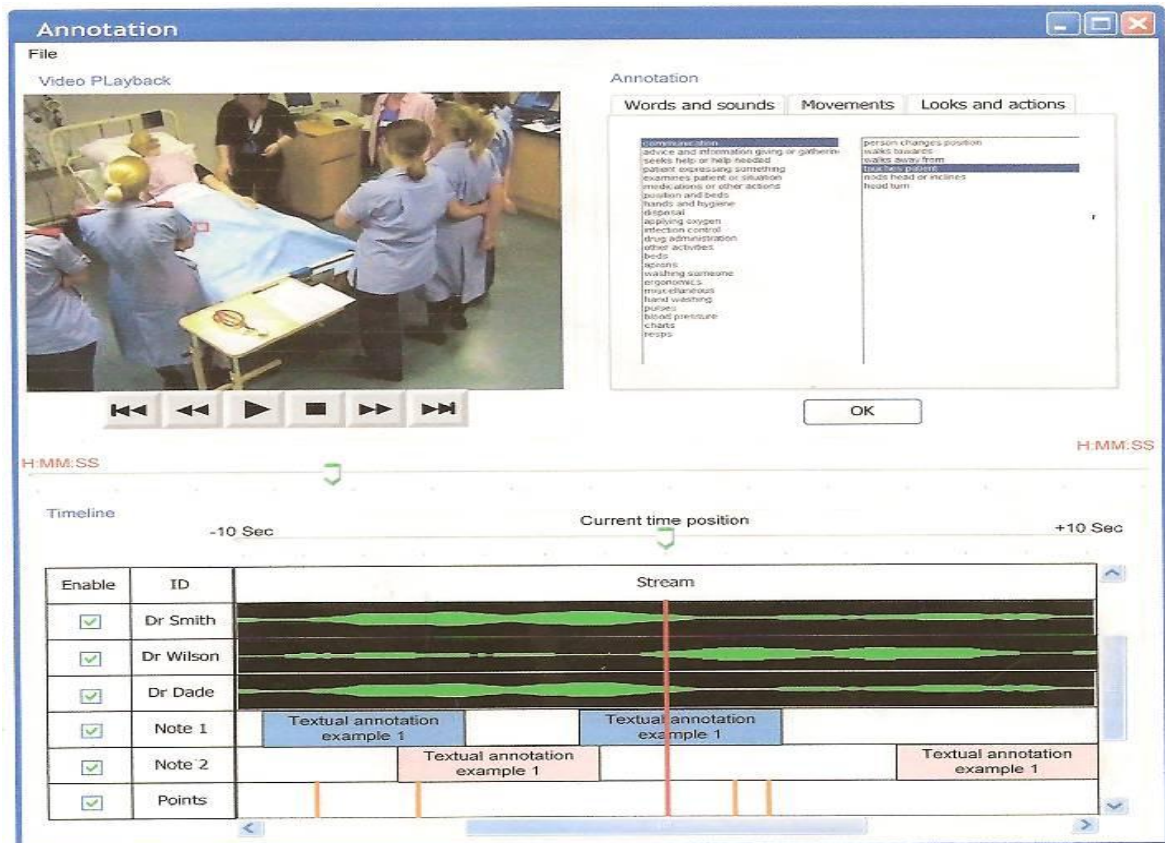
Figure 9: Big Sister Software Interface

Figure 9 is a screen shot of the software interface of the Big Sister tool. The tool is essentially a bespoke amalgamation of several freeware elements, linked in to a user interface to enable the functionality set out in the specification. It is compatible with standard file formats, and the interface is intuitive using a small number of familiar commands. The tool was formally and successfully tested against the set criteria as part of the MEng project assessment structure. The data storage considerations have been solved to the extent that the programme is serviceable; however a relatively high powered computer is required to run it. The programme provides a reasonably stable platform although future technologies may improve the speed, stability and functionality of the application. The students gave the prototype a name - 'Big Sister'. Despite some concerns about political correctness, the name has stuck.

Practical Application

The Big Sister software was opened on the computer, and the video (either 1 or 2 depending on the randomisation) was selected, A 'project' was then created and named via the software interface – in order to collate the data from all of

the participants observations of the same video, the project name was either video 1 or video 2. All three observations for the same video were saved to the same project. The last field for completion was the participant identifier, and initials were used for this purpose. The recording interface was then selected.

The participants were asked to watch the video specifically to judge whether the students were competent or not, as if they were assessing them in practice. The script for the observer briefing is presented in Appendix 4. They were asked to provide a commentary about what they were looking at. This Think Aloud method is described in the next section 6.7.3. At the same time as providing the Think Aloud commentary, the participants were instructed to use the mouse to move the cursor over the video and then left click as a means to 'point' at the subject they were talking about. Once the participant had indicated that they were happy to begin, they were instructed to click on the play button to start the recording. The participants were left in the room alone to perform the task to minimise distractions. The researcher remained outside the room so that the participant could access assistance should there be any technical difficulties.

6.7.3   The Think Aloud Method

Nursing Science has predominantly followed conventional methodological constructs. The desire for the establishment and recognition of a legitimate body of scientific knowledge to garner the acceptance of professional status meant that researchers focussed on topics identifiable as Nursing, but chose methods which would be judged as 'legitimate' (Polit & Beck 2004). The range of methods used for qualitative research in Nursing can therefore be seen to be conservative. These traditional methods; Ethnography, Phenomenology, Thematic Analysis, and Grounded Theory are utilised for the exploration of behaviour in general and rely on observation, language and text (Denzin & Lincoln 2007). Apart from one notable subset, Visual Ethnography which is described by Pink (2007) as a method which uses images where quotes would be in text, all of these methods use text as the data source and the means of representation of findings. Where the field of enquiry is tacitly understood behaviours, the absence of signifiers (the behaviour describing words) renders these conventional methods unproductive.

As previously described, the Ontology is shaped by the advent of new technologies and this provides opportunities to interpret and represent tacitly understood behaviours in innovative ways which challenge convention.

In consideration of the epistemology, one such technological adaptation of a less conventional technique is the use of The Think Aloud Method (van Someren et al 1994) combined with an Eye-tracker (Duchowski 2007). The Think Aloud Method has been used in Psychology since it was first described by Titchener (1929) as a method to elucidate internal cognitive processes. Newell and Simon (1972) were the first to combine the Think Aloud technique with computer models and generated detailed models of thought processes. This was further developed the 1980s as technological advances allowed for greater functionality, and Ericsson and Simon (1993) published their seminal work arguing that Think Aloud Protocols can be used as data and proposing a general theory of cognitive processes. Although now a widely recognised technique, there are a number of published criticisms: the challenge of synchronisation, disturbance of thought processes, the time lag between cognition and verbalisation, missing interpretations due to the limited perspectives obtained, and the difficulties in transcription (in line with traditional methods, Think Aloud data is also considered to be the transcribed text) (Seliger & Long 1983; Fonteyn et al 1993). Recently there has been a resurgence in the use of Think Aloud with eye trackers (see section 6.7.4) (van den Haak et al 2003, 2004; Guan et al 2006; Leow & Morgan-Short 2004) to examine the ease of use of online resources, and in second language acquisition. Although it is important to recognise the difficulties associated with these methods, the advances in technology provide opportunities to refine and develop the previously established principles, so that a) identified problems can be resolved, and b) these techniques can be incorporated in new solutions. The principles of the Think Aloud method have been incorporated in to the design of the BigSister and Eye tracker tools in order to elicit the cognitive processes employed when observers are assessing, in this test case, the competence of student nurses.

6.7.4   Eye tracker technology

Section 6.7.3 identified that some of the more recent research undertaken using Think Aloud protocols has utilised Eye tracker technology. This is a device which tracks where someone is looking on a text, image or video (Duchowski, 2007).

Commercially available eye trackers consist of a standard desk top computer linked to an infrared projector/camera which identifies and processes the projected infrared light reflected from the observer's corneas (Figure 10).
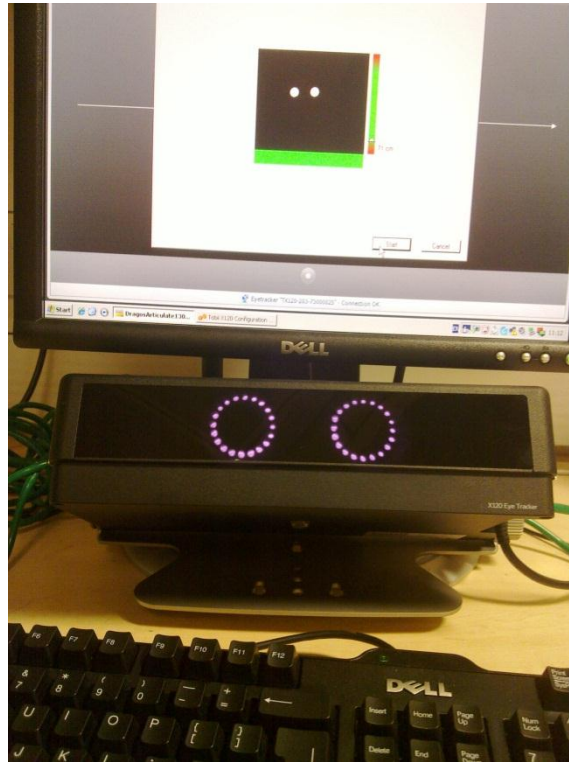

Figure 10: Tobii Eye-tracking Equipment

The current applications for these tools include the exploration and development of understanding surrounding the use of computer user interfaces (e.g. Poole & Ball, in Ghaoui 2006) and research into saccadic eye movement when reading text (e.g. Liversedge et al 2004). The end product is a visual representation, e.g. a tracked line of the sequence of the observer's eye movements, combined with dots denoting points of fixation, the size of the dot being relative to the length of time spent at that point. This is called a Gaze Plot (See Figure 11).
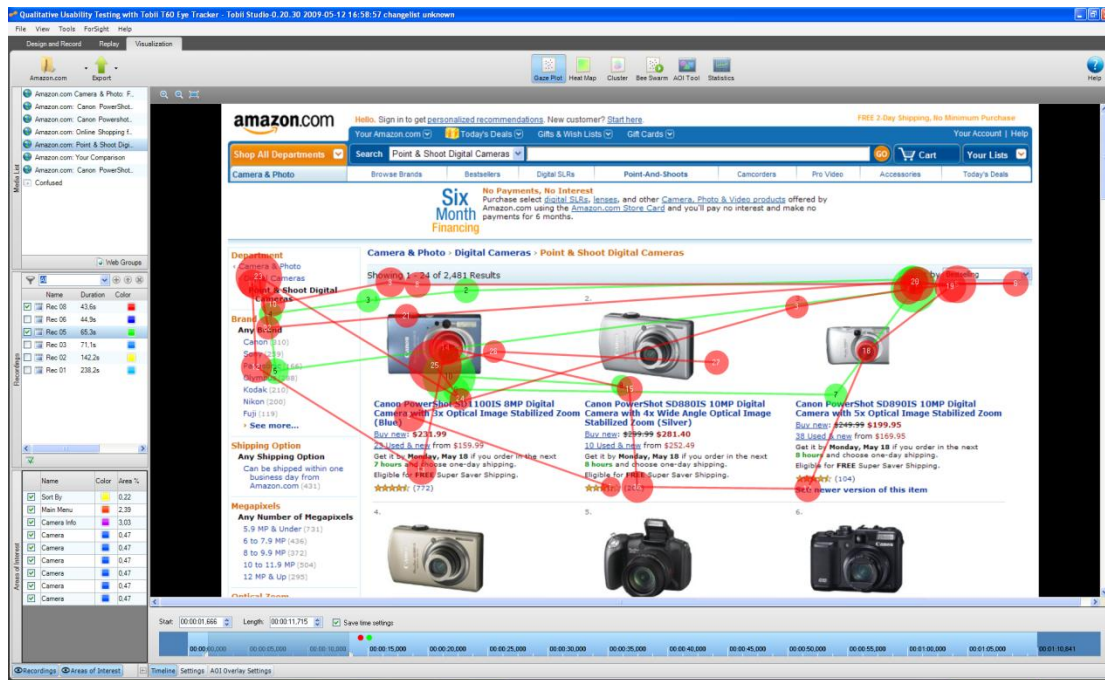
Figure 11: Gaze plot

The eye-tracking data can be analysed by the software package supplied with the equipment which allows the user to produce a number of different graphical representations of eye movement in relation to the object observed. It is also possible to synchronise a single audio commentary with the latest version of the software. The functionalities of synchronisation with audio commentary and identification of points of interest on a video by tracking eye movement made this the most similar technology to the bespoke tool developed as a consequence of the conclusions of the exploratory studies. This was therefore chosen in preference to all of the CAQDAS programmes as the comparator for the test of Video-View-Point.

Practical Application

When using the eye tracker, the first step is to open the eye tracker software programme which requires the researcher to set up a 'project' for each activity. It also has the facility to produce a set of instruction screens to guide the participant through the data collection process. Two projects with identical instruction screens were created, one for each video. The software does not allow for synchronised data collection, so each participant generates a separate file within the project.

Prior to data collection, the system needs to be calibrated to the individual participant. Calibration is non-invasive. The participant is required to look at and follow a series of dots which appear on the screen while the eye tracker calibrates the individual's saccadic eye movements. This takes less than two minutes. The protocol accounted for the potential failure of calibration, as this was identified as a relatively common event in the literature. If the calibration were to fail, it would be repeated. If the second attempt were to fail, the researcher would apologise for the difficulty and thank the participant for giving their time. The researcher would then contact one of the reserves to arrange an appointment to cover the shortfall. This did not happen with any of the participants in this experiment.

Once calibration was complete the participants were left to follow the instructions on the screen, and to complete the data collection whilst the researcher sat outside the room. In this respect the data collection was consistent, and ensured that the participants were not influenced or inhibited by the presence of the researcher.

6.7.5   Post- observation Interviews

At the end of each recording activity, the participant was engaged in an audio-recorded semi-structured interview (schedule in Appendix 5) which focused on the ease of use of the tool (Big Sister or Eye-tracker) and also on the observers' reflections on their ability to recognise competence in the video.

For those in Arm 3, after a break and the offer of refreshments, the process was repeated using the second tool. The second interview followed the same format as the first with additional questions about comparison between the tools.

At the end of the interview the participant was asked if they were still happy to participate, and for their recordings to be used as outlined in the PIS and Consent Form. All participants signified their agreement and were thanked for their participation. If they had wished to withdraw at this time, the researcher would have deleted the data collected, so that the participant could see that this has been done. The participant would be thanked for giving their time. The researcher would then need to contact one of the reserves to arrange an appointment to cover the shortfall. Again this did not happen in this experiment.

At the end of the data collection period, six observations of each video, three with Big Sister and three with the eye-tracker had been collected.

6.8   The Hermeneutic Analytical Approach

The aim of the exploratory studies was also to evaluate a range of qualitative methodologies to determine the most appropriate approach to the analysis of video captured data. The major conclusion was that the reliance on text in these methods was a fundamental limitation. The development of, and reflection on, the Ontology (as defined in Chapter 4) led to the conclusion that primarily text based methods would need to be discounted but that the principles of hermeneutics could be applied.

Bleicher (1980) provides a simple but effective description of hermeneutics.

> Hermes transmitted the messages of gods to the mortals, that is to say he not only announced them verbatim but acted as an 'interpreter' who renders their words intelligible – and meaningful- which may require some point of clarification, or other commentary.

> (Bleicher 1980 P11)

During the 19th and 20th Centuries, Hermeneutics fluctuated in its popularity. Philosophers wrote and theorised about the concepts (e.g. Dilthey, Weber, Betti, Heidegger, and Gadamer) and indeed developed rules/canons (Schleiermacher) or particular methods (Heidegger) which researchers have crafted in to practical research techniques (Bleicher 1980). Initially the techniques were solely text based, with the main focus on religious texts. This was expanded to language more generally, and most recently the study of contemporary hermeneutics has developed to include other media, which has its philosophical foundations in the work of Habermas and Heidegger, who both struggled with the inability of language to articulate 'dasein', or 'being in the world'.

The hermeneutic method is concerned with the understanding of the meaning content as opposed to meaning in itself; that is meaning as an act, or a meaning –full form. Betti (as described in Bleicher 1980) proposed that this can be achieved in four theoretical moments: the philological moment – a general effort to understand permanently fixed symbols; the critical moment – the emergence

of incongruences, illogical statements, and gaps in arguments; the psychological moment – to put oneself in the author's place and recreate his personal intellectual position; and finally the technical morphological moment – where one aims to understand the meaning content. This provides a framework for interpretation, the process of which Betti argues should enable the production of an objective interpretation. This is but one of many philosophical propositions for the process of interpretation. It does, however, serve as an example of the argument for the absence of mutual exclusivity in the practical execution of the positivist and post-modern paradigms. In terms of the epistemology this provides justification for combining principles from both.

In summary, one of the methodological approaches utilised in the epistemology of this research is to produce a paradigmatic hybrid, where positivist principles will be employed to generate focussed data amenable to post-modern hermeneutic enquiry in order to facilitate an objective interpretation.

Practical Application

The analysis was undertaken using a five step approach:

1. Identification of the points of observer congruence and the points of interest in both interfaces.
2. Transcription of the observer commentaries and the semi structured interviews
3. Production of a time stamped dialectic for each video, with screen shots of the points of congruence, and identification of the comments which were identifying 'signified' behaviours.
4. Counting of the distribution of the signified/signifier comments obtained from Big Sister and the Eye tracker, from Video 1 and Video 2, and in relation to the viewing sequence effects. Production of tables and graphical representation of the data
5. Thematic analysis of the interview transcripts in relation to:
   a) the usability of the tool
   b) the identification of the indicators of competence, which were then compared with the dialectic produced from the combined data.

6.8.1 Step 1: Identification of the points of observer congruence and the points of interest in both interfaces

Sensus communis

From an epistemological perspective, the Think Aloud Method is essentially a mechanism by which recollections of an episode of behaviour can be accessed. The participants provide a commentary directed to the subject of study. When several commentaries about the same subject are obtained, it becomes possible to identify episodes where there is a consensus amongst the participants in their interpretations, e.g. all the participants verbalised that it was significant that a particular student touched the patient at a particular time. This is an example of the original philosophical concept of 'Sensus Communis'.

The accepted modern meaning of Sensus Communis, ascribed to Descartes, is 'common sense' and interpreted as 'practical judgement'. Schaeffer (1990) argues that the original descriptions of Sensus Communis by Aristotle, St Thomas Equinas, the Romans (Seneca and Horace), and subsequently Vico, Kant, Gadamer and Derrida, offer a more sophisticated meaning. This is most eloquently described by Kant in 1760,

> For the principle, while it is only subjective, being yet assumed as subjectively universal (a necessary idea for everyone), could, in what concerns the consensus of different judging subjects, demand universal assent like an objective principle, provided we were assured of our subsumption under it being correct.

(Kant & Pluhar 1987 Critique of Judgement § 22)

The incorporation of the principle of Sensus Communis provides a means by which a collection of subjective thoughts, where certain conditions are met, can produce understanding which takes us closer to an objective principle. The conditions require the determination that the premises on which the commentaries are generated (Kant's subsumption) is correct. In order to use this principle, it is therefore necessary to first ascertain that there is tacit understanding of the issue under scrutiny and that the judges are sufficiently knowledgeable in the field to hold an informed view on the subject. The test of Video-View-Point builds on the evidence from the exploratory work, and all of these factors have been attended to in the methodological design in order to

provide the conditions where the principle of sensus communis can be used in the analysis.

As the Big Sister and Eye tracker user interfaces required slightly different procedures to achieve the same end result, it is necessary to describe the procedure for the identification of observer congruence separately for each tool.

Big Sister data

In order to analyse the Big Sister data, the software is opened, the project is selected and then the 'Analyse', rather than the 'Record' function, is selected. The analysis interface appears as below in Figure 12.
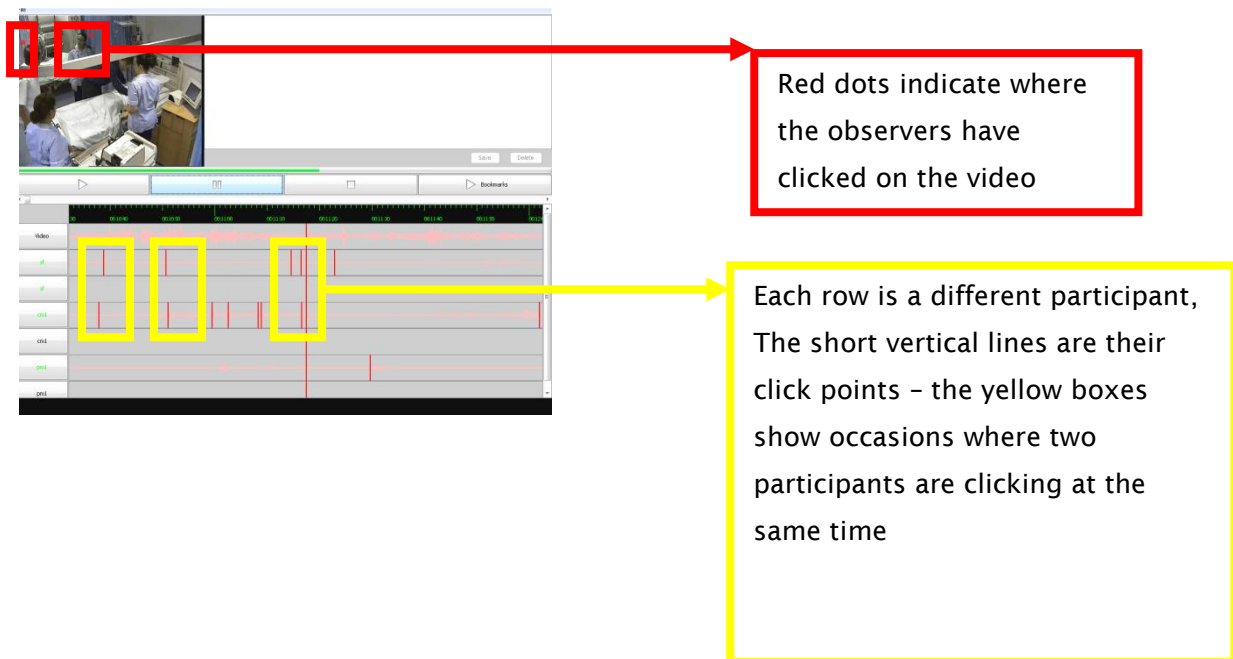
Figure 12: Big Sister Analysis Interface

Firstly, the video was watched in its entirety and a list was made of all occasions where two or more observers were clicking at the same time (e.g. a time stamped list of points during the video). An example of three of these points are indicated with yellow rectangular boxes in Figure 12. Each of these short vertical lines has an associated red dot on the video indicating the 'click' made by the observer. On a second viewing, the video was examined to note the location of the red dots (enclosed in red boxes on Figure 12). These dots indicate the points

that the observers were pointing at/clicking on. Screen shots were taken of these points noting the observer who made them. The long vertical line is the time mark, so this screen shot and the red dots on the video relate to the 'clicks' in the middle of the interface. The associated commentaries were listened to to assess whether there was collegial verbalisation by the observers. The points where collegial verbalisation on the same point of interest were identified with a tick in the time stamp list.

Eye tracker data

The Eye tracker software was opened and the project review option was selected. Each observer had to be allocated a different project in this software, so each was opened in turn to check that the eye tracks and commentary had been recorded properly. The eyetracker software does not have the facility for comparative analysis, so it is not possible to identifiy points of congruence in this interface. In order to address this difficulty a second bespoke software application, written as the result of another MEng Computing Science project, was used to obtain a comparative analysis. This software tool for 'Gaze Plot Analysis' takes the eye tracks from the different observers and compares them. For this project the the three files for each video were imported in to the software i.e. two Gaze Plots were produced. The software then caluclates the mathematical distances between the eye tracked points throughout the video. This produces a graph of gaze dispersion over time, where the closer the gaze points are, the closer the calculated line is to the x axis, the further apart they are the greater the distance to the x axis. This is illustrated by the blue line on the left field of Figure 13. Each downward spike (where the blue line is closest to the x-axis) indicates a event where the participants gazes are close together. By selecting the 'only show cluster' option on the user interface, the video data is represented with a pin-hole image, see right field of Figure 13. This pin hole surrounds the spread of all of the participants eye fixations (blue dots), therefore the closer they are the smaller the pinhole.
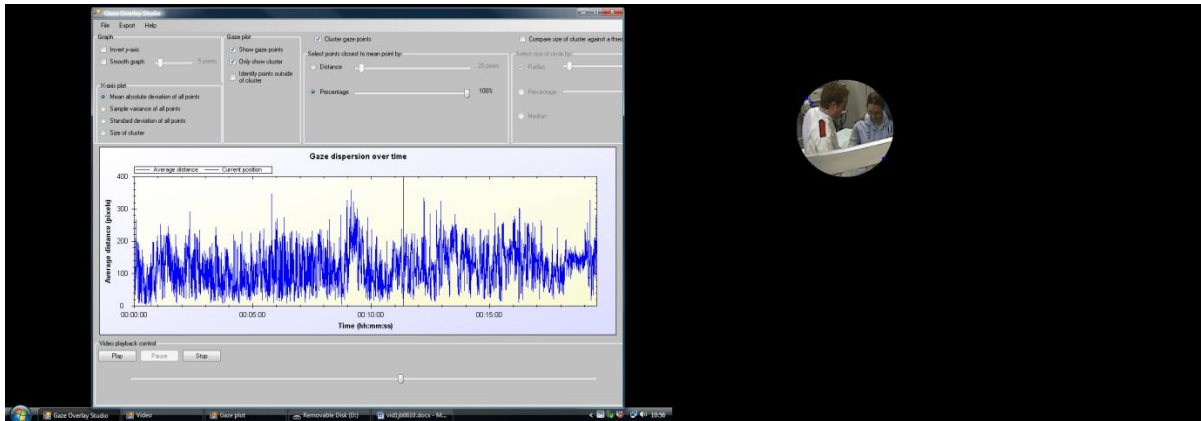
Figure 13: Gaze plot analysis software with pin hole image

The Gaze plot analysis was reviewed, noting the times of each downward spike (trough) in the gaze dispertion. This was the equivalent to the listing of the multiple click marks on the Big Sister interface. The second view then noted the subjects identified in the pin hole image and the associated screen shots were taken. It is notable that there were many more eyetracker troughs than BigSister clicks.

6.8.2 Step 2: Transcription of the observer commentaries and the semi structured interviews

Each of the observer commentaries was transcribed. The transcriptions also included the time at which the comments were made. The recordings of the semi-structured interviews were also transcribed.

6.8.3 Step 3: Production of a time stamped dialectic for each video, with screen shots of the points of congruence, and identification of the comments which identify 'signified' behaviours

The final practical challenge faced in the epistemology is the means by which the 'Sensus Communis' can be represented as the product of the research. In order to 'fit' with the Ontology this representation must demonstrate validity and reliability, address the data handling issues, and provide a means to develop understanding of tacitly understood behaviour.

As has been identified in both the Exploratory Studies and the Literature Review, contemporary research methods generally rely on textual analysis. This is a fundamental problem when researching tacitly understood behaviour. A multi-

media solution is required to facilitate representation of the 'Sensus Communis', accounting for both the verbal and non-verbal cues which prompt the observers' judgements. The technique by which Plato communicated Socrates' philosophical discussions, the dialectic, was identified as a potential solution. A dialectic is the report of a conversation which explores differing opinions in order to reach a consensus. This is generally reported verbatim, however advances in technology mean that it is possible to produce a multi-media dialectic: the verbal recollections of the participants linked to still images or video clips to illustrate the behavioural cues which are being commented upon.

The proposal is to produce a multi-media dialectic which represents the Communis Sensus of the judges' subjective qualitative commentaries about the behaviour under scrutiny. Where agreement amongst the judges in the dialectic is identified, the associated time-stamped episodes of behaviour can be used to produce an objective quantitative index of the video-captured data. The dialectic and the indexed episode of video captured and tacitly understood behaviour can then both considered part of the hermeneutic enquiry.

This step involved amalgamating all the observer comments, obtained by both tools, for each of the two videos. This was achieved by the production of a framework, including all of the comments in their time sequence, with identified points of congruence and the associated screen shots. This framework provided a visually accessible overview of the data. The collation of the comments by time period was complicated by the individual variation in the time lag between activity and commentary. This led to some sophistication in the allocation of the comments to time periods. As a general rule, the comments came after the time of the click or the gaze alignment, but then the comments, either side of the time point needed to be screened for content, to ensure compatibility. The patterns of the observers interaction with the BigSister software began to appear, some had longer lags between clicks than others, and once identified this could be factored in to the allocation. The completed framework then constituted a dialectic. A dialectic was produced for each of the two videos. The two dialectics were then analysed and coded for signifier and signified comments. The signifier comments were identified as clearly articulated descriptions of behaviours e.g. 'talking to the patient and putting it into context' or statements of fact e.g. 'There's mess all over the end of the bed'.

The signified comments were ill-defined, or concerned with thoughts of feelings e.g. 'appears to be making up information' 'so I think the one that is speaking now is taking the lead'. The signifier comments all contained an element of tacit understanding – e.g., we can recognise when someone is 'making something up' but what are they doing differently to make one think that; we understand 'taking the lead' but what is it that one is seeing that indicates 'taking the lead'. Once the practical distinction between signifier and signified comments was established, the coding was straightforward. The signifier comments were converted to red font which can be seen in the dialectics in Appendix 6.

6.8.4   Step 4: Counting of the distribution of the signified/signifier comments obtained from Big Sister and the Eye tracker, from Video 1 and Video 2, and in relation to the viewing sequence effects. Production of tables and graphical representation of the data

The two dialectics produced by step three (one for video 1 and one for video 2) were then coded further to identify the observer, the tool used, and whether this was first or second experience of using a tool (1st or 2nd view). Prior to each comment the observer's letter (A B C D E F G or H) was inserted, this was highlighted in Green if this used the BigSister software – left unhighlighted for the eye tracker. For participants A to D, this completed the coding. For participants E to H, it was necessary to code for sequence. After the identifying letter, a 1 or a 2, in brackets, indicated whether this was a comment resulting from the 1st or 2nd experience of using a tool. Eg G (2) was participant G using the BigSister interface, and this was their second experience of using a tool; they had used the Eye tracker with the other video prior to this commentary. With this coding in place on the dialectic, it was straightforward to count the total number of comments, the duration of the time period over which those comments were made, the total number of signified comments, the number of signified comments which were obtained from the BigSister tool, the number of signified comments which were obtained from the eye tracker tool, the number of signified comments which occurred during the 1st experience of using a tool, and the number which occurred during the 2nd experience (participants ABCD were excluded here, as they only experienced one tool). These totals were counted by event time and a table was produced. In order to produce greater

detail, the percentage of signified/total comments and cumulative results for each category were calculated.

6.8.5 Step 5: Thematic analysis of the interview transcripts

The transcripts of the semi-structured interviews were thematically analysed (Braun & Clarke 2006). This process involved two separate analyses:

a) The thematic analysis of tool usability contributed to the evaluation of the tools. The results of this analysis are reported as the findings for Research Objective 3 in Chapter 7.

b) The thematic analysis regarding the indicators of competence was compared with the signifier and signified comments in the dialectics to determine whether there was agreement in the two sets of data. The data were also reviewed to determine the level of detail which had been obtained by each approach. In addition, the observers had been asked to identify the significant 'events' in the videos which had contributed to their opinion of the students competence, and these were cross referenced to the events identified in the dialectics.

These five steps in the analysis produced both qualitative and quantitative results, as would be expected in a mixed method study of this nature. The results are formally presented in Chapter 7.

7. Findings and Analysis

This chapter presents the results and analysis of the test of Video-View-Point by research objective. The two multimedia dialectics constitute the raw data and these are presented in Appendix 6.

7.1 Research Objective 1: Test the hermeneutic approach and the BigSister tool using the principles of experimental design with a number of purposively selected but randomly allocated observers

The data collection was undertaken and completed successfully over the planned two week period. One of the purposively selected participants declined the invitation to participate and was replaced with one of the reserves. On two occasions the data collected were incomplete.

Occasion 1: the BigSister software did not save correctly as the result of a Java Script error.

Occasion 2: the Eye tracker saved the audio recording but no eye tracks, the reason for this was unknown.

Both of these participants were replaced by reserves and the incomplete data were not included in the analysis. The associated semi-structured interviews were included in the analysis as additional data. It was considered that their thoughts about the processes were equally valid as from their perspective they had completed the data collection, there was no valid reason to exclude this data, and the additional evaluation data would be useful to establish that data saturation had been achieved.

There was one other instance where the protocol was not followed correctly, and this concerned participant E, who experienced the Big Sister tool first and as it transpired after the event had not used the mouse to click as a pointer. It was decided to include this participant's data in the analysis as a truthful representation of the application of the method. It must be acknowledged,

however, that there is potentially some reduction in the cumulative marking of events in the BigSister data as a consequence.

Principles of experimental design

The proposed three arm experimental design was successfully applied. The employment of the formal control measures was translated in to an accurate coding and incorporated in to the representation of the raw data. This has enabled the production of a sophisticated visually accessible framework amenable to relatively rapid interpretation (see Appendix F). The production of the dialectics demonstrates that it is possible to apply the principles of experimental design to qualitative data collection. The application of the control measures has enabled a conventional, if basic, assessment of the validity and reliability of the data analysis which is described in section 7.5.1.

Use of the hermeneutic approach

The five step process for analysis, outlined in section 6.15, was easy to apply, and although time consuming, led to a comprehensive and objective overview of the data. All the observers' comments were included by time period. The ability to visually represent the cumulative data in this way adds an additional dimension of relative objectivity to the subsequent hermeneutic analysis. It was equally possible to achieve this with both tools (BigSister and the Eye tracker), although the ability to see all of the data on one interface using BigSister saved a considerable amount of time and effort during the analysis.

The representation of the cumulative data by time period in the dialectic establishes a platform which facilitates the hermeneutic effort. The use of multimedia adds depth to the interpretation. The ability to visually link the interpretations with the data identifies relevant episodes and provides access, previously inaccessible by traditional research methods, to the examples of tacitly understood behaviour. The detailed considerations of the results of the analyses undertaken are addressed within the sections for the remaining five research objectives.

As previously described the raw data in respect of Research Objectives 2, 3 and 4 are presented as the combined analyses. These will be referred to as the dialectics. The two dialectics, one for Video 1 and one for Video 2, are reproduced in Appendix 6, and include the coding undertaken in the analysis.

Coding system

In order to visually interpret the data, it is necessary to fully understand the coding system. This was first described in section 6.15.4, but warrants brief reiteration at this point. The participants are identified by their assigned Letter (ABCDEFG or H). Those highlighted green were obtained using the BigSister tool, those without highlight were produced by the Eye tracker. The letter in brackets after the participant identifier shows whether this comment was during the 1st experience of a tool, or the 2nd. The actual time of the comment is then provided before the comment itself. The Signifier comments (descriptive) are in red font, the signified (ill-defined/tacitly understood) in black font.

This simple coding structure provides an elegant and intuitively accessible representation of the data. Figure 14 illustrates the framework for coding as applied in the dialectic. This excerpt shows four participant comments, (E,G,H and A) the coding for participant G shows that they used the eye tracker, on the first view, and made a signified comment at 1445, whereas Participant H used BigSister on the 2nd view and made a signifier comment at 1448.
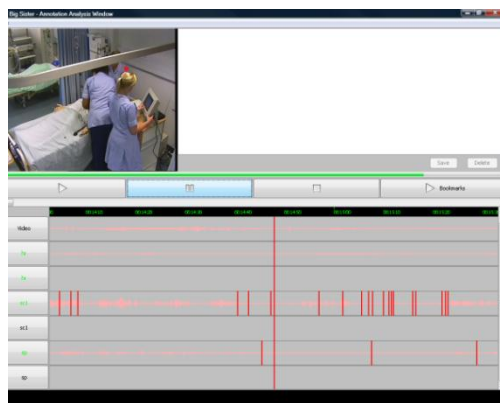
E(1)1445 they all need to start assessing the patient completely
G(1) 1445 responding to cues again from the patient
H(2) 1448 again seems to be a bit more of a leader, there seems to be , this one's interesting, I think she could do more
A1448 they don't sound very sure about what they are doing, they don't sound very confident

Figure 14:Extract of dialectic demonstrating coding structure

7.2 Research Objective 2: Determine whether the tools facilitate the identification of the 'signfied' i.e. tacitly understood behaviours

The dialectics illustrate that it was possible to code all comments as signified or signifier according to the definition articulated in Step 3 of the analysis (section 6.7.3). The ability to make a distinction between these two types of comments does not necessarily confirm that these tools provide the ability to represent the 'signified'. There is a distinction to be made between whether the 'signified' can be identified, and whether it is possible to render it amenable to further interpretation. Further discussion, with illustration from the dialectics, is required to present the results accounting for this distinction, and to demonstrate how the data elicited by the two tools differs.

The tools both provide the ability to collect time stamped comments. The subsequent grouping of the comments by time period allows for an overview of the Communis Sensus, and when considered alongside the screenshots reveals an insight in to the signified behaviours. The following excerpt from Video 1 at 0850 is used as an example (Figures 15 and 16).
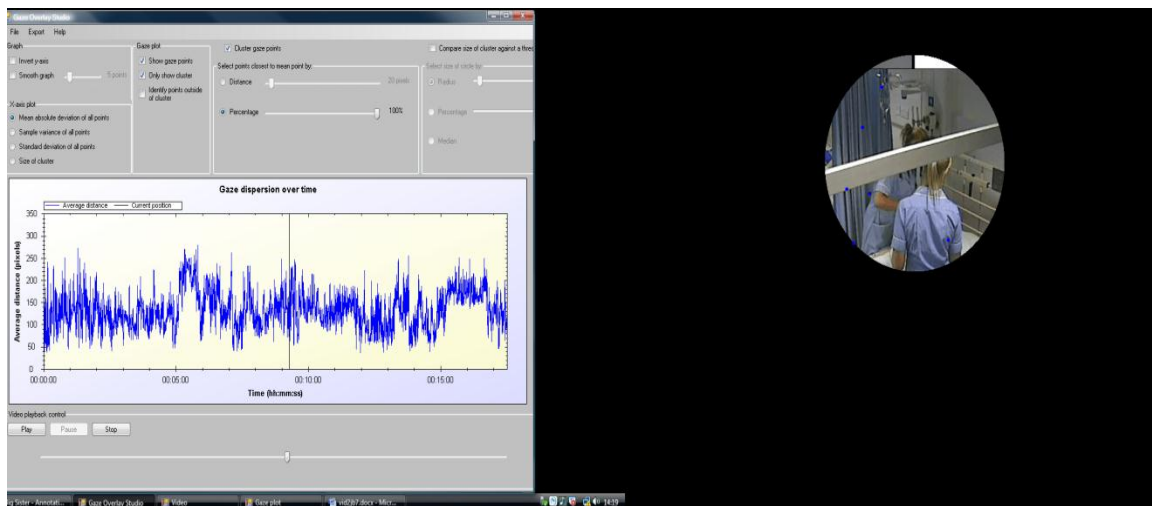

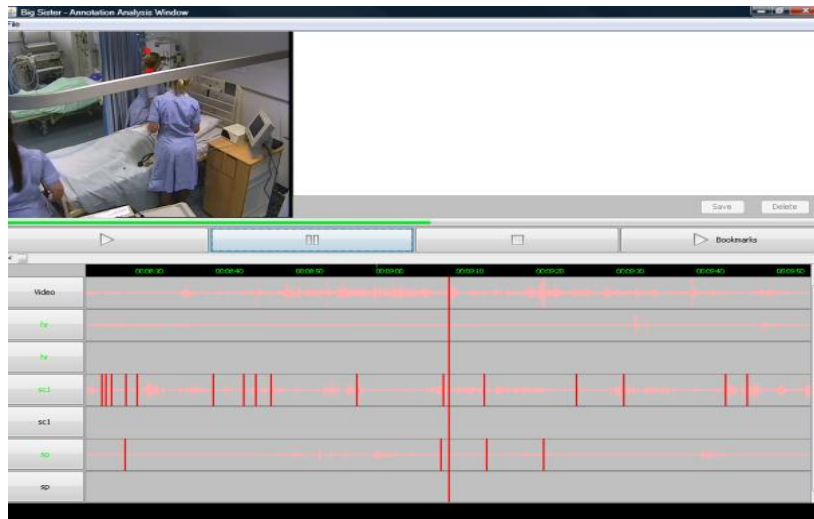Figure 15: Gaze plot - Video 1 at 0850

Figure 16:Big Sister interface -Video 1 at 0850

A0850 now they've all left the patient umm

E(1) 0855 So now this lady, the student here could start getting the patient ready for an emergency situation. Getting the oxygen ready while the guys were getting the crash trolley and the drs . oxygen on

G(1)0855 the girl who's got the charts in her hand

H(2) 0855 but they are recognising that this patient is getting very unwell. The crash trolleys arrived. But that was a collective decision. No-one was willing to make that decision themselves

C 0900 observation of the wound

C 0910 pulse is increasing, blood pressure dropping, respiration rate is going up. Recognition of potential for hypovolaemic shock

H(2) 0910 good establishing oxygen straight away now. She's certainly taking on a more leadership role, although I would get the sense that possibly the nurse – no scrub that

F(2) 0913 I'm not sure what this girl is doing

G(1) 0914 the blonde girl at the back is reassuring the patient again, and asking for information The students gone off with the charts this time, they've all left the one nurse, but she's staying with the patient, she reassuring her using touch again.

Table 7:Extract of Dialectic - Video 1 0850-0914

Both Figure 15 (the eye tracker) and Figure 16 (Big Sister) identify the same student as the focus for this set of comments. Over this 25 second period (Table 7) all of the observers who watched this video made comments (ACEFGH). The red font signifier comments describe the activities being undertaken. They indicate that whilst 3 of the students leave the patient and take the notes away, one is left with the patient. These signifier comments act like pieces of a jigsaw, adding detail to the activities occurring at the time. The black font signified comments, in contrast, are concerned with the interpretation of the meaning of those actions. There is an attempt to explain the perceived level of understanding and the roles of the participants. There is an implicit sense that although the student identified in the screen shot – far side of the bed - has put the situation together and is directing activity, that the others, ' the guys', are following as a group are not prepared to act alone. There is a subtle use of language, even more obvious in the audio recording than the transcription, which conveys that although certain activities are expected, putting oxygen on, getting the crash trolley, that these have been undertaken more by luck than judgement.

The comments, when viewed in isolation, are interesting, but when they are viewed as a group, the differing perspectives add richness to the interpretation of the interaction and add depth to the understanding of the judgements that the observers are making.

The tools were both successful in this use of an hermeneutic approach, incorporating a video-synchronised talk through to generate a Communis Sensus which identifies instances of the targeted and subtle signified behaviours. This excerpt demonstrates the ability to focus interpretive effort to these distinct episodes, by using the agreement of the observers as the filter. In each case the combined comments enable a more sophisticated interpretation of the activities, relevant to the focus of enquiry, which were observed. This includes insights in to the tacitly understood behaviour being identified by the observers, the collective nature of which is more informative than the individual comments alone. The episode, when seen as a whole using the advantages afforded by both the video and audio commentaries, rather than the transcription alone, enable the elicitation of the subtle inherent meaning identified.

7.3   Research Objective 3: Determine whether it is possible to use the commentaries to produce a dialectic which articulates collectively understood truths

The dialectics produced demonstrate that the observers identify distinct episodes of behaviour in relation to the brief. The cumulative comments made about those episodes provide an insight into the tacit understanding of the observed behaviour. The collation of comments in this way illustrates where observes are talking about the same thing, the shared truth. This episode from the dialectic of Video 2 (Table 8) illustrates the elicitation of a shared truth:

H(1) 1605 there's an awful lot going on here, they need anaesthetic support

G(2) 1607 taking the pillow away which is good to see

F(1) 1612 I like that he dropped the pillow on the floor, this girl she's got a really interesting role

G(2)1615 Making the environment safe which is good to see

E(2) 1616 the sats are dropping and she's not breathing well. They've managed to get her head back now

G(2) 1620 done it again

F(1) 1620 she's picking up around the edges she's done this a lot she's doing things like taking the pillow off him, she's facilitating the rest of the team, she's aware of what is going on, she understands what's going on but she's supporting these two guys who are the lead players. She's just not communicating as much about it as she could do

H(1) 1626 it was unclear what was going on in the conversation between the dr and the other nurses that wasn't actually articulated to the ones actually working with the patient sorting out the airway

D 1625 she's clearing up after the others, taking things off the floor

E(2) 1648 before the dr left they should have asked for a plan, I suppose the next stage would be specialist care

F(1) 1648 I like her focus on the patient. Standing there looking down on

the patient staying very close to the patient

Table 8:Extract of dialectic - Video 2 1605-1648

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There is a clear theme about picking up the pillow/tidying up, although seemingly insignificant, this is recognised as an important piece of behaviour. If viewed in isolation, this may be missed as an example of one person's particular 'hobby horse'. It is however mentioned by 3 different observers and is the focus of 5 out of the 11 of the comments, despite the fact that during this episode the other comments indicate that these students are dealing with a life threatening situation, managing the patient's airway. This example indicates, not only that the observers hold a shared truth about the nature of these activities, but also that the behaviours which indicate competence are not necessarily the obvious high profile activities which are being undertaken.

In combination Research objectives 1, 2 and 3 provide evidence of the successful application of the hermeneutic approach when used in combination with a technological tool. The remaining objectives focus on the comparison of the Big Sister and Eye tracker tools.

7.4 Research Objective 4: Use the technological tools to present the analysis whilst maintaining the context and truthfulness of the data

The dialectics illustrate that comprehensive data collation and representation can be achieved. Every comment from each transcription was allocated to the dialectic. In this sense, a complete and truthful representation of the data is presented. In addition, allocating the comments to time periods ensures the situated context. The screen shots are also time stamped to enable visual corroboration of the commentary. This could be enhanced by the use of the video clips and audio recordings as opposed to still images and transcribed text. The consideration of the use of multimedia in the presentation of the findings of research raises additional questions about the difficulties of 'reading' (i.e.assimilating) a report containing several different formats of data. This is significantly different to the way that research, or in fact any information, is traditionally presented. This therefore is one element which will require further research, and probably additional computing science innovation, to produce a format which makes such data easy to read.

When considering this objective, it is also necessary to compare the two tools ability to represent the context and truthfulness of the analysis. In this respect, a far greater number of Eye tracker troughs were identified than Big Sister clicks. Nevertheless, the Big Sister clicks corresponded with Eye tracker troughs. This indicates that the two tools are identifying similar points of interest. There are two possible explanations for the larger number of Eye tracker troughs. The first is that there may be events which 'catch the eye' of the observers, causing them to look at the same point on the video, but they are then consciously discounted and do not warrant a click. This is corroborated by the increased number of signified comments (black font), where there is Eye tracker/BigSister agreement. The second reason is a known feature of Eye tracking in that disengaging of visual attention causes an upward gaze movement (Duchowski, 2007). This artefact could be seen in the Eye tracker troughs which occasionally occurred with combined fixation on the curtain rail or IV bag at the top of the screen.

The data analysis also highlighted an unexpectedly sophisticated use of the clicking system with the BigSister tool. A pattern of multiple clicks for conversations and interactions emerges from three of the participants, but this was not a suggested strategy in the briefing and as the participants never met each other during the data collection, there was no opportunity to share this technique. The three participants all clicked on the relevant parties in a discussion or interaction in quick succession. This double click phenomenon enables these events to be identified from the BigSister interface alone (Table 9). The ability to identify interactions in this way has the potential to speed up the analysis where these types of behaviour, conversations or interpersonal communications, are the subject of the analysis.

Video 1 A 1250 that's good that nurse (click) is getting the head of the bed back, that nurse (click) is sorting the airway out opening the airway
Video 2 B 1800   this girl (click) and this girl (click)seem to know what they are doing
Video 2 F(1) 1240 these two (click) (click) were both looking at the monitor

Table 9: Examples of the double click phenomenon

In relation to this objective, both tools were able to represent the findings of the analysis. The techniques employed were equally applicable to BigSister and the Eye tracker data, and ensured that the truthfulness of the data was represented in context. It was possible to identify additional advantages achieved by the BigSister tool. BigSister generated less false positive correlations, and an increased sophistication in user application, facilitating an additional ability to identify episodes of communication behaviours from the interface.

7.5 Research Objective 5. Assess the Eye-tracker and Big Sister software with respect to validity, reliability and usability, by comparing the outputs with each other, and triangulation with the transcripts from the semi structured interviews

As a consequence of the coding structure, it became possible to apply some simple quantitative analysis to each of the dialectics. The observers' comments were counted by time period. The signifier/signified comments were then broken down to illustrate the number of comments of each type achieved with each tool (Big Sister/Eye tracker), and in relation to sequence effect, whether the distribution of signifier/signified comments varied with the 1st or 2nd experience of viewing the videos. As described in the analysis section, the sequence effect data only relates to those participants in arm 3 who viewed both videos. These data are presented in Tables 10 and 11.

Please note that the first column indicates Eye tracker troughs, points where the gaze plots of all the observers were close together. Where there is yellow highlighting of the Eye tracker trough, there was also BigSister collaborative agreement (i.e. a point where two or more observers clicked at the same point). All of the BigSister collaborative agreements aligned with Eye tracker troughs.

Time ET trough	BS and ET agreement	total comments	Duration (s)	Signified comments	%signified	BS Signified	ET signified	1st view	2nd view
0min 30sec	√	2	5	0	0	0	0	0	0
0 min 58 sec		7	21	5	71	3	2	2	2
1min 15 sec	√	9	27	4	44	3	1	2	1
1min 50 sec		6	11	3	50	2	1	1	2
2min 05 sec		4	15	2	50	0	2	0	2
2min 35 sec	√	7	17	4	57	2	2	1	2
3 min	√	7	21	4	57	3	1	1	1
4min	√	6	28	3	50	2	1	0	3
4min 30 sec	√	6	15	3	50	2	1	1	2
5min		5	22	2	40	2	0	0	1
6min	√	5	24	3	60	2	1	1	1
6min 10 sec		2	1	2	100	0	2	0	1
6min 20sec		3	8	1	33	1	0	0	1
6min 45 sec		2	3	2	100	0	2	0	1
7min 05 sec		4	1	2	50	2	0	1	1
7min 10 sec		2	5	2	100	1	1	0	2
7min 25sec		25	76	12	50	6	6	2	5
8min 50 sec		9	24	3	33	3	0	1	2
9min 25sec		3	10	2	66	2	0	0	1
9min 35sec	√	28	127	15	53	8	7	7	6

11min 55sec		0	0	0	0	0	0	0	0
12min		14	35	4	28	3	1	1	3
12min50sec	√	2	5	0	0	0	0	0	0
12min58sec	√	13	40	5	38	3	2	1	3
13min 50sec		8	22	2	25	0	2	1	1
14min 30sec		3	5	3	100	0	3	1	1
14min 45sec	√	4	3	2	0.5	2	0	0	1
15min 05sec		19	100	8	42	3	5	3	5
16min 50sec		2	15	1	50	1	0	0	1
17min 10sec		4	36	4	100	0	4	1	2
TOTAL		210	Average=24	101	51	53	46	28	54

Table 10: Video 1 data analysis

Time ET trough	BS and ET agreement	total comments	Duration (s)	Signified comments	%signified	BS Signified	ET signified	1st view	2nd view
0min 30sec		4	26	1	25	1	0	1	0
0 min 45 sec	√	2	6	1	50	1	0	0	0
55 sec	√	3	4	3	100	3	0	1	1
1min 10 sec	√	11	28	3	27	2	2	4	1
1min 50 sec	√	12	26	5	42	4	1	1	2

2min 30 sec	√	9	33	3	33	2	1	3	0
3 min 10sec	√	5	37	1	20	1	0	1	0
3 min 20sec		2	2	2	100	1	1	1	0
3min 30 sec		1	0	0	0	0	0	0	0
3min 40sec	√	5	10	1	20	1	0	0	1
4 min 10sec	√	7	17	2	28	1	1	1	1
4min 25 sec		3	16	2	66	1	1	2	0
4min 50sec		4	21	2	50	1	1	1	0
5min 25 sec		4	10	3	75	2	1	3	0
5min 35 sec		2	10	2	100	2	0	1	1
5min 55 sec		2	0	1	50	1	0	0	1
6 min 10sec		3	10	2	66	2	0	1	0
6min 30 sec	√	3	5	2	66	1	1	1	1
6min 40sec		1	0	0	0	0	0	0	0
6min 50sec		3	0	0	0	0	0	0	0
7min 10sec		3	11	1	33	1	0	1	0
7min 20sec		3	15	1	33	1	0	2	0
7min40sec	√	3	12	2	66	1	1	1	1
8min10sec		4	8	3	75	3	0	1	1
8min 30sec	√	6	25	4	66	3	1	2	1
8min 50sec		11	54	3	27	1	3	1	2
9min 50sec	√	5	18	3	60	2	1	2	0
10min 15sec	√	5	15	3	60	1	2	2	1
10min 50sec	√	6	21	3	50	2	1	1	2
11min 20sec	√	4	17	3	75	3	0	1	1
11min50sec		5	37	4	80	1	3	2	1
12min 30sec	√	2	11	1	50	0	1	1	0
12min 40sec	√	3	10	2	66	2	0	1	0
13min 10sec		3	14	2	66	2	0	0	2
13min 40sec	√	6	28	4	66	2	2	2	1
14min 10sec		5	10	0	0	0	0	0	0
14min30sec		2	2	1	50	1	0	0	1
14min 40sec		3	15	2	66	1	1	0	2
15min	√	3	15	2	66	1	1	2	0

15min30sec	√	10	33	8	80	6	2	4	3
16min 10sec	√	11	43	6	54	4	2	4	2
17min	√	9	30	8	88	5	3	1	3
17min50sec	√	5	12	4	80	3	1	2	1
18min	√	12	55	11	91	8	2	3	4
19min 10sec		1	9	1	1	0	1	1	0
TOTAL		216	Average =17	118	54.8	81	37	56	38

Table 11: Video 2 data analysis

This very simple quantitative analysis illustrates interesting similarities between the two data sets. 210 comments were made in the commentary for video 1 and 51% of those were signified comments. For video 2, there were 216 comments and 54.8% were signified. These descriptive statistics are surprisingly similar, particularly as video 2 is approximately 10% longer in duration than video 1. This can be explained by the fact that the same scenario was undertaken in both videos, so the activities undertaken were the same, but completed slightly more quickly in video 1. Regarding the distribution of the signifier/signified comments by tool, the BigSister tool produced more signified comments (Video1: BigSister 57/ Eye tracker 46; Video 2: Big Sister 81/ Eye tracker 37). This is visually illustrated in Images 17 and 18, where the blue line illustrates the BigSister signified comments, and the red line is the Eye tracker signified comments.
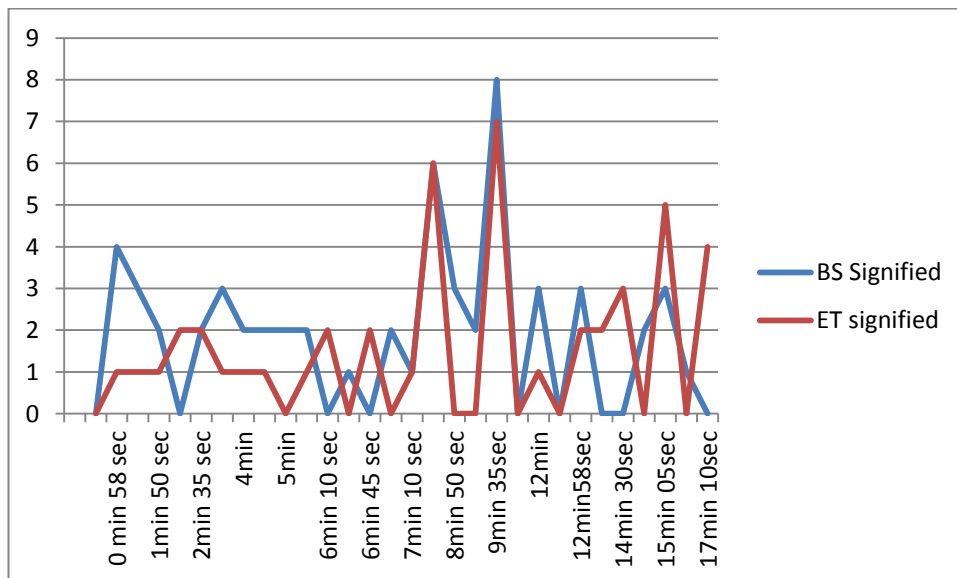
Figure 17 :Video 1 Signified comments by tool
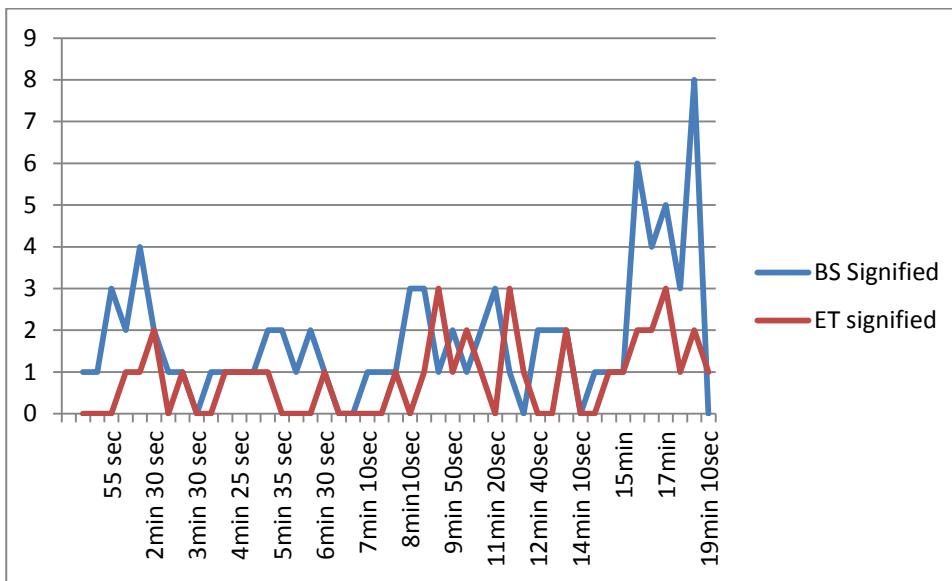
Figure 18:Video 2 Signified comments by tool

It is tempting to continue the statistical analysis and assess for significance in these results. The Ontology, however, clearly defines the interpretivist nature of this research. Although the intention is to apply the principles of experimental design to improve internal validity, there remains a difficulty of convention in the ascribing of statistical significance to qualitative data. It is not therefore commensurate with the Ontology to apply further statistical analysis. The application of simple descriptive statistics indicates that the Big Sister tool facilitates more signified comments than the Eye tracker.

With respect to the sequence effects, the results are contradictory. In video 1, the 2nd view produced more signified comments, as may be expected from a learned behaviour (1st view 28: 2nd view 54). In video 2, however the ratio was reversed (1st view 56: 2nd view 38). The data are illustrated in Figures 19 and 20, where the blue lines are the 1st view signified comments, and the red lines are the 2nd view signified comments.
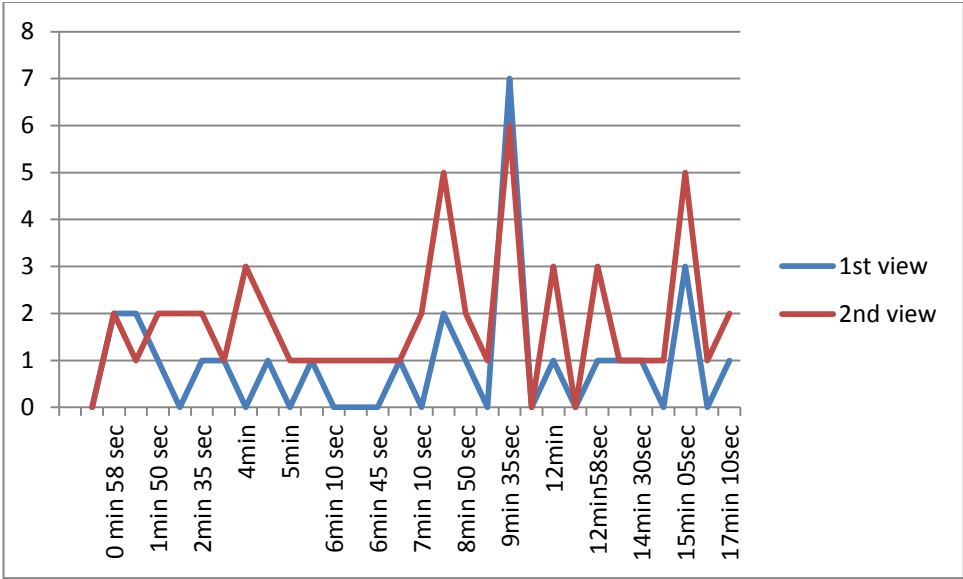
Figure 19:Video 1 Signified comments by viewing sequence
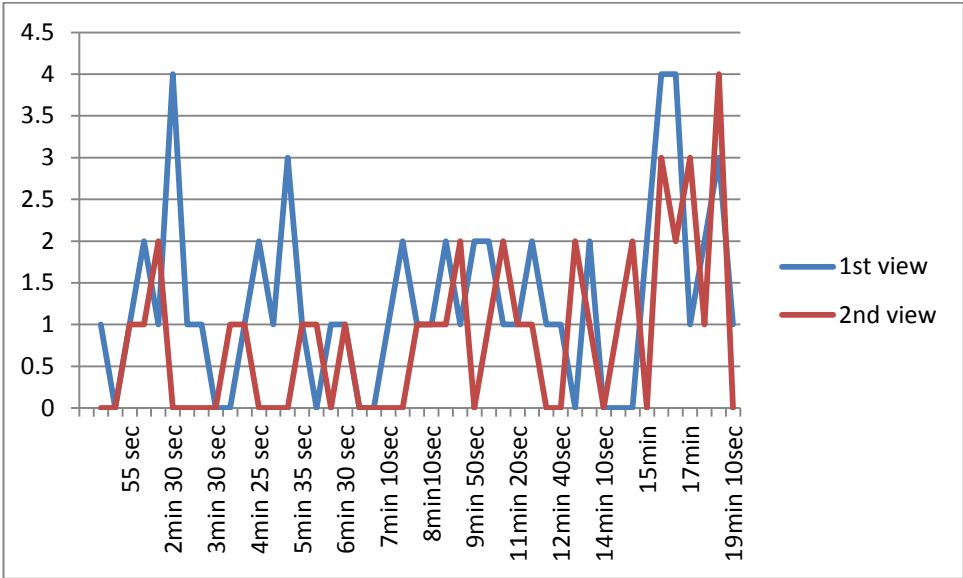

Figure 20: Video 2 Signified comments by viewing sequence

There is insufficient data to be able to draw any firm conclusions, but this preliminary data suggests that sequence was not a consistent confounding effect, and that the ability of a tool to elicit signified comments does not necessarily require several experiences to learn the technique.

7.5.1   Validity and Reliability

The Ontology (Chapter 4) and the Epistemology (Chapter 6) outline the reality being studied and the philosophical justification of the methods being used to achieve the research objective. This hybrid (mixed paradigm) methodological

approach, where the premise is that technology affords the opportunity to develop methods of research in ways which were not previously possible, requires a carefully considered and balanced review of the validity and reliability of the findings. In the context of an hermeneutic enquiry, the concepts of validity and reliability are considered to be inherent in the conduct of the study and the associated analysis. The results of such an enquiry conventionally would not and, it can be argued philosophically, should not consider validity and reliability. In the context of an applied experimental design, however, there is an expectation of formal explication of the results in these terms. This clearly demonstrates a practical consequence of the crisis of legitimation described in section 4.6.

In order to be consistent with the defined Ontology and Epistemology, it is necessary to balance these seemingly conflicting conventions. The validity and reliability of the experiment will be reported in explicit terms but with the following caveat: the discussion is based on the premise that research paradigms need not necessarily be mutually exclusive, and that advances in technology afford new opportunities to produce synergy by combining established principles. In this case, positivist principles are used to formally address validity and reliability, whilst the analysis maintains the context of an hermeneutic approach.

Internal validity

The use of an experimental design is used to control for confounding variables and increase the internal validity of the results. The design controls for:

- biased video selection, by using 2 videos.
- the confounding effect of approach versus that of the tool used, by using 2 tools based on the same approach.
- participant variation, by purposive selection.
- selection bias, by random allocation.
- sequence bias, by incorporating a cross-over design in arm 3.
- participant contamination, by undertaking data collection under laboratory conditions.

These controls were successfully applied, and as a proof of concept, the results demonstrate that it is possible to apply the principles of the control of variables to qualitative data.

External validity

The hermeneutic approach does not support the concept of generalisability of the results per se. The aim of such an enquiry is to generate understanding of the meaning of distinct examples of behaviour, not to generate rules or theory. In this sense external validity is irrelevant. In the context of testing of an hermeneutic approach by using technological tools, however, there is potential for generalisability and transferability. The techniques have the potential to be used, particularly but not exclusively, where the field of study is tacitly understood behaviour. The second phase of this research serves only as proof of the concept that technological tools can be used in hermeneutic enquiry. Further research would need to be undertaken with other examples of tacitly understood behaviour, to make any judgement about generalisability.

Face validity

The use of the dialectics as representation of the results is designed as a mechanism to explicitly demonstrate face validity. Face validity is defined as the obvious ability of a tool to measure what it is attempting to measure (Nevo 2005). Where the field of study is tacitly understood behaviour, the concept of face validity is of particular importance. The inability to articulate a description of these behaviours means that the recognition of the behaviours is dependent on other, predominantly visual, factors. The entire approach is reliant on the ability of the tool to make the visual presentation of the behaviours accessible. The use of the collegial verbalisation is reliant on the observers being able to recognise the behaviours, implying that face validity, although essentially the most subjective measure of validity, is essential. There must be agreement on what is being observed and therefore face validity in the ability to make the observation, i.e. that there is something to be seen and that different observers are able to see it by these means. The representation of the results as a dialectic, with the visual verification from screen shots (and the potential to use video clips), not only provides the means by which the commentaries and analysis can be visualised, it is also sufficiently transparent to allow the reader to draw their own conclusions relating to face validity.

One final check of face validity was to compare the interview transcripts, where the observers were asked to identify particular events which were influential in their judgements, with the events identified in the dialectic. The lists of the events identified in the interviews by all of the participants were mapped to the Video 1 and Video 2 dialectics (see Table 12). The table notes the times where the events appear in the videos. All of the events were identifiable in the commentaries and provided greater detail than was obtained from the interviews.

Video 1	Video 2
Removed BP cuff knowing the patient was deteriorating 0645	Oxygen popping off 1113
Giving drug not knowing what it was 1050-1125	Doctor shouting made the students fumble 1358
Calling patient sweetie 0935	Managed airway 1505
Recognising life threatening issues 0855	Getting the crash trolley 1150
Poor handover 0620	Not querying drug 1428
No systematic ABCDE 0710	Putting on oxygen 1505
Letting cardioversion just happen 1208	Poor handover 0850
Not calling for help when managing the airway 1305	Checking catheter bag 0250-0230
Poor handover 0620	Pillows 1610
No systematic ABCDE 0710	Clearing up 1620
After cardioversion, no plan 1340	Getting crash trolley 1150
MEWSing, recognised but no urgency 0645-0720	After cardioversion , straight to airway 1505
Checking catheter1505	Talking to doctor 1800
Poor communication 0710	Using hand gel 0600
Poor communication 0710	Scratching arm pit 1310
No challenge to doctor 1120	Incompetent handover 0850
Calling patient sweetie 0935	No questioning about drug 1428
Long time to establish monitoring 0340	Dr walked in, change in body language 1240
Talking over the patient 0030	No formal handover 0850
Correct Oxygen administration 0925	No checking of drug 1428
No action post cardioversion 1340	Getting trolley 1150
Long time to check catheter 1505	Pillows 1610
Turned IV on without checking 0750	Poor handover 0850
Touching and talking to patient 0725	Getting airway equipment 1530
Getting head of bed off 1245	Poor communication 0930
MEWSing – no urgency 0645-0710	Poor handover 0850
Giving drug without question 1120	No checking of drug 1428
Opening airway 1305	Writing down instructions 1750
Pulling bed out 1245	Getting airway equipment 1530

Table 12: Semistructured interview - judgements mapped to dialectics

When compared with the events identified in the dialectics, the volume of events identified by the interviews was notably different. In the dialectics; Video 1 - ET 30 events , BS 11 events, and Video 2 - ET 45 events, BS 24 events. In the interviews all of the observers only identified between 2 and 4 events each and the majority of these events are signifier events. It can also be seen in Table 12 that the events that were identified in the interviews tended to be those which occurred later on in the video, whereas the distribution in the dialectics was more evenly spread.

Content validity

The concept of content validity requires that test items relate to the domains that the researcher is attempting to study (Crohnbach & Meehl 1955). The distinctions which were made in the ontology are therefore essential to this aspect of validity. For there to be content validity in the context of an hermeneutic enquiry, the tools must be able to represent, rather than measure, tacitly understood behaviours. The representation of the results and the successful application of the distinction between signifier and signified comments demonstrate content validity.

Construct validity

Construct validity can be defined as convergent, where general agreement in the relationships identified can be seen, and discriminate, where no relationships are identified and where relationships would not be expected (Shuttleworth 2009).The concept of the dialectic relies on convergence in the commentaries as the proposition of analysis. This element of construct validity is therefore integral to the approach. With respect to discriminate construct validity, the nature of collegial verbalisation focuses on agreement rather than individual opinion which therefore limits the likely incidence of false relationships being identified. This aspect is however, totally dependent on the accurate briefing of participants as to the behaviours under scrutiny. Once again this highlights the absolute importance of the definitions in the Ontology and Epistemology as pre-requisites to this approach.

In summary, it has been possible to consider the validity of the experimental design and the use of the technological tools, whilst maintaining the integrity of the hermeneutic approach. As a test of the feasibility of the approach via the

use of technological tools, this study has shown the potential for synergy in the use of principles from both the quantitative and qualitative research paradigms. Further research, using different exemplars of tacitly understood behaviours, will be required to establish a body of evidence to confirm the validity of this approach.

Reliability

To be consistent, the concept of reliability must also be discussed with reference to the established definitions. Within the context of an hermeneutic enquiry, the discussion of reliability is more problematic than that of validity. Despite the use of an experimental design and the use of tools, the established concepts of reliability are not readily applicable.

In relation to internal consistency, the tools are not providing a measure requiring precision; they are providing the means of collegial verbalisation and representation. Internal consistency can therefore only be measured by the volume of relevant comments obtained. In this study, all comments were amenable to classification and allocation to time period. In addition, for both video 1 and video 2 there was consistency in the distribution of signifier to signified comments 51/49% and 54/46% respectively. Thus it can be seen that a test and re-test strategy demonstrates internal consistency.

The consideration of inter-rater reliability is particularly difficult, as the elicitation of differing perspectives is essentially the purpose of the approach. If all the observers were able to similarly articulate the behaviours, the approach would be redundant, however a level of consistency in the identification of the incidents of tacitly understood behaviours is required. These two elements: collective agreement on the behavioural indicators, and elicitation of different perspectives, must therefore be considered separately. In relation to agreement on the behavioural indicators, inter-rater reliability is required at a macro level. The collegiate verbalisation demonstrates some inter-rater agreement in relation to the events identified and the comments made. The mapping of the events identified in the semistructured interviews with the comments in the dialectic (Table 8) provides a coarse indication of reliability. At the micro level, elicitation of the meaning of the tacitly understood behaviours relies on the difference in perspectives obtained. The requirement of the differing perspectives means that inter-rater reliability is

not desirable. In addition, the Think Aloud technique when applied to fast moving examples of ill-defined behaviours would not be expected to be exhaustive on an individual basis. Inter-rater reliability is therefore only partially relevant in this context.

7.5.2   Usability themes from the interview transcripts

All of the participants, without exception, stated that both of the tools were easy to use:

Figure 21 :Comments relating to tool use from semistructured interviews

There were a number of suggestions for improvement, although these related to the quality of the video that was being watched, in particular camera angle (view from the head of the bed, bottom of bed, or see the students faces better) and sound quality (individual microphones, eliminate the intermittent sound of the compressor which powers Simman®). With respect to the usability of the tools, there was only one theme which was identified. This came from the participants in the 3rd arm who were able to compare the tools. The semi structured interview transcripts revealed that three of the four participants in arm 3 (plus one participant whose data was incomplete) made comments about the use of the mouse with the Big Sister tool when compared to the eye tracker.

> [**Interview 3** This felt less free form, so with the other video, where you were sort of looking and having to think, the action of pressing a button on something of interest and then talking about that felt easier than just watching something and speaking. I don't know why that should necessarily be. but sort of almost gave you permission to talk. Whereas before it felt very much just talking.]

This first excerpt was from the participant where the Eye tracker only saved the audio recording. For the main data collection this participant was replaced by a reserve. The semistructured interviews were however complete, and were therefore transcribed and thematically analysed as additional data.

[**Interview 11** No, it was physically more comfortable to sit here with the mouse and not be aware that I didn't want to move too much to distract the eye tracker, physically much more comfortable. But also that awareness that what am I looking at wasn't there because I could direct things, but if my eyes drifted, particularly when somebody goes off screen and you're listening to what they're saying , you don't necessarily look at the screen but look away slightly and that was more comfortable.

Yes just as easy, using the mouse was very subconscious umm and I actually felt it was quite useful because I was ab{le} even though my eyes were being tracked before. With this I felt I was definitely indicating what am I looking at, and I actually felt freer to look more around. As well I think I was thinking very hard to make sure I was concentrating on the other one whereas with this one I was I felt that , I don't know , It's a subtle thing but I felt slightly more in control of it.]

[Interview 13 With the technology and what I was doing, umm , no I liked both the eye tracker and the use of the mouse. and I would be happy to use either, although I for some reason. I deferred slightly more to the mouse. It just sat with me.]

[Interview 15 Yeah, there was something about the click is saying now I think I've made a decision. I guess the click is when I've consciously realised I've made a judgement, ahh what's more interesting is, I don't know whether its pulling together what's leading you to formulate you click when you know you've made one or consciously attracted your attention or not   so sure there's not things preceding that do you see what I mean you think of it as that one but   there must be something that made you lead to that.]

There was a general perception that the mouse was useful in directing their commentary, that it gave permission to speak. In combination with the identification of the pattern of double clicks for observed interactions, it appears that the pointing ability of the mouse does add value.

7.6 Research Objective 6: Determine whether it has been possible to identify specific indicators of competence

The thematic analysis of the semistructured interviews, and the mapping to the dialectics identified that the indicators of competence do not appear to relate to the ability of the students to perform tasks. The judgements identified from both sources were categorised in to 4 themes. These themes were

1. Communication, and the ability to communicate appropriately at different levels; with the patient (verbal and non-verbal), with other members of the health care team (in this scenario with the doctor, in person and on the telephone), and with each other.
2. Being able to process clinical information and perform appropriate clinical interventions based upon them e.g. take a set of observations and ask for permission to put oxygen on, assess fluid balance and check for IV fluid administration.
3. Being in the right place; e.g. being in the patient's eye line, staying with the patient, observing the monitor, knowing where the equipment should be placed in certain situations, e.g. the cardiac arrest trolley.

And finally

4. Being proactive; getting equipment ready, tidying up, asking for advance instructions if things change in the future, using communication strategies to prepare the patient and each other for future actions.

The four themes describe the observed behaviours which were judged as being indicators of competence. These descriptions of competent behaviour provide a clearer indication of what is being observed when competence is being assessed. They therefore have the potential to enhance the overall understanding of competence.

A further check of reliability can be made by mapping these observable indicators of competence with those amalgamated from the literature and presented in section 1.4. This mapping is presented in Table 13. The themes

map neatly to the dimensions amalgamated from Benner (1984), Buller and Butterworth (2001) and Zhang et al (2001). This mapping also illustrates the subtle difference between those dimensions which are theoretical constructs and open to a range of interpretations, and themes of observable characteristics which are easily applicable in practice.

Indicators of competence amalgamated from the literature review	Themes identified from the dialectics/Interviews
Doing the job- performing tasks -definition of task e.g. Taking a pulse (Benner's – Administering and Monitoring therapeutic interventions and regimens)	Information processing
Verbal language	Communication
Body language, gaze, scanning, gestures, movements	Position
Physical position in space - choreographing	Position
Relating and communicating - Interpersonal understanding, commitment, self-control persuasiveness, compassion, comforting, responsiveness (Benner's – Helping)	Communication
Information gathering. Critical thinking (Benner's – Diagnosis and Monitoring PLUS Management of rapidly changing situations)	Information processing
Thoroughness	Information processing
Being professional (Benner's – monitoring and ensuring quality of	Communication

Healthcare practices)	
Managing and facilitating (Benner's – Organisational and Work Role competencies PLUS Teaching and Coaching)	Being Proactive

Table 13: Mapping of identified themes to indicators of competence from the literature

7.7   Summary

During the testing of Video-View-Point, an experimental design was used to examine the ability of an hermeneutic approach in combination with two technological tools to elicit tacitly understood behaviours. All of the research objectives were addressed. Both tools identified episodes where Communis Sensus was observed – either by clicking and talking about the same activities via the Big Sister tool, or by convergent gaze plots in the Eye tracker. The observers' Think Aloud commentaries were successfully coded for signified or signifier comments, which in combination with the screen shots, were used to produce a visual representation of those tacitly understood behaviours. This representation of the findings as a 'dialectic' can either be considered without further manipulation, or used as a basis for further formal qualitative analysis. The experiment is reported in formal terms with results presented in both quantitative and qualitative formats. This serves as a proof of the concept proposed in the Ontology, that technological advances afford the opportunity to combine established research principles in new ways. The formal discussion of the findings is presented in Chapter 8.

8. Discussion

At the culmination of this research journey, this chapter critically discusses the testing of Video-View-Point. The structure of this thesis has demonstrated the evolutionary nature of the journey, explicitly acknowledging this as a feature of qualitative research (Flick 2009). Notwithstanding the evolutionary process, the two themes identified in Chapter 1 have remained constant, ultimately being refined and adopted as the primary and secondary aims for the test of Video-View-Point.

a) The potential to capitalise on recent advances in technology for research. This equates to the primary aim: To test whether Video-View-Point applied using a technological tool (BigSister or an Eye tracker) can validly and reliably elicit ill-defined or tacitly understood behaviours.

b) The exploration of student nurse competence in simulation. This equates to the secondary aim: To test whether Video-View-Point can identify tacit indicators of competence.

The discussion relates not only to the identified research aims, but also to these broader constant themes. In particular, the primary aim demonstrates how Video-View-Point contributes potential solutions to the six fundamental crises identified in Denzin and Lincoln's (1994) Fifth Moment: the tension between postmodernism and positivism; the crisis of representation; the crisis of legitimisation; the 'emerging cacophony of voices and agendas'; the blurring of the borders between science and art; and the influence of technology. This structure will be used to lay out the contribution Video-View-Point makes to the qualitative paradigm from an ontological and epistemological perspective.

This framework will include arguments in relation to the study of tacitly understood behaviours in this conceptual sense. It will not, however, address the identification of tacitly understood indicators of student nurse competence specifically, i.e. the secondary aim. The conclusions and implications in relation to the secondary aim will be addressed in the final chapter. This ensures that the contribution made to the academic debate around the acquisition of nursing competence is not over-shadowed. This is important as it acknowledges the original drivers for this research journey, and highlights

their major influence on approach taken to the derivation of the implications for and future applications of this research.

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8.1 Addressing the crises of the Fifth Moment

Chapter 4 proposed Denzin and Lincoln's (1994) 5th Post-modern Moment as a framework to define the Ontology of this research. Denzin and Lincoln assert that the 5th Moment is characterised by six challenges which require resolution. It is argued that the development and testing of Video-View-Point provides a valuable contribution towards the resolution of each of these six challenges. Although Denzin and Lincoln (2005) describe how the agenda of qualitative research community has shifted away from these challenges, this was not as a consequence of resolution. The objective of critically appraising the contributions to qualitative research in this context is to highlight that the use of technology in innovative ways has the potential to unlock fields for exploration which were previously considered inaccessible. Therefore the contributions to the solution of these six 'crises' are considered in turn.

8.2 The tension between positivism and post-modernism

Chapter 6 outlined the methodological process employed to test Video-View-Point. These methods were explicitly designed to test the premise that technology affords the opportunity to capitalise on the advantages of both objective (positivist) and subjective (postmodern) methods, in order to provide a robust and objective, yet innovative and creative elicitation of tacitly understood behaviours. Both Video-View-Point and the experimental design used to test it enabled the collection and analysis of data which was logical and consistent with the Ontology and Epistemology. The report of the findings of the analysis in Chapter 7, in terms which were consistent with both the hermeneutic approach and experimental design, was more challenging as the tension between the paradigms became more evident. To maintain the integrity of the philosophical argument for the lack of mutual exclusivity of the paradigms presented in the Ontology, it was necessary to report the findings with a balance which would demonstrate the contribution of both approaches.

This is consistent with Bourdieu's proposition, that in order to advance knowledge, researchers should acknowledge and then utilise the limitations of established thought, to move forward. The adoption of a balanced stance, neither negating nor omitting either position, allows for the acknowledgment of these limitations. The identification of the established conventions which are not logically applicable in the context of tacitly understood behaviour, indicates that in the development of a hybrid tool, the 'conventions' have to be adapted. The intention in the report of the findings was not to impose the 'rules' from either paradigm where they clearly did not fit, but to acknowledge the contributions which can be logically applied and therefore enable the analysis to benefit from the advantages of both approaches.

The results/findings presented in Chapter 7 illustrate the flexibility of the approach. Both quantitative and qualitative analyses of the same data set are used to generate depth of understanding of the tacitly understood behaviour under scrutiny. The presentation of the results/findings in this combined sense is consistent with the hermeneutic approach, where the intention is to understand the meaning content of behaviours. The dialectic produced from the observers' commentaries (see Appendix 6) is used as a visual representation of the data which facilitates the interpretive process. The interpretation of the dialectic can be undertaken informally without further manipulation, using the dialectic as the enduring representation of the underpinning evidence. The dialectic also presents the data in a format to which a formal hermeneutic method e.g. after Heidegger or Betti, could be applied. This thesis presents a proof of concept and therefore has been limited to an informal interpretation of the findings/results. This is sufficient to demonstrate that Video-View-Point using either technological tool, BigSister or the Eye tracker, as the data collection interface, renders tacitly understood behaviours amenable to the interpretative process. This research has also demonstrated the ability of the dialectic, to provide an accessible and valid means for the representation of multimedia data and this will be considered further in Section 8.5.

The application of the experimental design, control for variables and assessment of validity and reliability were also successfully applied. The perceived benefits of the application of positivist principles relate to internal validity. Where the events in the video relevant to the field of study are

objectively and collegially identified, the analysis generated is elevated beyond that of an individual subjective opinion. The technique is also a logical solution to the challenges of analysing video, where large volumes of data are collected and the transcription of the behaviours is impractical.

8.3 The Blurring of the borders between Science and Art

The testing of Video-View-Point described in Chapter 6 illustrates how the borders between science and art are blurred. This blurring occurs at two levels, which despite Denzin and Lincoln's (1994) categorisation as a crisis in qualitative research, can be used as an opportunity rather than seen as a threat. Firstly, at the theoretical level, the test of Video-View-Point has demonstrated the ability to combine an hermeneutic approach with experimental design; a creative hybrid of scientific principles. This amalgamation of post-modern and positivist methodological principles bridges traditional boundaries and is indicative of Bricolage. As an approach to methodological design, it makes use of the most appropriate tools to achieve the task; the elicitation of tacitly understood behaviour. As a consequence, it challenges some of the conventions of the current practice of science.

At the second level, the study of student nurse competence, as an example of a tacitly understood behaviour, is situated at the blurred border between science and art. Benner's assertion that nursing requires both 'techne' and 'phronesis' highlights an essential complication of this field of study, as it is necessary to examine nurses behaviour in terms of both an evidence based scientific discipline, and that of skill, judgement, character and wisdom. The literature review of competence (Chapter 1) described how the inability to capture both the science and art of competent practice has led to the current impasse, epitomised by Garside and Nhemechena (2012) who suggest that nursing competence is unlikely to ever be defined. Traditional attempts at defining competence have focussed on the 'science', i.e. the categorisation of tasks, whilst no account is taken of the 'art'. The most recent developments in competence assessment have included the addition of a single subjective judgement element which indicates that there is recognition of this problem. The imbalance in the weighting attributed to the 'science' remains an obstacle

which is limiting progress towards broader acceptance of competence assessment. This is in turn perpetuating the current system of theoretical assessment of healthcare practitioners which fails to address the well documented theory-practice gap (Maben et al 2006).

When the bricoleur approach is applied to this problem, it seems obvious that positivist principles would be the suited to the categorisation of tasks, and post-modern principles to the assessment of art of practice. There is logic in the assumption that where practice consists of both science and art, the methods used to teach, learn and research it would need to be likewise, as argued by Gobbi (2005). The testing of Video-View-Point has therefore utilised a bricoleur approach to research design, combined elements appropriate to the field of study, and demonstrated the potential of a hybrid design. Although the exemplar used is student nurse competence, there is face validity in the application of such a hybrid methodological design to the research of any behaviour, and in particular those behaviours that are tacitly understood.

8.4   The cacophony of voices and agendas, and The Other

The cacophony of voices, where the behaviour is tacitly understood, is particularly problematic. The absence of signifiers for this behaviour, as argued in Chapter 4, means that individuals struggle to articulate how they formulate their judgements. This research revealed that a cacophony, in this case the perspectives offered by participants, can be tamed and represented as a 'plurality' of voices by Video-View-Point.

Video-View-Point reveals the general agreement, the Communis Sensus, in the identification of these behaviours. The method capitalises on the variety of terms individuals use to describe the behaviour, or at the lowest form of abstraction, their ability to 'point' out their judgements e.g. in relation to competence: 'he's got it', or 'I'm not sure about her'. The use of collegial verbalisation by think aloud commentaries of behaviour produces a visual representation of the 'pointing' –either by gaze plot alignment or clicking via the tools, as well as the attempts at articulation. By representing these data together, alongside the videoed episode of behaviour, a plurality of perspectives are provided. This is then amenable to a process of interpretation.

This interpretation may be amenable to articulation, and subsequently allow for the signifiers for certain behaviours to be agreed. It is theoretically possible, however, that articulation and identification of the signifiers may continue to be elusive. In this situation, it may be possible to use the video clips of the identified behaviours themselves as a visual representation of the tacitly understood behaviour i.e. utilising the sign in the absence of a textual signifier.

The representation of the data as a dialectic, incorporating all of the comments from the observers, provides a Communis Sensus. It can be argued that this Communis Sensus constitutes a representation of the Other. This concurs with Jansson et al (2006) analysis using collegial verbalisation in train drivers, and Dunn et al (2010) description of video texts. The variety of perspectives adds depth to the interpretation without the requirement for the researcher to 'put words in to the participants' mouths'. In Video-View-Point, the addition of screen shots and video clips endure as a representation of the identified behaviours, which can be used to verify the interpretation.

The testing of Video-View-Point was undertaken with a purposively selected group of participants. There is a condition in the philosophical argument, (after Kant, Section 5.6) to ensure that there is universal assent that the premises on which the commentaries are made are correct. In order to represent the collegial verbalisation, in this situated context, the observers should be socialised in to the culture they are observing (Goffman 1974). The analysis highlighted that this subsumption is an absolute requirement. It is necessary to have confidence in the observers' commentaries. Where, by definition, there is a struggle for articulation, there will be a divergence in the strategies used by individuals in their attempts to convey their judgement. It is therefore essential that observers have legitimate views, so that it is possible to see beyond the strategies employed, to believe that the views are valid, even if at first examination they appear divergent.

The variety of perspectives became obvious during the process of transcription and allocation to time periods. This variety indicates the way that the participants' views are influenced by their 'lifeworld' (Habermas 1984). Some participants demonstrated a predominantly negative assessment in their judgements (focussing on what the students did wrong), some were

predominantly positive (focussing on what the students did right). Some participants used their personal interpretation of events, and what they personally would or would not do, to highlight the mismatch in the students' performance. Others directed their comments at the students' performances, either individually or collectively. When using standard research methods, this variation may be problematic or distracting, however in the context of the dialectics it was possible to 'see' the similarities and differences when considered alongside the other comments. The ability to view the different perspectives in the dialectics, therefore worked as it was intended.

The coding of the comments as signifier or signified, was straightforward. This is the one element of the analysis which has the potential for bias. For the purpose of this study, I coded all of the comments in order to demonstrate consistency in approach; however this could be considered a weakness. This could be resolved, either by separate individual coding by different researchers, and reaching agreement by discussion over any discrepancies, or by developing a more detailed set of criteria for coding. The choice between these two solutions would potentially depend on the nature or context of the behaviours being studied. For example, whether the interpretation of the behaviour is dependent on cultural understanding, or whether the understanding of the cultural influence on the behaviour is the primary purpose of the research.

The final point for discussion in this section is the difference between the dialectics and the post-observation interviews which was noted during the triangulation. When generating the data for Table 12, the mapping of the events identified by the observers as influential their judgements, it became apparent that during the interviews the comments were predominantly 'signifier'. The observers identified tasks rather than behaviours. It could be argued that this was due to the interview question. On the other hand it could also be attributed to the way that nurse mentors are socialised to assessing the 'scientific' elements of competence, or to focus on simple descriptions of easily recognisable activities. The events identified all correlated with 'events' identified by either Big Sister clicks, and or eye tracker gaze plot troughs. In all of these instances, there were associated signified comments. In these cases the tacitly understood indicators were not related to undertaking the task per se, but to how the students did it, how they communicated it, or their

perceived level of understanding of it. These specific elements were amalgamated from the two data sources to produce the 4 themes identified in Section 7.8. It is also notable that the observers only identified between 2 and 4 events in the interviews, significantly less than has been identified in the dialectics, and those events generally occurred later in the videoed scenario. This distribution may be attributed to a short term memory effect. The comparative inability of the semi structured interviews to identify signified behaviours, explicitly demonstrates the additional depth of understanding achieved by the production of the dialectics.

8.5   The crisis of representation

The crisis of representation has been the main driver for the development of the tool in this research. The potential to render the unsayable visually accessible by the use of technology was essentially the primary aim of this research. The production of the dialectic has provided a means of representation of the findings and done so relatively successfully. There is however potential for improvement by the incorporation of video clips, rather than still images. The traditional requirement of a thesis to be a paper document has limited the scope to achieve this. In the future, however, the ability to embed video files in to an electronic document would add value to the representation of the findings of research utilising these techniques.

The dialectic, as represented in this thesis, provides a sophisticated and yet easily assimilated means of representing the findings of the research. The ability to use time periods to synchronise the observers' comments and associated still images from the research tools links the perspectives together transparently and comprehensively. The use of time periods was previously described by Walter at al (2010) in a coding for emotion abstraction patterns, but they chose fixed 10 second intervals. Walter et al (2010) and the findings from this research both identify that the use of time periods as a unit of analysis, provides a degree of objectivity which adds strength to the subsequent interpretative effort.

In addition to the main textual structure of the dialectic, it was logical to add additional coding by way of colour and highlighting. This provides an instant visual indication of the elements of the coding, and illustrates a greater range

of analysis in one document. This enables the reader to recognise the more subtle links in the data, when they are pointed out in the interpretation. Example of this include: the duration of identified events, the spread of events throughout the scenario, and the distribution of signifier and signified comments by tool and by observer. The dialectic as the initial means of representation, then allows the extraction of quantitative data which can be illustrated graphically. The production of tables and bar graphs enables a further indexing of the scenario, identifying the areas of increased comments. This indexing can be used to focus the interpretative effort to the areas of increased interest, and therefore begin to address the challenge of managing the large volume of data produced when using video as the medium of data collection. This is not to say that the task becomes simple, just more manageable. For example, in Video 1, the Big Sister tool reduced the 17minute 10 second video to 11 events, with a combined duration of 5 minutes 12 seconds, 30% of the initial volume of data. This is similar to the automated tool described by Walther et al (2003) to screen out periods of nothing from submarine video cameras prior to human annotation.

As a final point for discussion in this section, it is necessary to return to Plato's "The Meno". This study has used video as a means to 'fasten' and 'recollect' episodes of behaviour, and explicitly demonstrated the ability of a technological tool to be able to achieve this. Qualitative observational techniques can thus be corroborated. The fastening and collegial recollection of behaviour in this way can be used in contribution to a defence against the positivist allegation that all observational research methods are wholly subjective. This defence would not be robust, however, unless the crisis of legitimation has also been resolved.

8.6   The crisis of legitimation

The Ontology underpinning this research is based on the argument that advances in technology have provided opportunities to combine positivist principles with a post-modern approach to elicit objective and creative ways of understanding tacitly understood behaviour. This is open to fundamental criticism by methodological purists from both ends of the paradigm spectrum who would argue that there is, at best, no virtue in undertaking such an approach, and at worst that it demonstrates naivety, lack of understanding of

research method, or bad science. The intention throughout this thesis has been to demonstrate a robust yet balanced review and an objective evaluation of the processes undertaken. At the conclusion of this research, I have demonstrated that it is possible to combine these scientific principles in a creative way in order to explore previously inaccessible fields of study. I acknowledge that the essential criticism of the virtue of combining positivist principles with an hermeneutic approach has not been addressed. However, as argued in Chapter 4, it is not necessary to justify the use of a hybrid approach where the alternative is archaic classificatory thinking which itself is unfounded.

During the research process, it has been necessary to confront and address the components of the tool where there is a perceived crisis of legitimation;

1. How far we can suppose a reality objectively exists (after Flick 2009),
2. The justification of the use of video as data,
3. That indirect observation via video is equivalent to direct observation, and
4. The widely acknowledged limitations of the 'Think Aloud' method.

With respect to the first 3 points, philosophical justifications have been proposed earlier in this thesis. In this study of tacitly understood behaviour, the ability to completely resolve these crises of legitimation is currently unachievable. It is argued however that this should not preclude the attempt to gain a deeper understanding of the behaviours. As stated in the Ontology, the intention is to accept the limitations of both positivist and post-modern methods, and it is necessary to reach compromises in the application. From a positivist stance, it is not acceptable research practice to proceed with research where there are concerns over legitimation. Conversely the post-modern methods are all subject to such crises and accept that these crises remain. The overt identification of these limitations by researchers using postmodern methods serves as an indicator of research quality. The proposed hybrid approach will therefore align most closely with the postmodern methods, and whilst it has addressed several of the areas of difficulty, it explicitly recognises the crises of legitimation which remain unresolved.

In relation to point 4, the widely acknowledged limitations of the 'Think Aloud' method, it is possible to discuss more fully how the limitations have been

addressed. The limitations are described as; the challenges of synchronisation, the disturbances to thought processes, the time lag between cognition and verbalisation, the missing of interpretations, and the difficulties in transcription (van Someren et al 1994). The advances in technology have now made it possible to produce tools where the synchronisation and time stamping of data is possible. This limitation is thus fully addressed.

The Big Sister tool was also specifically designed to assist in the transcription element, by being able to stop and start the commentary, to skip and rewind. In this test of the tool, the commentaries were transcribed verbatim. In the process of doing so, the commentaries were listened to in their audio form many times. This highlighted the value of the audio data over the transcribed text. In the future, there are several options for the development of this technique. Firstly voice recognition software may be able to produce an automatic transcription, and this software could be embedded in to the tool. The second option would be to negate the need for transcription altogether and use the audio as the data source. When the research communities embrace new technologies and it becomes acceptable to utilise multimedia for the representation of the findings of research, transcription may become redundant. The experience of listening to and transcribing the audio commentaries has led to the opinion that there is a risk with both options. They would both be quicker, but incur the risk of a gaining only a superficial understanding of the data. The value of transcription, although a laborious process, is the intimate knowledge of the data which is achieved. Practically, however, many researchers already outsource transcription and therefore use other strategies to achieve the in depth knowledge from the transcripts with limited, if any, attention paid to the original data source. On reflection, the value of the transcription process in this research was the ability to hear the nuances of language used, which were evident only in the audio commentary. This facilitated a deeper understanding of the inherent meaning of the comments than can be ascertained from the transcripts alone. I would therefore recommend that the second option, removing the need for transcription and relying on the audio commentaries as the source of data, would be preferable. This approach has the potential to improve face validity, and could be achieved by using the Big Sister interface as the representation of the dialectic. Future research using these techniques will need to be mindful of

the need to use strategies which ensure that an in depth knowledge of the data, and therefore hermeneutic interpretation is achieved.

The disturbances to thought processes described as a limitation in the literature, appears to be addressed, in part, by the BigSister tool. The participants' statements about the way that the mouse click provided structure to their commentary are an extremely interesting finding. They implication is that the process of 'pointing' with the mouse has a sophisticated psychological effect on the ability to talk through the events. This warrants investigation in future research.

The remaining 2 limitations: the time lag between cognition and verbalisation, and the missing of interpretations, are addressed by the production of the dialectic and the use of collegial verbalisation. Firstly the construction of the dialectic allows the time lag between cognition and verbalisation to be visualised. The process of assigning comments to time periods in the construction of the dialectic, intuitively led to the development of rules. It was generally logical to assign comments after the clicks or eye tracker troughs. In following this rule, it could be seen that there was often a delay of several seconds between click and comment. It therefore became possible to account for the time lag. The development of the 'rules' was an inductive process and includes an element of subjective judgement. The decision about the allocation of the comments was often as a consequence of the nuances inherent in the audio commentaries. In defence of this subjective element, since every comment is allocated, the dialectic can be reviewed as a complete time line, in addition to a review of the individual events. This allows for checks and balances to be applied in the subsequent interpretative effort.

The final limitation of the 'Think Aloud' method identified in the literature is the potential to miss event interpretations. The process of data collection and collegial verbalisation addresses this concern. The briefing of the observers directed them to attend to one aspect of behaviour, and not to provide a running commentary of all behaviour. This focussing of attention meant that the observers appeared to be able to keep up with the events as they unfolded. There was no evidence that the observers felt that they were unable to follow the brief they were given, either in the commentaries or in the post event interviews. By the elicitation of a number of different perspectives, the

likelihood of entirely missing interesting events is reduced. The Epistemology proposes the use of Communis Sensus as the means to identify the tacitly understood behaviours. Those tacitly understood behaviours will be identifiable where there is congruence in the commentaries. In this sense the generation of a comprehensive 'list' of all the behaviours is not the purpose. It can be argued that if there were missing interpretations, they would be of behaviours which are not relevant to the research question.

8.7   The influence of technology

The influence of technology has been pervasive throughout the research process and this thesis and is one of the two constant themes identified in Chapter 1. The development and testing of Video-View-Point demonstrates that advances in technology can provide solutions to methodological difficulties, e.g. researching tacitly understood behaviour.

The technological tools, the eye tracker and the Big Sister interface, were evaluated against 5 criteria:

1. The physical attributes i.e. what the tool needed to do;
2. the user interface – the functionality available to the user on the computer screen and the way that it looks and is arranged;
3. the ability to use the tool in several different modes ;
4. future-proofing; and
5. technical considerations of media storage.

These criteria were drawn from the specification of the tool (see Appendix C), and also formed the basis of the participant evaluation, as reported in Chapter 7. In common with any developing technology (the Eye tracker) or prototype (Big Sister), there were some problems in the stability of both of the tools in relation to data collection. Now identified, these issues can be resolved as a consequence of the testing process.

The testing of Video-View-Point was undertaken as a comparison of the Eye tracker (the most appropriate commercially available technological tool) and BigSister (a bespoke software application). The findings/results indicate that both tools are able to elucidate tacitly understood behaviours. The analysis of the results (Eye tracker troughs and BigSister clicks) identified that the Eye

tracker appeared to produce more false positive event identifications than the Big Sister tool. In addition the ability of the Big Sister interface to facilitate 'pointing' at events appeared to add value to the talk through/think aloud process.

With respect to usability of the tools, it is necessary to consider both the participant and the researcher perspectives. The analysis of the semistructured interviews identified that the participants agreed that both tools were equally simple to use. Both interfaces required only very basic knowledge of the use of a computer, and the only evidence of any misinterpretation of the task was the omission of Big Sister mouse clicks by Participant E. This was attributed to nerves rather than inability to perform the task. The participants also demonstrated some innovative use of the mouse clicking, when the used double or multiple clicks to identify interaction in the video, which provides evidence of the intuitive nature of the interface. In relation to the eye tracker, some of the participants identified that they felt that they needed to sit very still which was somewhat distracting, although there was no apparent loss of data due to excessive movement of the participants.

From the researcher's perspective, both interfaces worked well. The Eye tracker's function to provide instruction screens for the participants prior to starting the video was useful, and the data collection was more stable, as would be expected from a commercially available product. The disadvantages were the inability to collate the different perspective and to be able to compare the different participants' data sets. With the current Eye tracker software, it is only possible to collect individual Eye tracks and commentaries which require the researcher to open each data set individually, limiting the ability for comparison. Neither does the commercial software include a means to collate Eye tracks. This was achieved by importing the participants Eye tracker data in to a separate bespoke software tool to be able to analyse the gaze plots. This worked well, but required the researcher to have access to, and be familiar with, another software tool.

Both the Eye tracker and Big Sister have the ability to synchronise the audio commentary to the video. The added advantage of the Big Sister interface is to be able to align several commentaries and click patterns, which makes the identification of the areas of interest possible in the analysis window. This

removes the need to transcribe the timestamps and comments prior to comparison, and makes the analysis via Big Sister much quicker.

It is also notable that although the Eye tracker used was a compact version of the technology, it was more practical to leave it set up in one room permanently. This meant that the participants had to come to the University to use it. The Big Sister interface however can be installed on any computer, and as long as there is a mouse and a microphone installed, can be portable. This allows the potential for the data collection to occur wherever the participants are, which adds flexibility to the research process. The Eye tracker is also an expensive piece of equipment, in the order of £20,000, whereas the BigSister software tool is essentially free.

In conclusion, the BigSister tool is a cheap and portable solution, which is not inferior to the Eye tracker. For the purpose of research in to this field, the Big Sister tool also has the advantages of ease of use in the analysis window, and shows potential for the reduction of the number of false positive event identifications, and added structure in the commentaries.

9. Conclusions and Recommendations

At the outset of this research journey, the intention was to explore the competence of student nurses in simulated practice by using video recordings. The experience and findings acquired from four exploratory studies established:

1. That competence is an example of a tacitly understood behaviour, and
2. An understanding of the limitations inherent in the use of traditional research methods when applied to video captured data.

Video-View-Point has been developed as a solution to these two fundamental issues. This innovative hybrid method of video analysis is underpinned by philosophy. It incorporates elements derived from both extensive practical experience of attempts to analyse video captured data and comprehensive exploration of the literature relating to the use of video in research. The main study described in this thesis demonstrates the potential for the method to successfully elicit tacitly understood behaviours. In addition, Chapter 8 provides a critical appraisal of the ability of Video-View-Point, as an example of the application of new technology, to address the six crises of post-modern qualitative research.

In relation to the secondary aim of this research, Video-View-Point identified four themes of 'signified' competent behaviour in the two videos of simulated practice which were tested. The simulated practice scenario, which was the subject of the two videos, was identical for both the groups of students. The scenario provided a set of conditions, and clinical information released to the students in response to known cues as a predictable pattern of activity. In both examples, Video 1 and Video 2, the students followed the anticipated pattern of events. The predicted pattern comprised the following; assessment, recognition of dehydration, referral to doctor, recognition of deterioration, handover to doctor, preparation for emergency procedure, negotiation of a plan for ongoing management, recognition of further deterioration and airway management.

The predicted pattern was mapped against the events identified in the semistructured interviews and the dialectics. This mapping demonstrated that

there was content validity in the identification of events. The dialectics were then reviewed in relation to the themes which could be identified relating to the indicators of competence. The first interpretation of note is that the themes, although correlating with the tasks which were occurring at the time, relate to the performance of the tasks rather than the tasks themselves. The coding of the dialectics for signifier and signified comments, allowed for the distinction to be made between the tasks undertaken, and the way that those tasks were performed. The dialectics facilitated this interpretation of events based on the observers signified comments. The signifier comments focussed on the recognisably observable physical activities, while the signified comments referred to the thought processes, motives, or conduct of those activities. The combination of the signifier and signified comments provided a greater insight in to the indicators of competence which were being used in the observers' judgements. These judgements were then grouped in to the four themes identified in section 7.6.

1. Communication, and the ability to communicate appropriately at different levels; with the patient (verbal and non-verbal), with other members of the health care team (in this scenario with the doctor, in person and on the telephone), and with each other.
2. Information processing: Being able to process clinical information and perform appropriate clinical interventions based upon them e.g. take a set of observations and ask for permission to put oxygen on, assess fluid balance and check for IV fluid administration.
3. Position: Being in the right place; e.g. being in the patient's eye line, staying with the patient, observing the monitor, knowing where the equipment should be placed in certain situations, e.g. the cardiac arrest trolley.
4. Being proactive; getting equipment ready, tidying up, asking for advance instructions if things change in the future, using communication strategies to prepare the patient and each other for future actions.

These themes can then be compared with the amalgamated competences identified from the literature, as listed in section 2.4. The four themes, although highlighting a subtle difference in application, are aligned to the amalgamated competence list as identified in Table 13. The fundamental difference is that the four themes are in the form of the signified behaviours

and describe observable characteristics rather than abstract theoretical concepts.

The challenge of articulation of the signified endures and there is scope for this initial interpretive effort to be subjected to further formal hermeneutic enquiry. As a contribution to that enquiry, video clips of the behavioural themes can be used to add visual clarification of the signified. Where the behaviours are tacitly understood, the associated time stamped video clip will illustrate the behaviours in their signified form, in order to address the limitations of description in words.

9.1   Areas for further research and potential applications

The use of Denzin and Lincoln's Fifth Moment to frame the critical review identifies the extent to which Video-View-Point has been able to address the ontologically inherent philosophical and methodological challenges. The objective of this section is to outline a practical plan for future activity based on that theoretical debate.

Video-View-Point was developed as a prototype methodological solution to the problem of eliciting tacitly understood behaviour. The results/findings of the test of Video-View-Point are presented as a proof of the concept that it has the potential to be a valid and reliable solution. It would not be scientifically sound to infer that this concept, based solely on this preliminary evidence, is immediately transferable to other tacitly understood behaviours. Therefore further research is required to establish methodological reliability and validity. It will be necessary to develop a programme of research to conduct further studies establishing whether the use of this hybrid design, facilitated by the Big Sister tool (and/or the eye tracker) can be replicated by other researchers and with other examples of tacitly understood behaviours.

As identified in Chapter 2, the use of simulated practice as the platform for this research was a pragmatic solution to the identified ethical difficulties which precluded the use of a real world exemplar. Ultimately, it will be desirable to undertake research using videoed examples of real clinical practice. Firstly, this will provide evidence about the equivalence, or otherwise,

of simulated practice to real clinical practice. The literature review identified this as an important gap in the evidence based justification for the use of simulation in health care education. Secondly, it could be used to explore complex clinical situations such as error event identification in critical situations. This would facilitate the depth of understanding of roles and processes which could be used to enhance performance. This evidence can then be used to inform the education of healthcare teams, and provide an evidence base for the feedback provided for simulated practice activities.

A further application within the field of education is the potential to use the Big Sister tool to provide bookmarked annotations as originally intended in the ESRC funded study described in Chapter 2. The annotated videos can then be used as a means to provide feedback to students after the simulated practice activities. Once research has confirmed and refined specific indicators of competence, these can be used to develop an annotation tool which can be incorporated in to the BigSister interface. This would enable the video to be used effectively during the student debrief after simulated practice.

The discussion in section 8.5 identified that there is a requirement for continued work on the representation of findings. The use of audio commentaries and video clips in the dissemination of future research would be desirable. The mechanism by which this can be achieved must be explored; however, the increasing acceptance of on-line publishing makes this a realistic objective. Publication of research findings in a multimedia format will require specific attention to ethical and data protection implications, although much of the ground work has already been established in the PREVIP Protocol.

It will also be necessary to give further consideration to the format of multimedia data representation. The production of the dialectics highlights that assimilation of different information formats together i.e. text, images, video and audio streams, is very different to the way information is conventionally accessed. The production of an interface which makes concurrent multimedia access intelligible will require further research and development.

Finally there are some practical applications for the initial findings of this research. The clearer understanding of the observable elements of competence will be used to inform the development of simulated practice scenarios. The

four themes that have been identified will be used to develop the ability of staff to deliver specific feedback for students in simulated practice debrief.

The ultimate aim of the future programme of research and the associated simulated practice developments is to develop sufficient understanding of competence acquisition to develop teaching and learning strategies. Once established, this also suggests tot eh potential to develop a summative assessment strategy which could be used to formally assess nursing students. As outlined in the historical context in Chapter 2, one of the major challenges to the healthcare workforce is the dilution of skill mix which is resulting from the retirement of the most experienced nurses. The subsequent challenge to nurse education is not only to deliver sufficient quantities of nurses to replace those leaving, but also to accelerate the competence acquisition of students so that they are further along the 'Novice to Expert' continuum at the point of qualification. With a greater understanding of competence acquisition it will be theoretically possible to assess students individually and identify their competence profile. For example, one student may communicate well, but needs further practice in processing information. It should be possible to provide each student with a tailored set of learning objectives selected to address the shortfalls in their competence profile. The embedding of the understanding of competence acquisition in both curriculum design and individual practice competence learning provides a means by which nurse education can respond to the challenges the profession faces.

There are a number of recent developments which will have a positive effect on the viability of this ambitious plan: nationally, the legislative change to 'All Graduate' Nursing programme provision and the changes in Higher Education funding, are leading to a review of educational processes; locally, we have redesigned and revalidated our nursing curriculum which embeds simulated practice as a developmental set of activities over all three years of the Adult, Child, and Mental Health programmes; and socially, the growing interest in and acceptance of advances in technology and multimedia applications as solutions to long standing problems, and as cost reducing initiatives. This set of factors provides an environment where there is a desire for change, and also the infrastructure which will enable the changes to occur.

9.2   Summary

This thesis has described the development and testing of a novel approach to the analysis of video to elucidate tacitly understood behaviours. The research design, the development of the tool, and the findings of the research have each provided original contributions to the fields of Healthcare Education Research and Nursing Practice.

Now that this very long journey has come to an end, it is possible to reflect on the purpose of that journey. Although I was not aware of it at the time, the journey started as a young girl being taken to see Michelangelo's David in Florence. My memories of that moment are still crystal-clear: standing silent and still at the feet of the statue, my head tilted almost uncomfortably backwards, the heightened awareness of all of my senses – a bright and magical light radiating from the glass dome above David's head, the feeling of being slightly cold compared to the summer heat outside, the smell of floor polish. I can relive my emotional response in those moments but, to this day, I am unable to articulate it. What I did do, with childish innocence, was attend to the utterances of the grown-up strangers around me in their attempts at articulation, in the belief that they knew more than me. It was all there, in that moment: tacit understanding, Communis Sensus, Think Aloud, Fastening and Recollecting, Art, Images, expert opinion.

It was all there.

Subsequently, serendipitous exposure to a range of life experience and learning opportunities has influenced the way that I have approached the challenges of this doctoral journey. I have learned that all knowledge and experience is valuable. I have learned that it is not necessary to be apologetic about my passion for the art of nursing, and that we should strive for greater acceptance of the art of practicing science. Finally, by completing this journey I have learned that the creative use of new technologies affords us the opportunity to develop deeper understanding of what has, until now, been difficult to study: tacitly understood behaviour.

This thesis describes the following novel contributions:

- The identification and practical exploration of tacitly understood behaviours as the field of study for this research. Although tacitly understood behaviour is a theoretically recognised phenomenon, it was found to be practically difficult to explore as it is not readily amenable to research by established methods. The availability of video captured behaviour, and the advances in technology which enabled the handling of the large volumes of data generated by video capture, provided an opportunity to explore these behaviours where it had not been previously possible. It was necessary to provide a philosophical justification of the use of video as data, and establish the set of conditions which enable video to be considered as data.

- The production of a protocol to ensure the ethical collection, storage and use of video captured data. The PREVIP protocol continues to be used, and has been adopted by other researchers in the Faculty, and the broader research community within the University.

- The development of a hybrid method, combining an hermeneutic approach with formal experimental design. Although the mixed method approach to research is well established, the research design utilised in Video-View-Point is a true hybrid, rather than a mix of methods from different paradigms to explore different elements relating to the field of study. The application of experimental design facilitated the non-inferiority testing of the two technological tools, whilst maintaining the context of the hermeneutic approach. This demonstrated that the hermeneutic approach has internal validity, and that both tools were able to elucidate tacitly understood behaviour. It was also possible to identify the added potential benefits of the BigSister tool when compared with the eye tracker, in relation to the ability to identify tacitly understood behaviours.

- The production of the specification for the Big Sister tool prototype, based on the findings of the exploratory studies. The development of this tool addressed many of the issues identified in the Ontology.

- The design of the BigSister interface served as a catalyst for the development of the dialectic as the means of representation of the findings which itself is a novel contribution. The concept is similar to visual ethnography, but time stamped and coded, providing a

sophisticated visual representation of the collegial verbalisation generated by the 'Think Aloud' technique.

- The amalgamation of 'Think Aloud', collegial verbalisation, Communis Sensus, and structural linguistics and incorporating these components as a representation of the analysis in one document is a further original contribution.

- It should be acknowledged that the BigSister prototype was not the only specifically designed software application used in the test of Video-View-Point. Although the gaze plot analysis software which enabled the identification of Eye tracker troughs was designed and written by a Computer Scientist, the use of this software tool to identify Eye tracker troughs, and therefore points of agreement in the cumulative Eye tracker data, and the representation of the trough data by pinhole images in the dialectics in this study is novel.

- The contribution to the field of nursing practice relates to the elicitation of four observable indicators of competence.

The elucidation of the tacitly understood yet observable indicators of competence with Video-View-Point has added depth to the understanding of the theoretical constructs identified from the literature. Significantly more work is required to develop a comprehensive understanding of nursing competence, but these initial findings demonstrate that there is potential for this technique to extend our understanding of tacitly understood behaviours in general. We are now in a position to move beyond what Benner proposed 30 years ago.

Appendices

Appendix 1: The Simulated Practice Scenario Script

Mrs Alice Cramp is a 72 year old lady. She is normally fit and well, but fell over 3 days previously and fractured her left Neck of Femur. She was admitted to an orthopaedic ward from the Emergency Department for hip replacement surgery. She was kept nil by mouth awaiting a theatre slot. That night, the decision was taken to delay surgery until the following day and she was allowed sips of water until 0600. The same pattern occurred for the next 2 days because other emergency cases needed prioritisation. Mrs Cramp finally had her hip replacement this morning, and has been returned to the ward post-operatively with a urinary catheter and a wound drain in situ. She has an Intravenous catheter in her right arm with a 500ml bag of 0.9% Sodium Chloride attached but this is not running. The students are introduced to Mrs Cramp 3 hours after her return to the ward.

The students should introduce themselves to Mrs Cramp and undertake a physical assessment, and document a full set of observations. Mrs Cramp is chatty and 'really wants a cup of tea'. She is repeatedly saying she wants a drink.

The students should recognise thirst as an important observation, and ask the mentor if she is able to drink. They should also look back at the paperwork to assess for her fluid balance status. They should find that the paperwork from theatres is missing, and should request it is brought to the ward. The students should also check the urinary catheter which is nearly empty, and recognise that the IV fluids are not running.

They should refer to the medical team for a plan for ongoing management of her fluid balance. At this point Mrs Cramp begins to complain of chest pain, and feeling faint.

They should repeat a set of observations and recognise that her pulse has increased from 78 regular to 123 irregular with an associated drop in Blood Pressure. They should recognise acute deterioration, be concerned about dehydration as a potential cause and may establish monitoring. They may recognise that the ECG rhythm is now Fast Atrial Fibrillation.

They should refer to the medical team once again, with a clear description of the problem and action which they require, hopefully using the recognised

referral framework they have been taught - Situation Background Assessment Recommendation (SBAR) (NHS Institute for Innovation and Improvement 2008).

The students at this point should be reassuring Mrs Cramp, recognising that she is becoming increasingly uncommunicative, and prepare for an emergency procedure, bring over the cardiac arrest trolley and consider closing the curtains

They should consider Oxygen administration – and establish monitoring if this has not already been done.

The doctor arrives and decides to perform a Synchronised DC Cardioversion. The students should recognise their limitations and question this if they have had no experience.

The doctor will direct them to draw up an ampoule of midazolam; they should refuse and provide the doctor with the equipment to do this him/herself. The doctor will not correct them if they draw up the drug but will ask them to administer the drug. They should refuse, but again will not be corrected if they do.

They should assist the doctor with the procedure, follow instructions and observe the patient and the patient monitor throughout.

They should request an on-going plan before the doctor leaves the ward

The should repeat observations and reassure Mrs Cramp, and ensure her dignity

 Mrs Cramp will start to snore, they should recognise this as an obstructed airway and get the head off the back of the bed and secure her airway with a head tilt, chin lift. They should call for emergency assistance – scenario ends.

Appendix 2: Summary of the Literature by Year of Publication and Methodology

Year	Number of papers	Author	Method of video analysis
1986	1	Porter et al	Coding
1995	2	Kot & Law	Counting
		Makoul et al	Coding
1996	1	Couchman	Trascription/counting
1997	2	Tait & Lutman	Coding
		Digiacomo et al	Counting
1998	3	Daniel	Transcription/Thematic analysis
		Waller et al	Conversation analysis
		Routasolo &Lauri	Counting/coding
1999	2	Ram et al	Peer observation
		Barenek	Coding
2001	2	Emerson et al	Transcription
		Tait et al	Coding
2002	2	Campion et al	Coding
		Koch & Zumbach	Coding/Software applications
2003	3	Walther et al	Textual annotation
		Andersen et al	Coding
		Roberts et al	Discourse analysis
2004	2	Parry	Conversation analysis
		Xiao et al	Grounded Theory
2005	6	Barenek et al (a)	Coding
		Barenek et al (b)	Coding
		Blomqvist et al	Coding

		Hallgren et al	Observation
		Parry	Conversation analysis
2006	4	Seagull et al	Coding
		Axelrod & Hone	Coding of transcript
		Janssen et al	Think aloud
		Pea et al	Textual annotation
2007	8	Heath et al	Conversation analysis
		Clifford et al	Coding
		Froggett et al	Transcribed extracts
		Hunt et al	Coding
		Aina & Olorunshola	Counting
		Cocks et al	Counting
		Roberts & Bucksey	Coding
		Jenks & Higgs	Counting
2008	5	Virta & Eriksson	Thematic analysis
		Crane & Winsler	Coding
		Kaji et al	Coding
		Von Aufschnatter et al	Coding
		Parmeggiani	Textual analysis
2009	7	Lubbert et al	Coding
		Twitchett et al	Counting and coding
		Seeberger et al	Conversation analysis
		Bagley et al	Counting
		Qvarfordt et al	Coding
		Phelan et al	Coding
		Hrisos et al	Observation
2010	23	Barron & Topping	Coding
		Bylund et al	Coding
		Hindhede	Counting
		Sparrow & Hird	Coding

		Williams et al	Conversation Analysis
		Flenthrope & Brady	Coding
		Nadler et al	Coding
		Pappas & Seale	Conversation Analysis
		Mendoza et al	Coding
		Schug et al	Coding
		Muntigl & Choi	Transcription
		Lidar et al	Transcription
		Dunn	Commentary and overlay
		Bunning & Ellis	Transcription
		De Leng et al	Transcrition
		Vehkakoski	Ethnography
		Horton & Riddell	Coding
		Zhang et al	Thematic analysis
		Pedro et al	Coding
		Jost et al	Grounded theory
		Walter et al	Pattern analysis
		Thomas & Locke	Coding
		Sirota	Ethnography
		Preston	Coding/ Software applications
		Ohman	Transcription
2011	14	Bloch	Conversation analysis
		Oien et al	Transcription
		McDonald et al	Coding
		Barron & Topping	Coding
		Savage et al	Coding
		Allen & Marshall	Coding
		Blauw-Hospers et al	Coding
		Dirks et al	Coding
		Elberse et al	Case study

		Nind et al	Ethnography
		Bickerton et al	Phenomenology
		Henry et al	Transcription
		Jonker et al	Coding time periods
		Bolton et al	Coding time periods
2012	12	Barenek et al	Coding
		Wilkinson & Wielaart	Conversation analysis
		Ferm et al	Pattern analysis
		Birkenes et al	Coding
		Stockel & Weigel	Coding
		Poon et al	Coding
		Endacott et al	Cue for interviews
		De Letter et al	Transcription
		Tso et a	Coding
		Iedema et al	Ethnography
		Pillet-Shore	Conversation analysis
		Howard et al	Discourse analysis

Table 14: Literature by year of publication and methodology

Appendix 3: Specification for the Analysis Tool

The tool will:

1. Playback video files

2. Capture audio annotations made by facilitators whilst reviewing a video

3. Record points of interest on video (in particular students) to correspond with audio annotations

4. Support semantic annotation for observed behaviour and dialogue to be added by researchers at a later date

5. Support playback of annotation from multiple users along with original video file

6. Allow synchronisation between video files, multiple tracks of captured audio annotations, and textual annotations

7. Show user-identified points of interest by overlaying onto video during playback

8. Mouse based user interface to specify points of interest on the video, while allowing possible integration of eye-tracking hardware at a later date

9. Overlay a marker onto the video when a point of interest is created using a single left-click, and hide it after a set period

10. Provide a time-based overview of all identified points of interest in the video (possibly of multiple users) allowing easy visualisation of patterns and groupings.

11. Allow easy navigation to points of interest.

12. Allow deletion of points of interest.

13. Implement the ability to skip to any region of the video, audio or text annotations.

14. Playback text annotations in a separate area of the display, along with audio and video annotations

15. Implement simple and quick reset of recording window for next user

16. Allow for multiple modes of operation for different users of the system, i.e. playback for students, analysis for researchers and recording for mentors

17. Save captured audio annotations as a compressed sound file

18. Implement basic support for discarding recording of audio regions where there is no speech

19. Have the ability to bookmark areas of interest for later playback

20. Be able to view and mute the sound stream of the video or audio comments.

Appendix 4: Observer Briefing Script

I would like you to watch the following video. It is a group of students working in a simulated practice scenario. While you are watching it, I would like you to talk about what you are seeing in the students' performances which you think are important when it comes to assessing their competence. Just as if you were assessing them in practice, point out to me what are the good points and what are the worrying ones. There are no right or wrong answers. From a research perspective, we can only very broadly categorise competence and yet we all know 'OK' or 'not quite there yet' when we see it, and I'm really interested in what you see that makes you think those things. I don't expect you to cover absolutely everything about every student, I'm just interested in the things that grab your attention along the way. Is that OK?

Appendix 5: Semi-Structured Interview Schedule

The following questions identify the main themes for discussion, additional questions will be used in each section to confirm understanding and clarify meaning.

How did you find the video?

How did you find the experience of using technology like this?

[Showing a still of the students in the video]

Can you tell me your overall assessment of the students competence?

Did any of the students stand out, either as competent or not competent?

Were there particular incidents that made you think about their performance?

How did you find talking through what you were seeing?

Did you find the technology easy to use?

Can you think of ways that this could be improved?

Second video (participants E F G and H only)

Same as above , plus

How did the two systems compare, now that you have used them both?

Appendix 6: Dialectics

Eyetracker troughs	BigSister agreement	Screen shots and commentary
00.05		
00.10		
00.30	√	
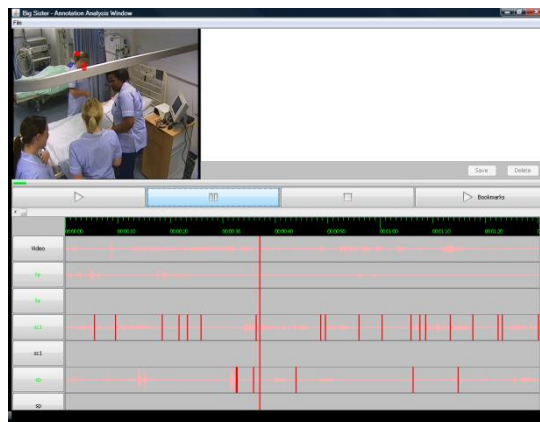
H(2) 0030 so again there was lot of conversation about the patient by the patient before engaging with them. Im glad that the nurse introduced herself , give her a name

A 0035 good shes introducing herself umm

00.58

H(2)0045 still seems to be a lack of leadership here

A 0045 that nurse didn't seem to say what she was doing

E(1) 0050 so this one doesn't seem to be doing that much

C 0050 the lack of contact with the patient himself

G(1) 0100 none of the students seem particularly interested in the patient

H(2) 0100 I like her nature though shes engaging friendly reassuring, I don't know what shes doing, I don't know what shes doing, I don't know what shes doing .

A 0106 that was good, she was trying to reassure the patient

01.15   √
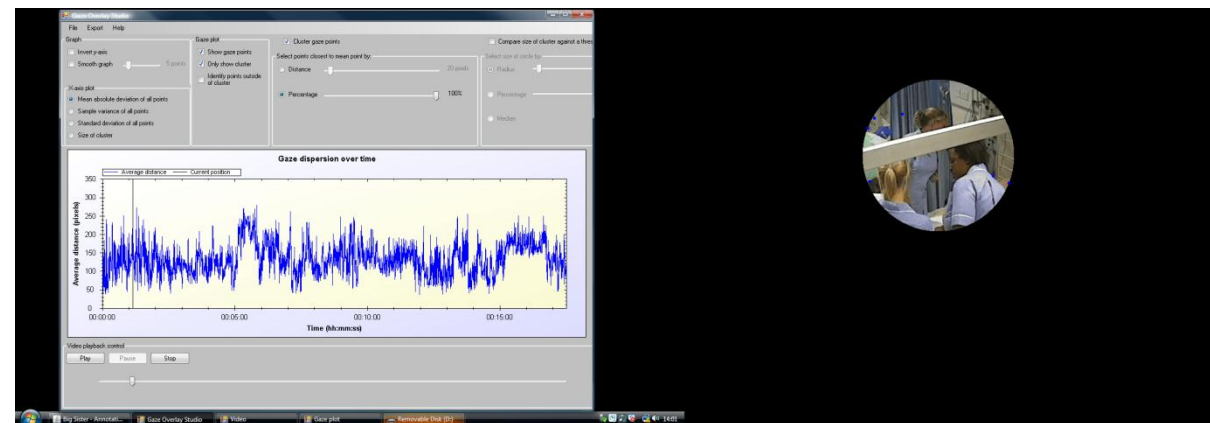
C 0111 no evidence that the students has told the patient what they are doing

F(2) 0115 what did she just say

G(1)0116 I think the student with her back to me is touching the patients hand

H(2) 0118 again addressed the persons concerns about the tea – hadn't ruled it out. I don't know what these two are talking about. Its not nice to whisper in front of the patient.

A 0118 sometimes saying check your obs, perhaps she should have said what obs meant really

E(1)0120 this one seems a bit unsure of herself id be a bit .Id be eager to teach her. I don't know

G(1) 0123 so the girl checking the pulse is checking the pulse and not talking to the patient

H(2) 0130 I don't know what shes doing

H(2) 0138 Still dont know what theyre doing

01.50   c 0144 the other three haven't introduced themselves, observation of the patient, examination of the patient, engagement with the patient to ask them their impression of what is wrong, Observation of charts rather than the patient and machinery

H(2) 0145 again I haven't seen anyone clean their hands

F(2) 0147 Im not really getting a clear sense of what any of them are doing at the moment ??? what happened there , is that them taking stock??

G(1) 0148 so the girl at the back talking to the patient, but shes actually touching the patient at the same time as shes talking to her which is good to see

E(1) 0150 this one seems to be taking a long time to collect her thoughts, and now this one has introduced herself shes more happy to stay and watch everyone else's and let other

people take the lead

H(2) 0155 What are they doing What are they doing No-one is reassuring me that that they think about the patient

02.05

A0200 all of the student are sort of talking amongst each other and not really to the patient at the moment, and theres 4 of them there umm, and one of them perhaps should be holding the patients hand, telling them whats happening cos theres a bit of a gap now, when they said they were doing the obs

E(1) 0205 this one hasn't introduced herself to the patient, I think she needs to umm start looking at her patient as a whole rather than just looking at the paperwork so Id probably start teaching her ummm ABCDE assessment

F(2) 0210 its just she ready to do something, shes got the sats probe and the   ??? out the way

H(2) 0215 is she is charge? Shes asking permission to do sats. Why isn't she going ahead and doing, she seems to be waiting form her to tell her. Shes now given the sats to her, she hasn't explained why

02.35   √

F(2) 0238 weve got two pairs , I cant hear what theyre saying, there are the two near the bed that are discussing something. They are wanting to start assessing and monitoring, but the other two are worrying about the charts, but they are standing in the way. They know they are standing in the way.

C 0238 there is evidence that the respiration rate is being done umm they are going to check

the sats, they havent done their capillary refill rate

A 0242 be nice if the student had told the patient what the probe was for and that it wouldn't hurt them. Good that she asked if she had any pain

H(2) 0245 finally someone has addressed her pain. Just gave an OK didn't give any more response about managing it

E(1) 0250 I still havent seen this nurse here do much

G(1) 02 52 it doesn't seem that any of them are sure what they are doing

H(2)0255 why does she just stand there the whole time shes not doing anything

03.00 √
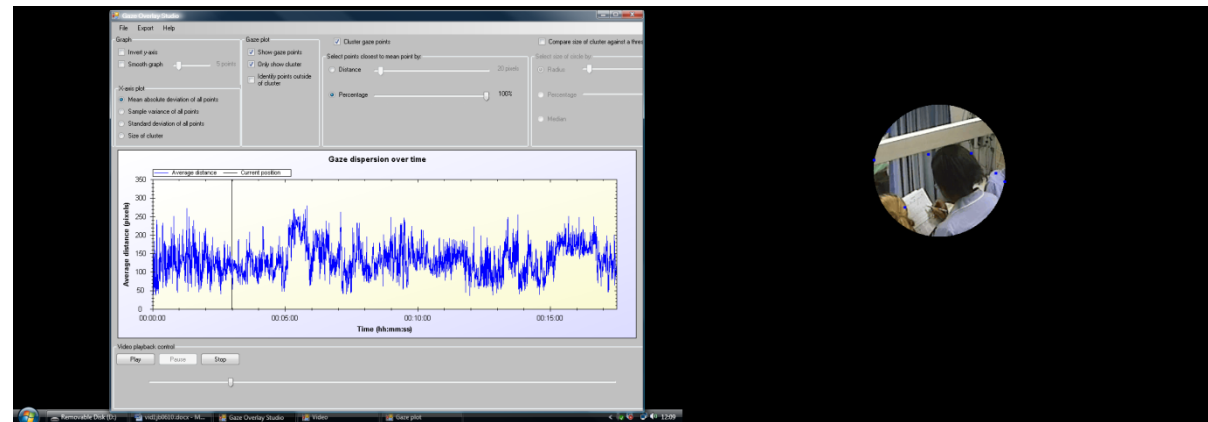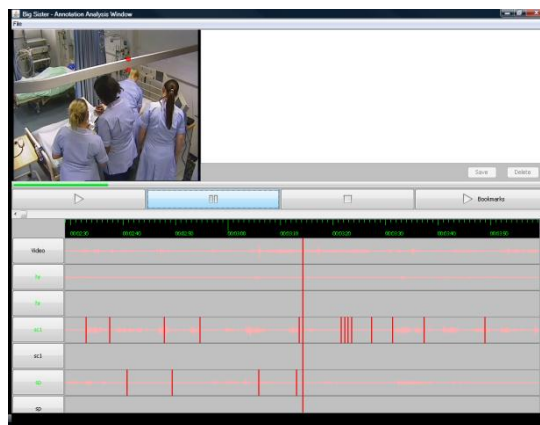
A 0314 be nice if she had told her what she was popping on her arm and what she was doing with the blood pressure cuff

C 0315 any evidence that they know what they are doing with the probe on the finger

H(2) 0315 again no explanation as to why shes popping it on the arm. I still cant figure out what these two people are doing she seems to be the only one having any real patient contact E(1) 0315 Id be a bit worried about her competency she hasn't even introduced herself to the patient yet, she's not umm she s too busy looking at the screen and she's not really moved away from this corner

F(2) 0320 what's she doing? Keeps looking at the pulse but I cant see and she keeps moving. Yes she is, shes taking the pulse

G(1) 0327 its good to hear her doing something with the probe on the patient and asking the patient how shes feeling at the same time

H(2) 0335 shes very good at looking at the monitor. Don't like the hands on the hips either but that's just a pinnickity thing

04.00   √
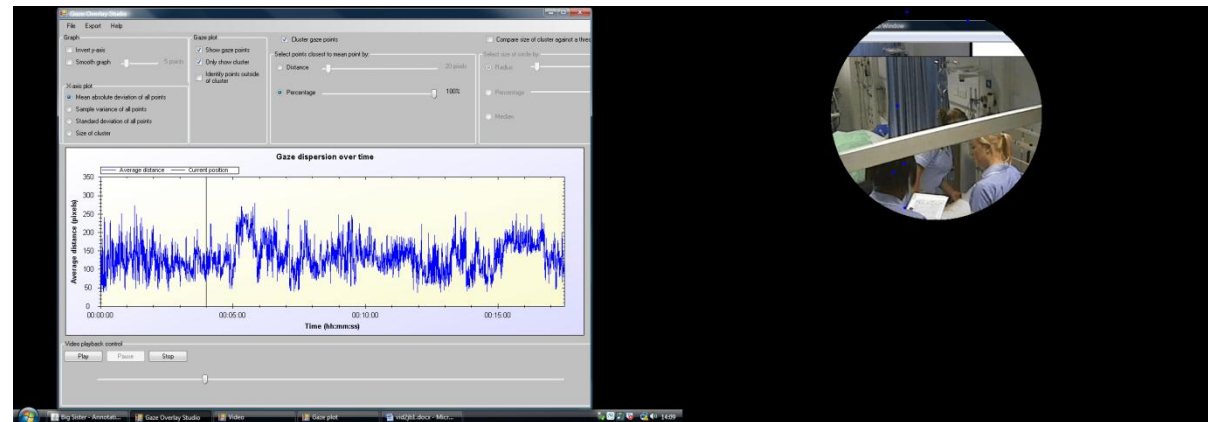
F(2)0340 so shes actually finally made a decision to start getting this monitoring on [that two have them wanted to do for a while]

H(2) 0353 whats her temperature, didn't like that, shes in front of the patient

C 0403 all that is visible at the moment in the patient is one arm and the patients face. There is evidence that they are absolutely recording the observations

H(2)0405 good shes exp... good shes offering some explanation and reassurance

H(2) 0415 I would be worried about these people just stood there, repeating the question that they asked before

A 0408 good that shes trying to explain

04.30 √
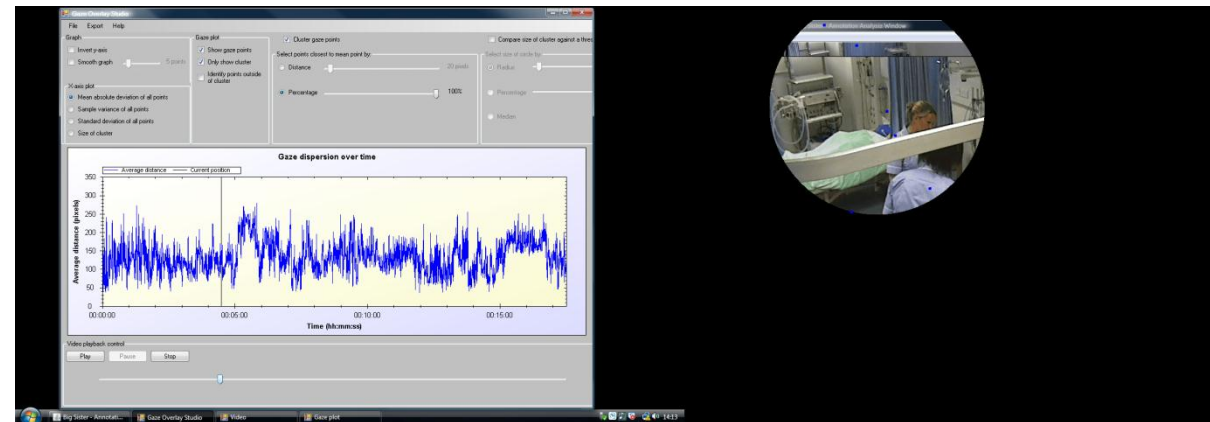
F(2) 0430 shes is being interested, watching whats going on

G(1) 0432 seems that girl with the chart, she seems to be constantly hanging on to the chart, shes talking to the patient again and attaching to the patient, shes trying to get in to her eyeline , which is good to see

H(2) 0430 good explanation of the pain scale though

A 0429 that's good that shes explaining the score

E(1) 0438 Im quite worried about this girl here, she may be completely different out of simulation practice

H(2) 0445 again the patient gave an answer, very dismissive OK

05.00 C 0508 how long have you had the pain for?

H(2) 0515 shes got to stop just standing there looking at this chart, its taken her all time just to ask about the pain

A 0508 they haven't really addressed the fact any of them yet that shes thirsty, shes said that twice now

H(2) 0528 whats she playing with. Good reporting that the patient keeps wanting a drink, but she should be doing that with her chin on her hand

C 0530 we looked at the fluid balance chart to see how, what is her output for the day

06.00   √
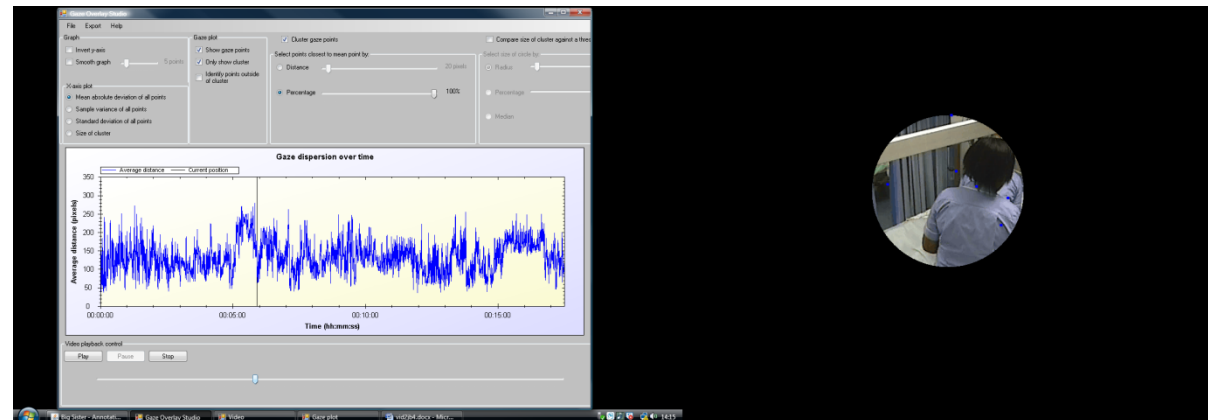
E(1) 0544 None, its really difficult being in simulation practice having been there myself, but they don't seem to be taking it seriously. They cant….

H(2) 0548 what she actually wants is something to drink

A0600 at least shes explained to the patient that they are now trying to sort out whether she can have a drink

H(2) 0605 again im glad youre engaging with the patient. Listening to the handover

G(1) 0608 the blonde girl at the back is making good statements and linking things together,

shes taking control in a very subtle way

06.10   F(2) 0610 Ok shes picked up on something, and shes got concerns there

C 0611 I suppose there is an absolute disassociation that this is a person

06.20   E(1) 0620 so the girl on the phone should have said who the patient was, what bed they are in, obviously a bit of their history and then gone in to why umm what they are MEWsing on. So she needs to learn a bit more of a systematic approach and then escalate concerns

C0628 I suppose I would like to think of them looking at the person A to E

H(2) 0620 very poor communication over the telephone, no-ones doing anything just looking at the phone call. Better hand over now but its having to be dragged out of her

06.45   F(2) 0635 there is something about the last comment she made, whether shed like a drink. They are all discussing the patient by the bedside, but they are ignoring the patient , it can t really be something concerning????

C 0638 if you had a patient who was MEWsing why would you take the blood pressure cuff off

07.05   E(1) 0705 I think the general feeling is that they all need a bit of support in thinking why the persons pulse may be high or why the persons pulse may be a bit different

G(1) 0704 so none of them are talking to the patient although they are all stood around

C 0705 have we looked at the left neck of femur at the wound site?

H(2)0705 try to avoid using euphemisms like obs

07.10   H(2) 0715 would have been better to see a more formulaic reassessment using ABCDE, there is still not a clear leadership here. Those are very significant findings good to have reported

them, should they not eb escalating this up

F(2) 0720 it is interesting it is significant she has taken the sats probe off , it may be that she amy not think this patient is appropriate for continuous monitoring

07.25

G(1) 0725 the girl at the far side of the bed has gone straight to the patient, shes touching her again as she talks to her , she getting in to her eyeline

C0725 they recognise that something isn't quite right but there doesn't seem to be a general purpose

A 0730 that's good that shes explained what they are now doing with presumably the ECG

F(2)0730 Ive got a clinical picture in my head to decide whether that's appropriate or not

E(1) 0735 they need to start doing like an ECG or something, and start thinking while the other persons on the phone they should be doing the initial assessment of the what the dr is going to want to see when he arrives on the ward, like an ECG, recent observations a fluid chart

H(2) 0740 again they have not pulled the curtain

G(1) 0740 she talking to the patient and directing whats going on

F(2) 0750???

H(2) 0750 you can turn the fluids on – what verbal order was that then

C 0755 why aren't the fluids running , have they been written up correctly

C 0800 the relevance of the chest pain and the observation of the difference in the pulse. Potential for each patient to go into what type of shock needs to be recognised. Still no observation of the wound

H(2) 0800 again I like the fact shes apologising , she has a nice manner

A 0801 that nurse has finally got the drip going I think

E(1) 0805 it could be that there are too many in this simulation, it could be that there should only be two to each uhh   I get the feeling that if there were only 2 people doing the simulation then they may be able to get more involved

H(2) 0810 I don't like the term sweetie – no-ones asked what the lady prefers to eb called

A0812 not a good idea to call the patient sweetie really, but they are trying to reassure her umm

F(2) 0817 there are two of them by the patient. It is interesting that one of them is putting on the ECG, one is doing the sats, ???it is likely they are investigating proactively trying to work out what is going on

G(1) 0817 shes reassuring the patient putting the ECG leads on. The lass on the left doesn't appear to have much awareness about where her colleagues are

H(2) 0823 the patients complaining, probably to her because she is engaging. Nobody else is taking on board what the patients saying or doing, just what the monitors doing.

C 0828 oxygen?

A0828 that's a good nurse shes trying to reassure the patient

F(2) 0835 shes moved in to a communicating role

G(1)0834 she gone to turn the fluids back on

H(2)0840 heart rates going right up, its not the sort of language we should be talking in front of a patient

F(2) 0846 I get the sense that they know exactly what they are doing she communicating with the other nurse

08.50

A 0850 now they've all left the patient umm

E(1) 0855 So now this lady, the student here could start getting the patient ready for an

emergency situation. Getting the oxygen ready while the guys were getting the crash trolley and the drs . oxygen on

G(1)0855 the girl whos got the charts in her hand

H(2) 0855 but they are recognising that this patient is getting very unwell. The crash trolleys arrived. But that was a collective decision. No-one was willing to make that decision themselves

C 0900 observation of the wound

C 0910 pulse is increasing, blood pressure dropping, respiration rate is going up. Recognition of potential for hypovolaemic shock

H(2) 0910 good establishing oxygen straight away now. Shes certainly taking on a more leadership role, although I would get the sense that possibly the nurse – no scrub that

F(2) 0913 Im not sure what this girl is doing

G(1) 0914 the blonde girl at the back is reassuring the patient again, and asking for information The students gone off with the charts this time, theyve all left the one nurse, but shes staying with the patient, she reassuring her using touch again.

09.25   A 0920 they are realising that the patient might go into shock so they are giving her some oxygen, that's good

F(2) 0930 She is calming the patient down , she got monitoring on quickly, and they did that as a group – well two of them

H(2) 0930 is she in charge? Or is she in charge?

09.35   √   C 0945 she could be going in to cardiogenic shock, have we looked at the ECG to see if it is a normal rhythm

F(2) 0947???

H(2) 0950 please stop calling her sweetie – drs arrived

E(1) 0950 I get the impression that this girl knows her stuff, but is not getting in to the swing of simulation, I think she is quietly confident, but I think student here I would probably take under my wing if I was her mentor because she doesn't seem to be showing the ability of what is needed

G(1) 0953 they've thought about the trolley but the girl on the left is still nowhere near the patient and hasn't been

H(2) 1000 there is some avoidance of the dr now, no-one wants to make eye contact

G(1)1000 so behind the bed, again she being proactive ensuring the patient is ???

C 1004 has she got a history of having chest pain has she ever had this type of pain before

H(2)1015 its interesting to note how body language has changed now someone more senior has arrived, from all of them, Again –

F(2) 1015 getting the oxygen on

C1028 have we looked at the things – you know – the colour of the mouth

E(1) 1030 Im not sure about this girl

G(1)1041 again she's talking to the patient

H(2) 1045 she hasn't put any gloves on, she hasn't checked the drug

F(2) 1050 its significant that shes even looked at the monitor, she interested??/?? what shell say

G(1)1050 again the student at the back on the left has still not touched the patient. The one at the back on the right again is looking at the monitor to try and give information. The girl on the left just seems to be guessing

C 1050 is it regular?

H(2)1055 no-one is questioning whether that is safe to do here, it wasn't clear that they had checked the drugs properly

E(1) 1100 so by now they should be getting everything all off the patient

C 1105 now what are the side effects of midazolam? Could it depress your respiratory rate, so you need to know the side effects of the medication you are giving. Is the dr going to write that up – have you made those arrangements with the dr, if the drs giving the medication is it going to be written up straight away. Have you checked the expiry date, it's the correct dose. Explanation to the patient would be great.

A1110 none of the nurses have thought to screen the patient at all

E(1) 1112 starting to get the patient ready, this person is waiting for an instruction, so is this one

H(2) 1115 I would have preferred the bed to be pulled out , somehow someone needs to be given the task of managing the airway. Havent pulled the curtain, nobodies challenging on that

G(1) 1120 ok so shes acting outside of her scope of practice, drawing up what the drs just given her

F(2)1130 I hope she praises them   for saying that , it was very fast, as soon as she said it was irregular it was fast, it was Af

H(2) 1135 interesting the crash trolleys gone to the left side

whats the plan?

H(2)1142 unsafe practice with the defib but that's a small thing. Good oxygens been taken away. Put the paddles back

G(1) 1152 ok they've all left the patient no-ones talking to her any more, although the girl on the right is in a great position to do that

11.55

12.00
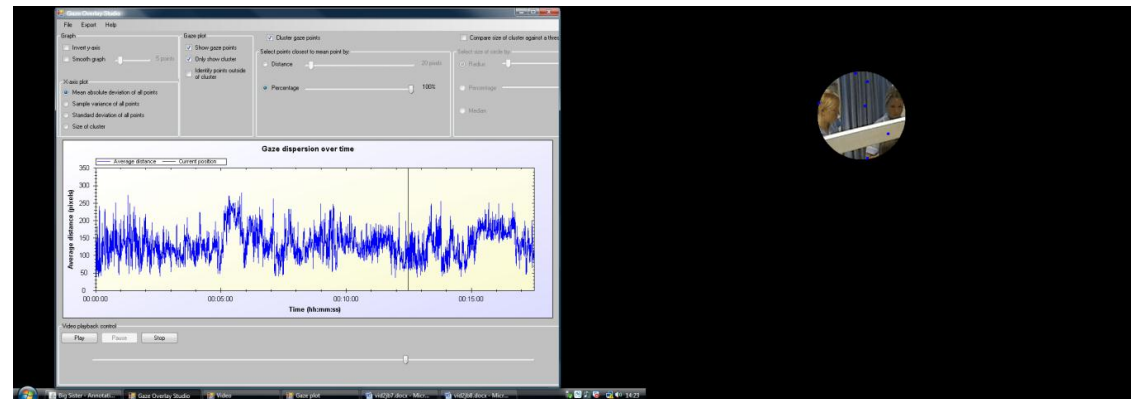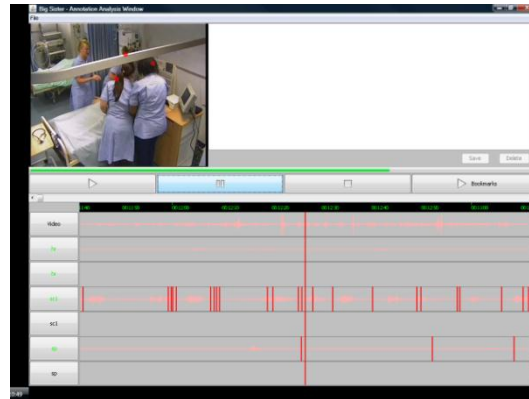
C 1210 Should we remove bed head and move the bed downwards please

H(2) 1208 who is instigating the review now, everyone is just stood around, there is no challenge on leaving them to it,

A 1215 they are all looking at the monitor and not talking to the patient. That nurse is doing very well she is talking to the patient and putting her oxygen back on, shes trying to maintain communication with her

G(1) 1221 ok so shes cleared the oxygen away properly

H(2)1225 good putting the oxygen back on, being more proactive. These two are paralysed, trying to engage a bit more now. Never giving an explanation of what she's doing

C 1225 are we looking at the patient or are we looking at the monitor?

E(1) 1225 Ive not really seen much from this girl here

F(2)1229 she was looking

C 1233 are you happy that the drs left or what is the prescribed plan, what is the team

decide to do to the patient

G(1) 1233 ok they are all looking at the monitor not the patient

A 1240 the patient is making a snoring noise, have they realised what is happening with her

F(2) 1240 they were both very good with the oxygen, theyre listening , they are both actively trying to help, as soon as they hear a request they are very very quick to respond

C1245 next of kin, consequences

H(2) 1245 good finally moving the bed out, after the event. Shes taking on a more competent leadership role by de facto, by the fact that nobody else seems willing to

12.50   √
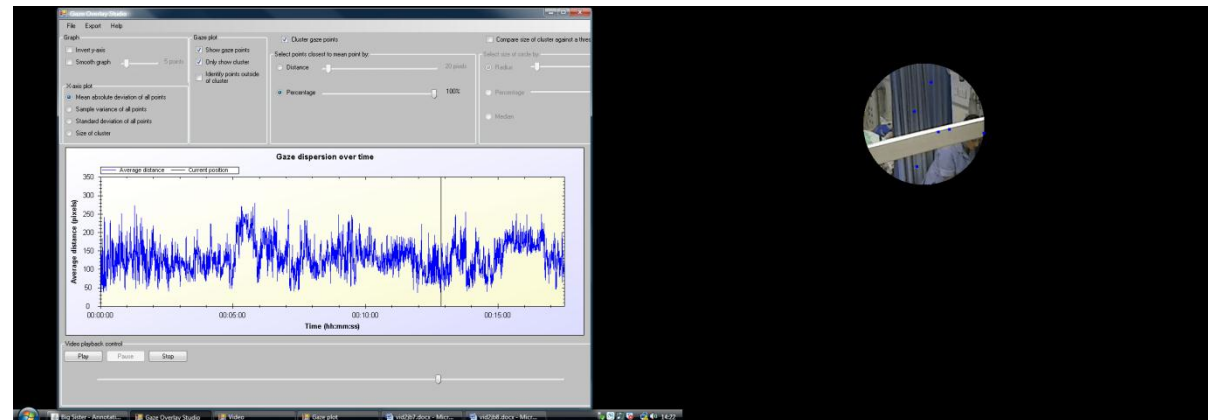
A 1250 right so they are getting the head, that's good that nurse is getting the head of the bed back, that nurse is sorting the airway out opening the airway. They haven't looked in the mouth though, umm

E(1) 1255 get the pillow out may be or get the patient flat, at least one of them , I don't know . if they are struggling then they need to get the dr back

12.58   √
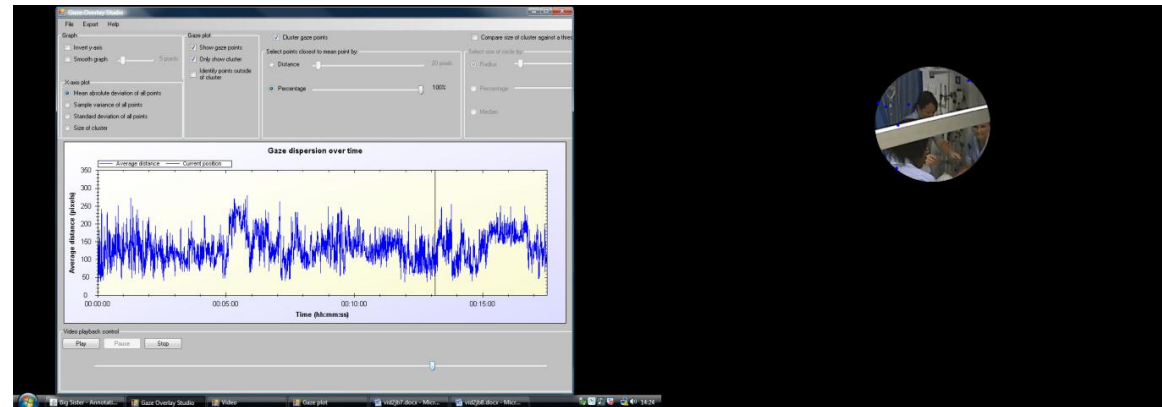
F(2) 1303 I didn't hear who said sinus

C1300 I am not hearing what I am hearing , the patients breathing rhythm has changed and now she is audibly snoring. Remove the bed head and move the be a bit further down. Recognise that midazolam, thankyou

H(2) 1305 good managing the airway, not calling for help, seem happy that this is the situation that they are in , which is worrying. Oxygen now going back on. Again just spent the while time looking at the monitor Why haven't they called the dr back, why are they having to do airway manoeuvres on someone without calling for help

A 1310 good shes getting the oxygen back on again. Nobody has called the dr back

G(1)1318 that's the girl who is directing things again, about getting the bed out but why shes not put the oxygen back on ,, so shes going to the head of the bed, finally theres a student   ???   that's dangerous and nobodies recognised the fact that actually the pillows should be out of there and the back of the bed should be away. They haven't recognised that

they need help

F(2) 1320 shes putting the oxygen back on which is good

C 1325 Pillow , pillows girls , tilting the head back, airway airways. Pillow please , pillows

A 1325 nobody's checked the breathing

F(2) 1335 I cant hear what theyre all talking about - but she was anticipating something

C 1338 emergency procedure please

E(1) 1340 all of the girls really need to start thinking about getting the dr back if they are really concerned, they don't seem entirely happy, they haven't asked for a plan from the dr about what they want next. So may be some teaching is required about what they need when they start escalating care, what to have inm place before the dr leaves

H(2)1340 more confident, very unconfident, periphery, and remains on the periphery

C 1343 antidote to midazolam

13.50   F(2)1350 this girl by the screen shes recognising the situation, she simmediately gone to airway, somebody who knows what to do, not terribly effective just yet, but she knows what she is trying to achieve, oxygen mask straight back on

G(1)1404 as soon as somebody else is in there the girl with the   ??   has walked away from the patient

E(1) 1405 im not quite sure what this girl is doing here. What she doing with the   …

C 1405 no response

A1405 clearly the airway is still impaired.

H(2)1410 good sticking with the airway, still unsure what this persons doing, and this person, and this person

A 1410 she needs to be looking at the , none of them are looking at the patients breathing at all

C 1412 is she fast asleep or is she unconscious? Shes not response to voice is she responsive to pain . Pillows

14.30

C 1430 is that keeping the airway patent, and where's the other nurse? There nobody that's the director here, that s the one person that's directing the care, theres no sense of recognition of the deteriorating patient

F(2) 1435 shes communicating a judgement the sats are 98 and fine. I like the way she was turning that monitor around. Was it her who say about midazolam. As a group though there is a good understanding about what the problem is

G(1) 1435 directing things asking for information at the back

14.45   √
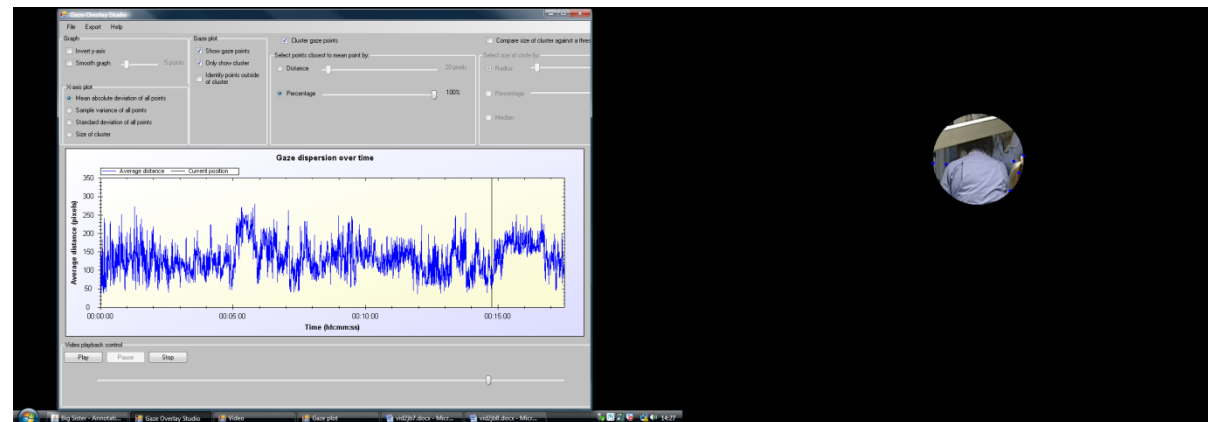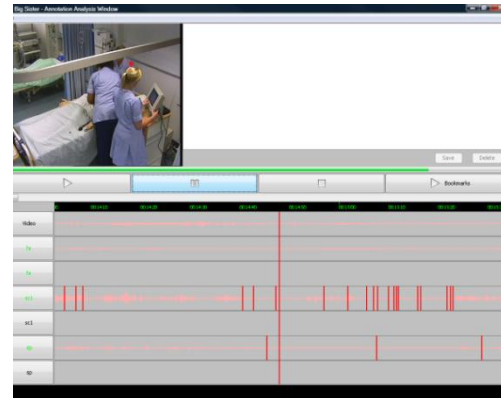
E(1)1445 they all need to start assessing the patient completely

G(1) 1445 responding to cues again from the patient

H(2) 1448 again seems to be a bit more of a leader, there seems to be , this ones interesting, I think she could do more

A1448 they don't sound very sure about what they are doing, they don't sound very confident

15.05

E(1) 1505 its now a good few minutes in to the simulation now and they have just realised that she has got a catheter, that just makes the point that they should have done a good ABCDE assessment

H(2)1505 still on the periphery. Has got a catheter. Now rummaging around , no thought to infection control, exposing the patient when they are still in an open area, theyre not explaining what they are doing

C 1508 have we looked at the wound, no urine output

A1510 that's good that shes looking to see whether there is something wrong with the position of the catheter, whether its blocked, bearing in mind there is nothing in the bag

C1512 is it blocked or is it that shes anuric. Has she got a drain in, shes got teds on . checking that's good ,seeing if theyre functioning properly

F(2)1515 again no overt communication about what she is doing but she is getting a stethoscope

H(2) 1545 no explanation as to what they, why she listened to the chest – who is she feeding it back to, good still engaging with the patient. Still on the periphery

C1552 are you just leaving the fact that's theres no urine, what about the MEWS, do you know how much she weighs. You need to ring the dr to say there is no urine, is the catheter patent?

F(2) 1553 theyre thinking about the blood pressure but no-ones sure about the monitoring equipment, or it's the simulation not quite sure theyre picking up the blood pressure hasn't changed

G(1) 1555 shes starting to problem solve thinking about whether the catheters blocked but neither of them are telling the patient what they are doing

G(1)1605 it seems the two students with the patient are not really talking note of what the patients happening but at least they are there

H(2) 1605 hasn't really moved from that spot for the entire time that she has been there

F(2) 1607 where did that come from, did she see what she was doing or get a sense of her train of thought, she went for that. I like that shes looking at the monitor whilst looking after the airway

E(1) 1610 Im still not really too sure what this girl is doing

H(2) 1615 I like that she is still holding the airway open

C 1625 is she just sleepy , or is she just not responsive to voice

F(2)1630 beginning to get the sense that shse knows what critical care practice is about

G(1) 1636 shes talking to the patient, explaining whats happening

H(2) 1645 so getting the observations written down, they do seem to be slightly unaware of how dangerous a situation this is. Good drs back , everyones gone mute, no-ones volunteering a handover

16.50   G(1)2 1650 doing a resp rate

H(2) 1705 oh they are bringing it to an end

17.10   F(2) 1714 that was interesting, shes out of shot but shes back in vision now, but she was very clear about what was happening, shes corrected the others put them back on track, moved on.

F(2) 1730 that means she cant see the monitor, I hadn't quite picked up on that but shes asking the others for information on heart rate and sats, that's appropriate, hasn't mentioned respiratory rate mind but she was watching quite closely when she was at the bedside

C 1758 So sats of 88, whats the normal parameters please. Theres no oxygen, I cant see if theres oxygen.No recognition of a deteriorating patient. Oh there is oxygen. mmm

G(1)1800 the student is trying to tidy up and sort things out, she was the most confident of them

Table 15:Dialectic for Video 1

Eyetracker troughs	BigSister agreement	Screenshots and commentary
		BS highlighted green (1st or 2nd view), Signifier comments in red
00.30		G(2) 0012 introducing herself well
		G (2) 0027 shes starting to look at the eyeline, shes talking to the patient
		H (1) 0034 nervous approach from all of them, not really introducing themselves particularly well. Uhhh male nurse hand in pocket wouldn't be happy with that, another nurse with hand in pocket
		F(1)0038 Ok shes making all the running at the moment
00.45	√	
		H(1) 0050 receiving multiple instructions
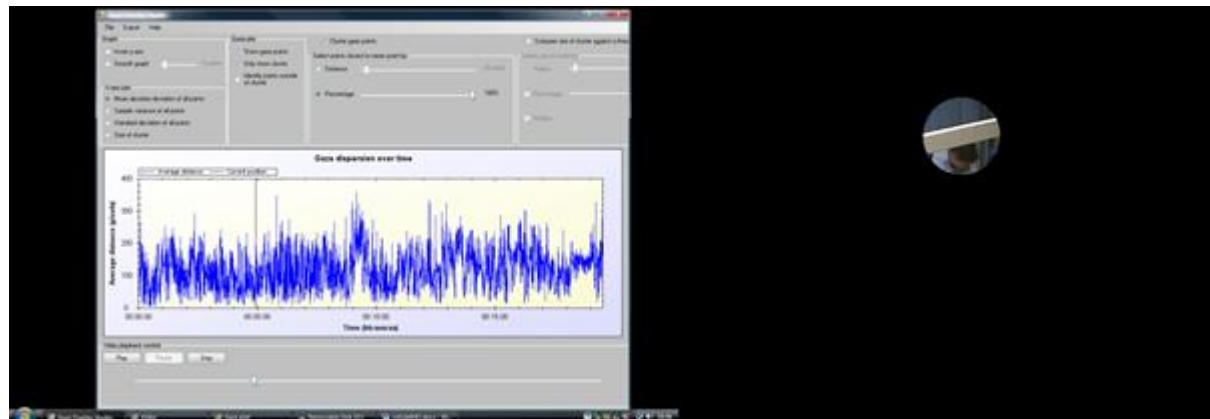
B 0044that's quite good practice

00.55 √ B 0059 unprofessional behaviour, I dont think any of them are really telling the patient what they are doing.

G(2) 0058 he talked to the patient but hes not actually saying what hes doing

F(1)0103 not quite sure what shes doing. This girl here just tried to get her to look at the charts

01.10   √
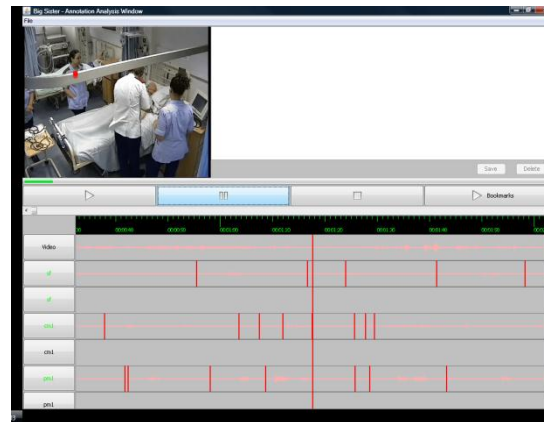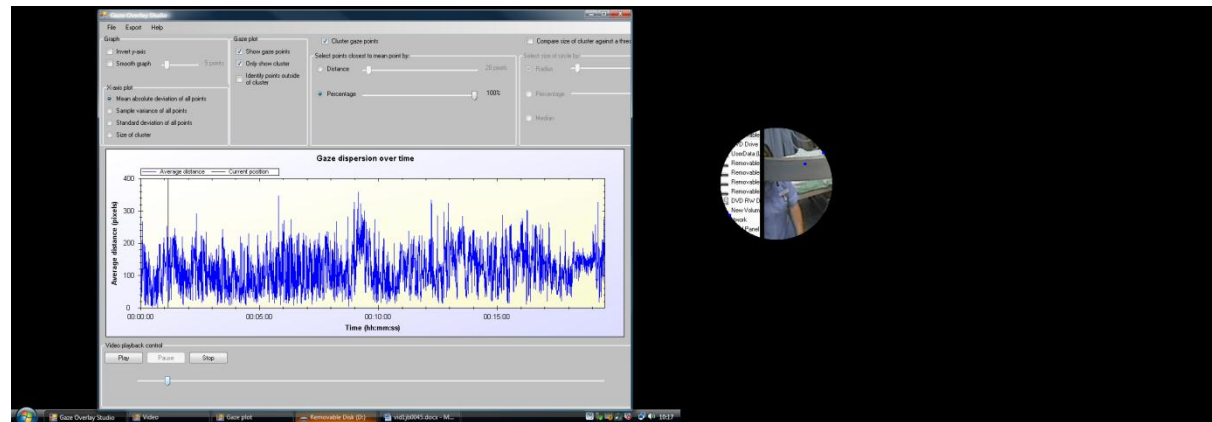
B 0109 Theres mess all over the end of the bed

F(1) 0112 and yet shes not taking any interest in what shes discussing. She just looks like shes hanging back watching

H(1) 0113 gained consent for the pulse again lass at the back with her hands in her

pockets

E(2) 0116 so I think the one that is speaking now is taking the lead

G(2) 0118 stood with her hands in her pockets, not really doing anything

B 0125 shes gelled her hands so that good behaviour, hes got his hands in and out of his pockets, and touching everything

G(2) 0125 that's good infection control, theyre using the alcohol gel

F(1)0125 something interesting just happened here as well, cos she was making all the running and then hes stepped in to actually do some of the physical assessment

H(1) 0128 not quite sure what the rest of them are actually doing

H(1) 0136 there doesn't seem to be any oh was pleased that she cleaned her hands after touching the notes. But don't see any evidence of any of the others cleaning their hands

D 0137 I don't like the way shes stood back with her hands in her pockets

01.50   √
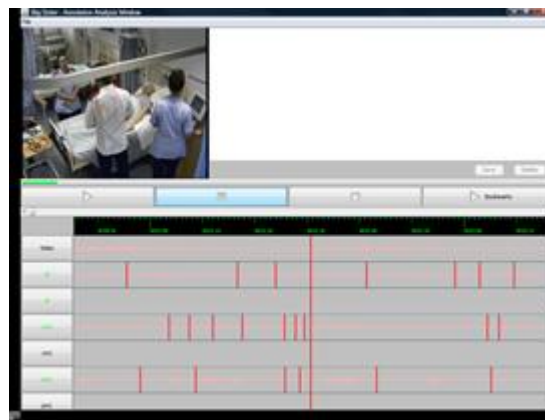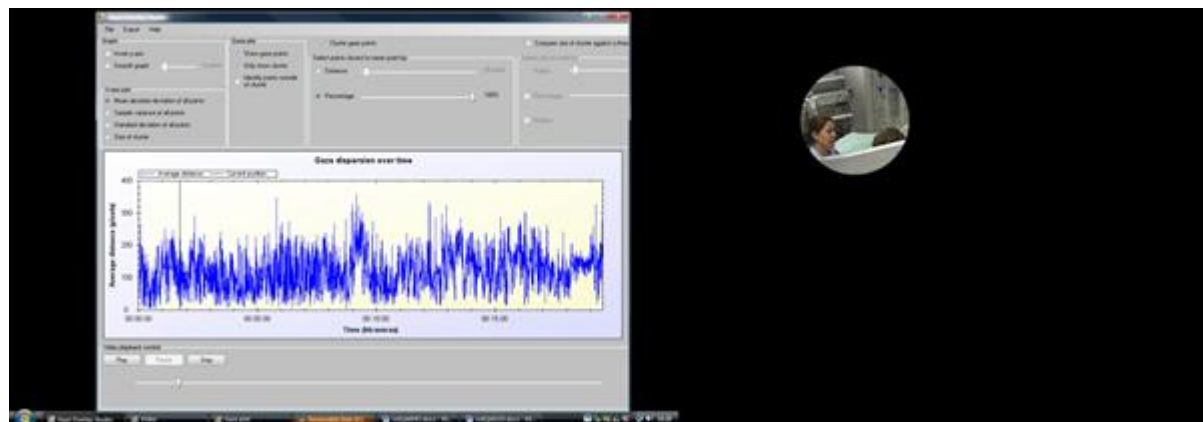
G(2) 0144 shes the one talking to the patient even though shes not near

B 0145 that wasn't much of an explanation

D 0156 hes picked up on it being irregular

H(1) 0157 he really needs to leave his pockets alone

E(2) 0200 so two of the four haven't umm ummm started doing anything yet. I havent seen them look at the notes or look at , not looking at the patient

G(2) 0200 shes told the person what shes doing

H(1) 0203 didn't feedback to the patient that he was happy and didn't feedback to the nurse

F(1) 0205 that's interesting shes been spending some time hanging back just looking at the charts and shes now gone to check the catheter , so theres something going through her mind

G(2) 0205 and shes looking at the catheter bag but shes not telling anyone what shes doing

B 0208 shes twiddling with the patients bed and she's not told the patient why shes doing that, in fact all of them around the patient like that is probably quite overwhelming if it was a real patient

H(1) 0210 no-one is addressing the patients main concern which is that she wants a cup of tea

G(2) 0210 stood with her hands in her pockets all the time

02.30   √   F(1) 0219 its not a structured assessment but shes zoned in on something

H(1) 0220 could have asked about the blood pressure in a more professional way, explained why. There has been no explanation as to why they are doing any of this to the patient really

F(1) 0227 OK so it's the catheter

G(2) 0230 so now shes talking to the patient

D 0237 whats shes doing there, shes investigating something, presumably catheter bag

B 0240 well the curtains aren't particularly round all the way

H(1) 0245 again gave some explanation as to what they were doing but not why theyre doing

B 0248 good to chat to the patient

G(2) 0252 talking to the patient and putting it into context

03.10 √
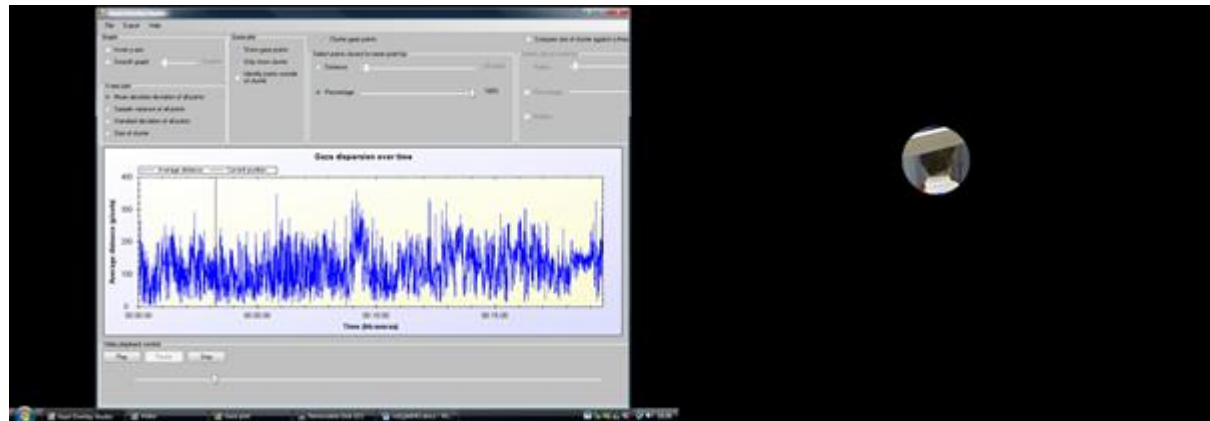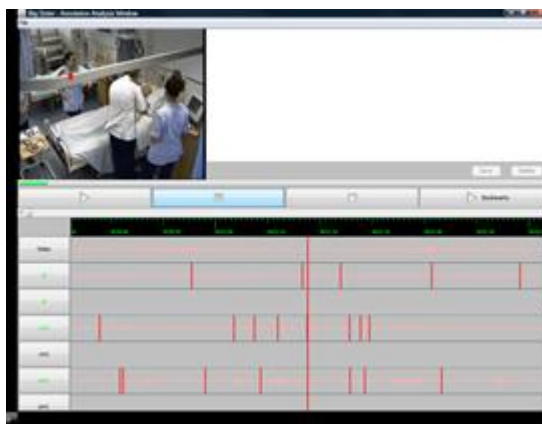
F(1)0256 shes quite interesting now , because shes been standing back and shes just absorbed a pattern, looking at charts and things and shes zoning in on, that patients been to theatre, the validation is that she may have fluid balance problems, whereas the other weren't really zoning in on a problem

B 0304 I don't know what shes doing under those sheets and I don't think the

patient would know

E(2) 0310 so the one girl seems to be taking the lead, and two of the still aren't really doing anything. One has got her hands in her pockets

H(1) 0318 again the nurse has her hands underneath that cover but shes not wearing any gloves

H(1)0333 theyre rotating round the patient which could make them very confused with so many people engaging with them

03.20   F(1) 0318 on the other hand this girl is now steering it back towards something like a structured, I don't know ABCDE head to toe kind of assessment, going back taking capillary refill

D 0320 she seems to be asking the right questions about the patient   and how shes feeling, shes doing those other little things that we do to get ???

03.30   F(1) 0335 I like the way that they've attempted to maintain her dignity by obviously drawing the curtains. That should be a natural response

03.40   √   G(2) 0340 shes touching the patient whilst shes talking to her so she knows where she is

B 0343 is the dynamap going on the same hand that she pricked the finger on?

H(1) 0350 I wouldn't be happy with the way they are stood there again with their

hands in their pockets, just staring at the patient

B 0350 and there was no warning that that dynamap was going to go

G(2) 0350 thinking about what shes doing it seems

04.10   √
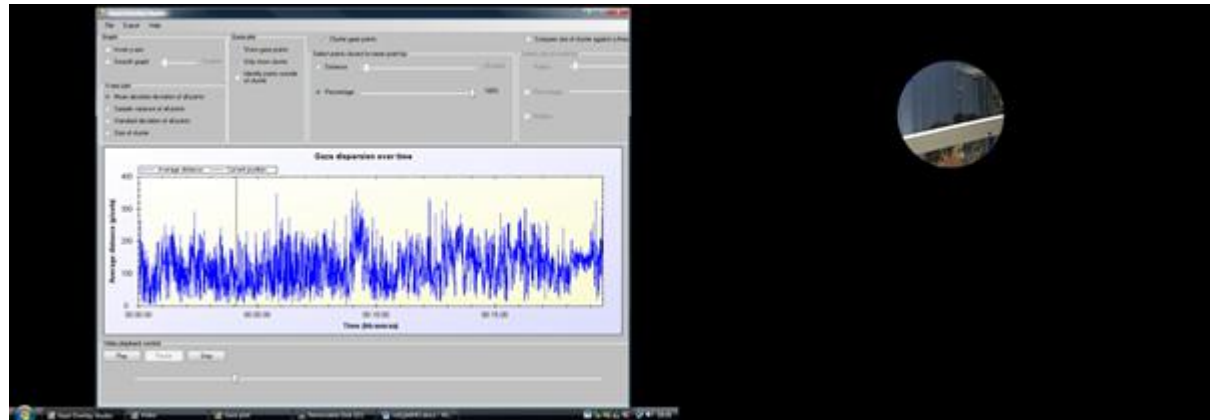
B 0400 how is she supposed to hear the chest when that's blowing up, theres no way you could hear someones breathing over that dynamap

H(1) 0400 not explaining why shes doing that procedure and still not addressing the tea, nice manner though

D 0406 this student seems to be doing a lot more of the assessment, she seems to be redoing the breathing

E(2) 0407 so at this point 3 of the students are getting involved

B 0415 none of them have got aprons on, only one of them has gelled their hands

in

E(2) 0417 the one with the glasses on doesn't seem very sure of herself

F (1)0417 this girl, she started getting her own idea if what the problems were, now shes doing a relatively structured assessment of her own, going to assess breathing, shes not commubicating like the rest of the team but I get the sense that she does know what shes doing

04.25

E(2) 0420 good practice this she continues to talk to the patient, which they are doing and reassuring her

H(1) 0427 its not clear to me the order of what they are doing, which means it cant be clear to the patient

F(1) 0436 the rest are just a little bit unstructured and this girl here who was the initial initial contact for the patient seems to be making very little contribution here

04.50
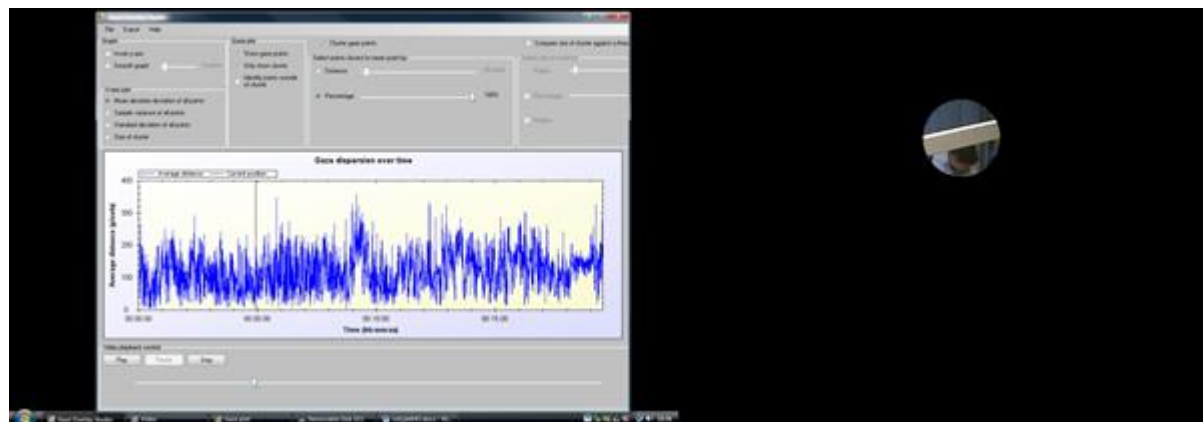
H(1) 0444 again no use of gloves, no proper hand washing technique

B 0450 this lass seems to come over as if she knows what she is doing , she has checked the notes she does the appropriate things, shes using a stethoscope, which seems to be appropriate because she cant sit the patient forward umm apart form the fact that she tried to listen to the patients chest while the dynamap was blowing up which … probably .. and

G(2) 0450 good shes maintaining dignity while she is listening to her patients chest

H(1) 0505 I would also question where the nurse is actually listening to that chest, they haven't closed the curtain, but then I don't know whether that is limited by the video but they should really have gained some privacy

05.25

F(1) 0520 I don't know what these two are talking about, I wish I could pick it up

G(2) 0523 shes further away from the patient but the only one to go back and talk

223

to her when she started to ask questions

F(1)0524 I think the girl that's stood by the screen umm she seems to feel, I don't think she feels that at ease with doing the simulation. If I was her mentor I would probably get her involved in umm taking a bay, obviously with,   talking through about what she would do with patients, if they were her patients maybe start with thinking about it on her own getting her to think about what others are doing, and the moment she seems to be happy that they are doing them work. She needs more work intensively just because shes

H(1) 0530 again not reporting back to the patient just immediately whispering back to their colleagues. She sounds as though shes alright, Id be satisfied with the response

05.35   G(2)0538 doesn't seem to be getting involved , standing back all the time

F(1) 0548 not quite sure how she got to that, I think she may be having a discussion with this guy that I couldn't pick up but they have obviously reached some sort of conclusion about her cardiac status or her heart, something has led them to that ECG

05.55   H(1) 0600 Ok better explanation, very limited use of the hand gel

G(2) 0600 seems to be the one leading things, being asked questions by the others

06.10
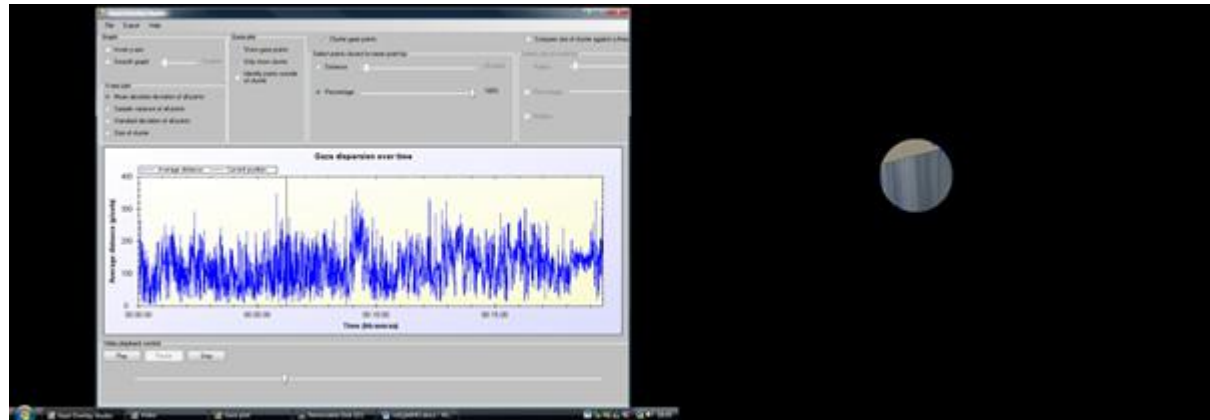
B 0610 I think the overall thing is that they don't appear to be working very well as a team, its all a bit mishap, ill do this and you;ll do that and youll do the other. Nobodies really, apart from perhaps that lady whos taken the lead it seems , you know

H(1) 0615 again no privacy having electrodes on your chest need to pull the curtains round, and you'd also need to ask whether they were happy to have so many people present while that was happeneing, Theres a lot of stood staring looking at what the person is doing, although I do accept that it's a mannequin

F(1) 0620 then again shes now, looks like shes doing a respiratory rate to me, its not stepped back but shes doing something

06.30   √
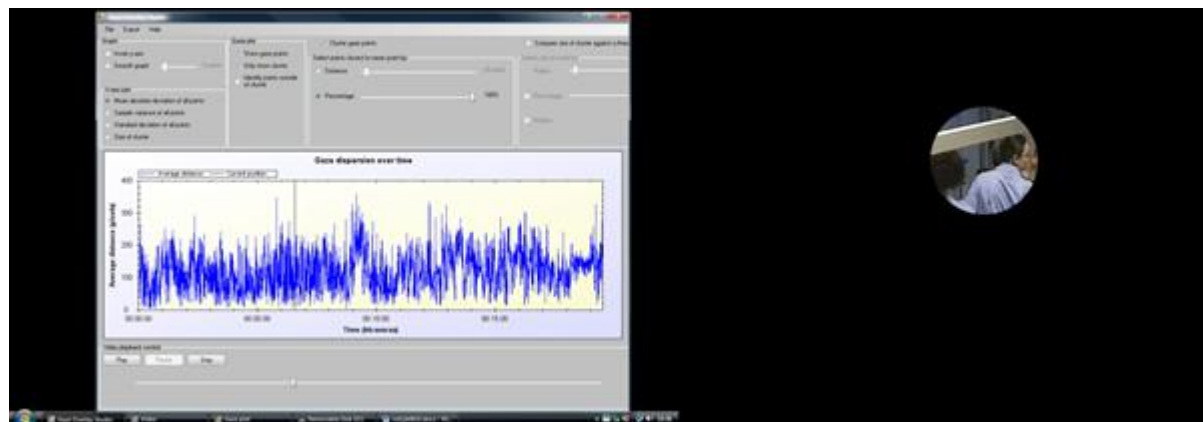
E(2)0630 If I was her mentor I would start to show her a thorough assessment to kind of let her see how and why things happen

F(1) 0630 whereas this girl just doesn't look particularly involved at the moment

G(2) 0635 giving good information to the patient

06.40
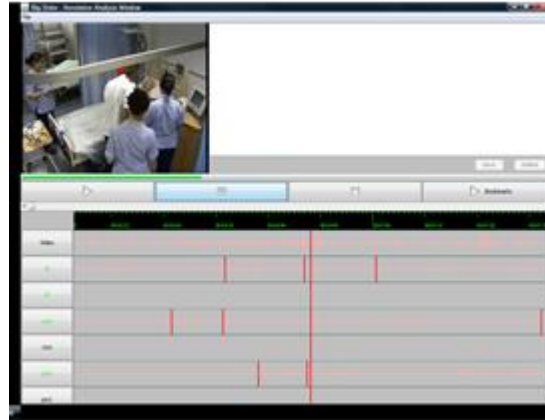
B 0640 shes touching her hair and all sorts of things

06.50

H(1)0650 that could have caused some anxiety, a bit of a better explanation, it's a bit irregular we'll get the dr

B 0650 your squeezing it on the same finger you've got a dynamap on . I think ive just fallen that that's not the blood pressure machine it's the simman that's pumping up, but you still shouldn't be doing it on the same arm

G(2) 0650 repeating what another student has already done

07.10

G(2) 0705 appears to be making up information

B 0710 the patients obviously really thirsty, well nobodys offered her any sort of mouth care or anything else like that, theyre all too busy looking at the screens, taking things up in , technical things

E(2) 0715 theres continuous communication with the patient and they have identified that a dr is needed, so its just down to one of them to decide now, whos

going to get the dr

G(2) 0716 they are all ignoring the patient now

07.20

H(1) 0720 again no use of hand gel, no explanation of why they are doing that, no reassurance either to the patient, not feeding it well back to the team, that was a significant finding

B 0728 they're concentrating on her peripheral circulation , has anybody actually checked to see what her legs are like

F(1)0735 shes just looking completely lost, all the others are having discussions, either between two at a time, or theyre , well theyre thinking about whats going on and this girl just doesn't look like shes doing anything particularly

07.40   √
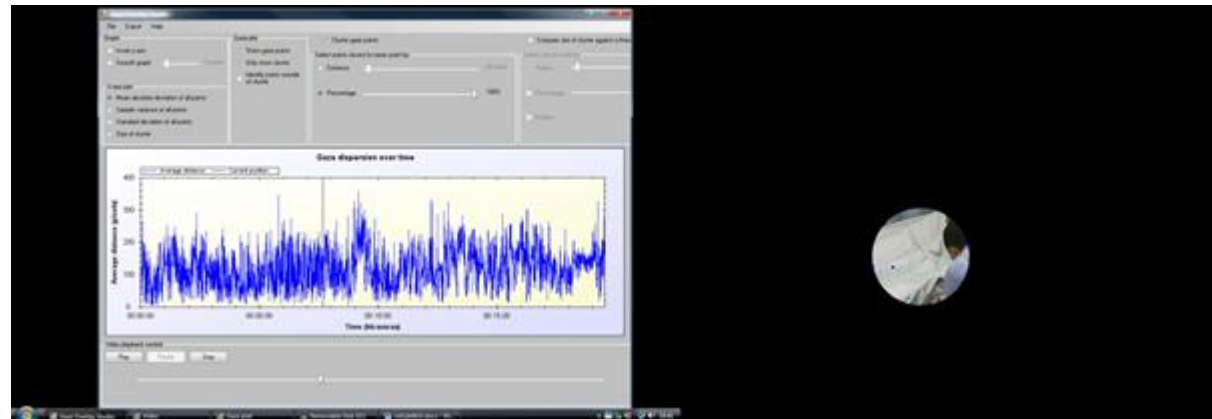
H(1)0743 theyre not communicating well with each other which means that theyre not getting the overall picture just small elements of it

G(2)0745 seems to be the first thing shes done

E(2) 0755 nobody responded to her request for a cup of tea

08.10

F(1) 0810 so the guy I can hear now on the phone to the dr has actually presented a very succinct set of information really

G(2) 0815 so the students just told the dr capillary refill is over 4 seconds and he said it was 4 when he was at the bedside

E(2) 0817 I assuming that the chap has gone to go and get the dr

B 0818 oh there, theres no mention about there being no oxygen

08.30   √

G(2) 0830 so again she is being proactive and actually doing what shes been asked

F(1) 0830 there was something about the way he said is she bleeding , its umm, confidence that that's obvious that that was something they should have looked for, but not apologising for not having done, and it makes you th.. , its very subtle but it makes you think, gives you some confidence that the guy does understand things

B 0835 You see, she hasn't gelled her hands, hasn't put the screens round, unless the screens are supposed to be around

G(2) 0840 she seems to keep moving out the way and not actually doing anything

H(1) 0843 that was inappropriate to shout across the ward about the wound site. They need to use a more structured communication tool

D 0855 shes pushed the other student out of the way there, she wanted to get there and shes not doing anything

08.50

E(2) 0846 hes saying all the right things he gave a bit of a history of the patient, so the dr knows why they are in hospital

G(2) 0848 he seems to be doing a lot of 'abouts' rather than having the information

H(1) 0854 again patients complaining of chest pain

B 0900 pain assessment done, so what is she going to do with the responding

H(1) 0905 everyone has gone to interact with her at the same time

E(2) 0916 they are a few minutes in to the simulation now and nobody has checked the wound, so presumably with the history of why she came in to hospital, they should have known there was a wound which they should have looked at when they did her initial assessment

H(1) 0917 I just want one of them to clean their hands please

G(2) 0920 shes stood nearest to the patient but shes still not actually doing anything, talking to her, reassuring her

H(1)0930 Im glad that they are communicating these observations but Im not happy about the way that they are doing it

D 0930 yes patients normally hypertensive

G(2) 0940 shes now talking to the patient touching her at the same time

09.50   √
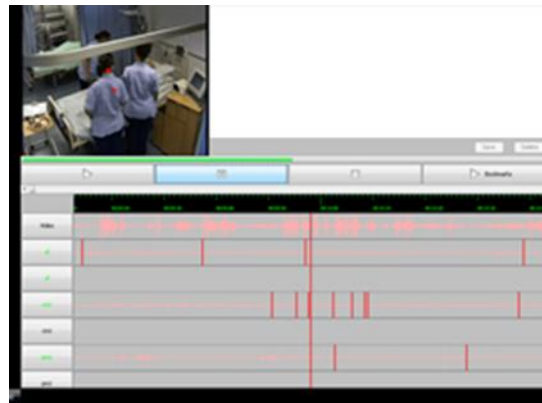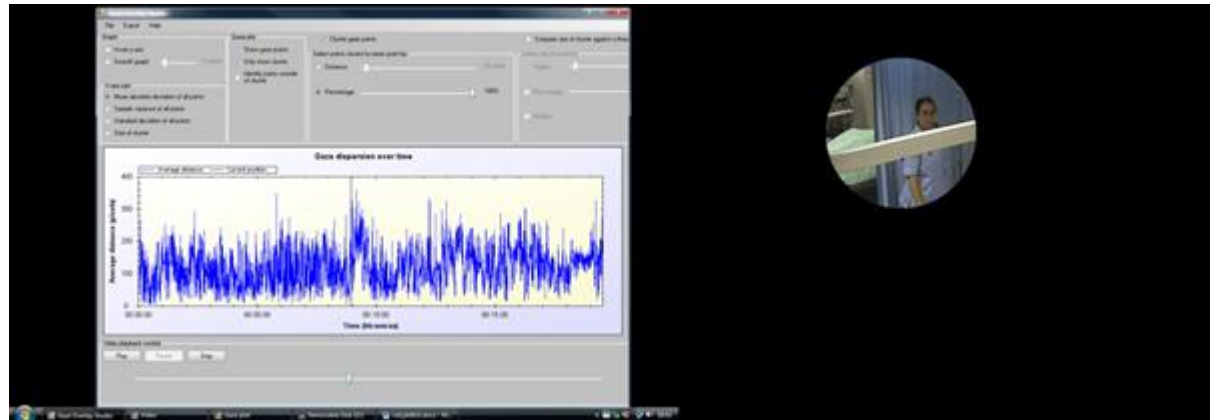
F(1) 0950 that's interesting, this girl just had a chat with the girl whos off screen at the moment and I don't know if she was the one whos picked up about the chest pain or whether it was her, I just cant quite hear what shes saying to work out what contribution shes making but again theres a very swift decision, on this girls part to move this forward so that the guy on the phone can pass on the information
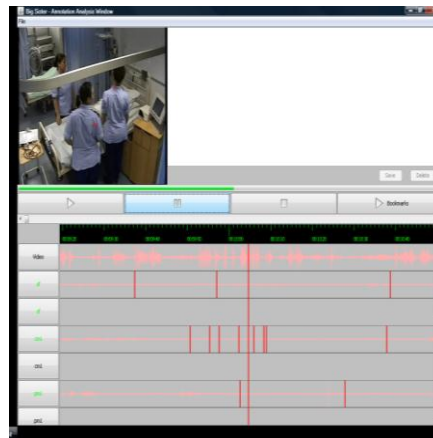
G(2) 1000 giving good clear information

E(2) 1001 that girl still isn't doing much

H(1) 1005 they could have communicated about the chest pain quicker, but that's a result of not talking to each other properly ???

B1008 not mentioning no she shoudnt

10.15 √

E(2)1025 ????

H(1) 1031 they need to be escalating this ??? 100% oxygen??? Given the nod?

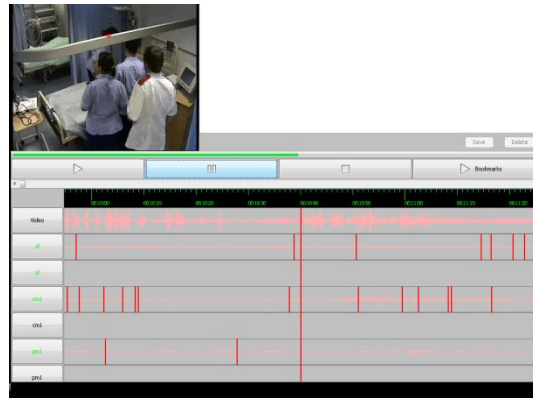E(2) 1032 so these two that are left should be doing an ECG now

B 1035 nobody has assessed her neuro level

F(1) 1040 that was quite good as well, theres that approaching the patient making it sound umm reassuring even when whilst shes putting. Its clearly an emergency and her approach to the patient was really quite reassuring

10.50   √
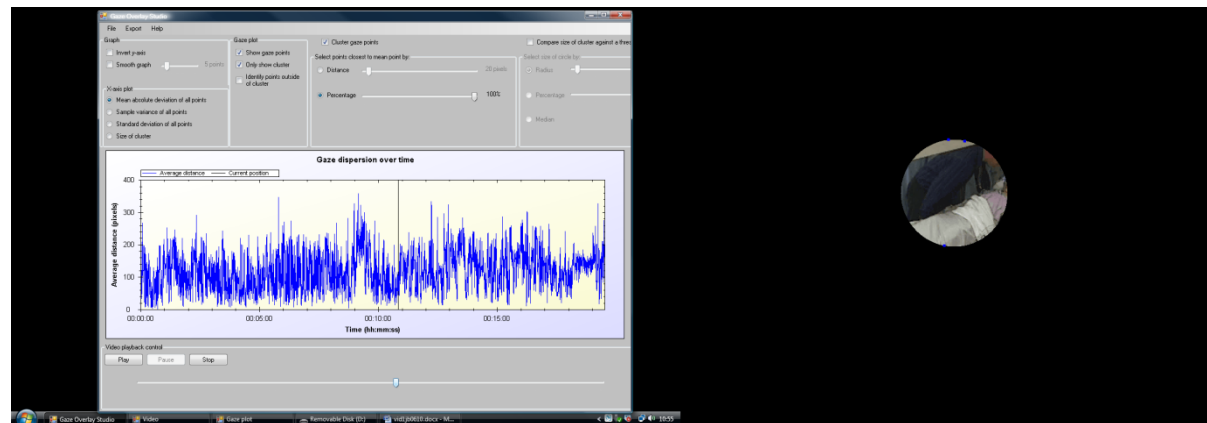
E(2) 1044 if they were???

G(2) 1045 again shes giving information

H(1) 1052 I accept that this is a training exercise but laughing out loud in front of the patient is completely inappropriate

G(2)1055 doesn't seem to know what shes doing shes a bit lost

D 1058???

F(1) 1105 again shes making very little contribution, I cant see what shes doing

11.20 √
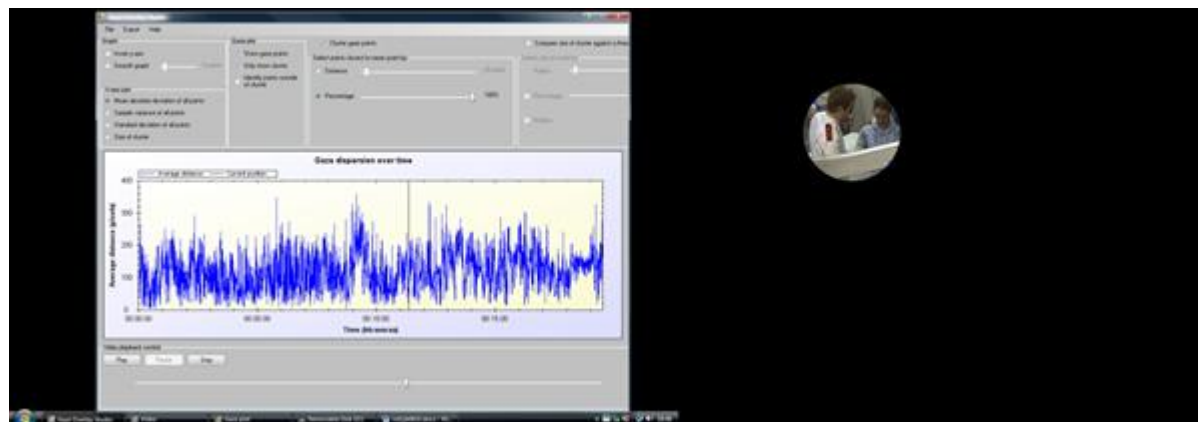
E(2) 1139 ????

B 1130 I don't know what theyre faffing about at, but that should have been done already

G(2) 1120 positioned herself well, moving equipment out of the way to give more space and now hes helping out shes recognised she needs some help with that

F(1) 1113 I like that I didn't hear anybody ask for that trolley, that's anticipating, bringing equipment. Shes still trying to troubleshoot the oxygen by the looks of it

11.50 H(1) 1143, obvious confusion about the oxygen mask

H(1) 1156 making the dr clean his hands would have been even better

F(1) 1208 I cant see what shes actually doing now but she is doing something, is she holding the patients hand, I cant see if shes talking to the patient, she looks
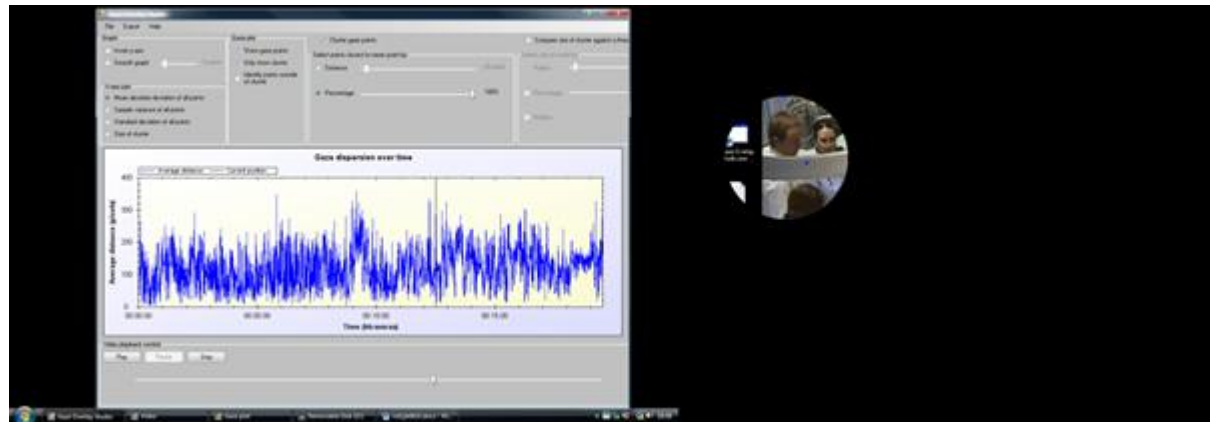
like shes paying some attention

G(2) 1212 not sure what shes doing but it seems to be that shes reassuring the patient with touch

D 1220 the one by the resus trolley is staying quite calm

12.30 √

E(2)1233???

H(1) 1224 jobs need to be assigned, there needs to be more nurse leadership here, someone needs to take charge

12.40 √ F(1) 1240 shes been concentrating getting the equipment together which was won,,,,, whereas just a moment ago these two were both looking at the monitor and they just took that step back they were obviously trying to make sense of what was going on essentially

B 1240 he wants to get that pulse down

D 1250 yep shes given up with the mask

13.10   H(1) 1311 that lass is scratching armpit under uniform and then touching crash trolley

G(2) 1315 shes doing what shes been asked to do straight away. She seems reasonably confident doing it

G(2)1325 good teamwork between these two

13.40   √   H(1)1330 I would need to intervene her, they need more help and support

D 1350 the one at the back shes given something so the other one

G(2) 1350 again she seems lost but she obviously knows where to put the pads

B 1355 seems to know what shes doing

H(1) 1356 again not wearing gloves to draw medication up

F(1) 1358 Ok despite the pressure hes not responding in a way, hes not getting flummoxed hes not fumbling, hes not apologising for what hes not doing, hes just carrying on quite calmly as best he can. Theres something about that that's reassuring, you often get giggling or some thing when students aren't quite trying to play the role

14.10   H(1) 1405 still the curtains are open

D 1406 at least shes explaining it

D 1408 she needs to get those defib pads on but shes stood there holding them

D1410 the other one is still just stood there doing nothing

H(1) 1415 they've put their hands all over the equipment in the crash trolley, having not cleaned them – end stage

14.30   H(1) 1428 no-one has checked that drug with the dr

G(2)1430 good movement of the trolley so that its set up for the dr
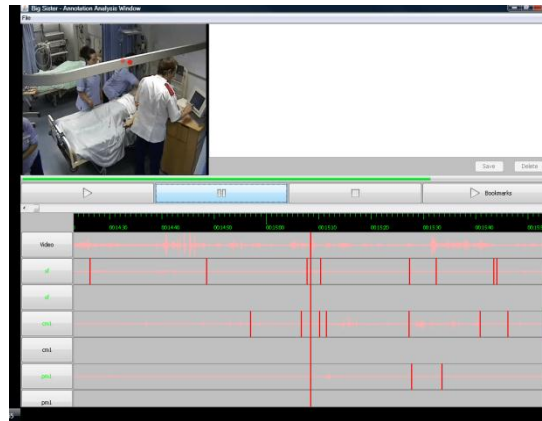
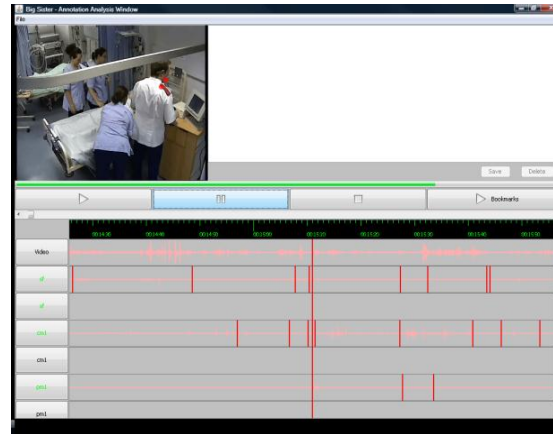14.40   E(2) 1445 Im quite worried about that girl

H(1) 1445 the dr didn't change the needle either, that's a small thing but, is he giving it IM or IV

G(2) 1455 well prepared knows what shes doing

15.00   √

F(1) 1505, just seeing shes anticipated I think, is the oxygen coming off, certainly that's very quick, and the oxygen is going on again without any prompting. Straight on the monitor, this girl is still not making very much of a contribution
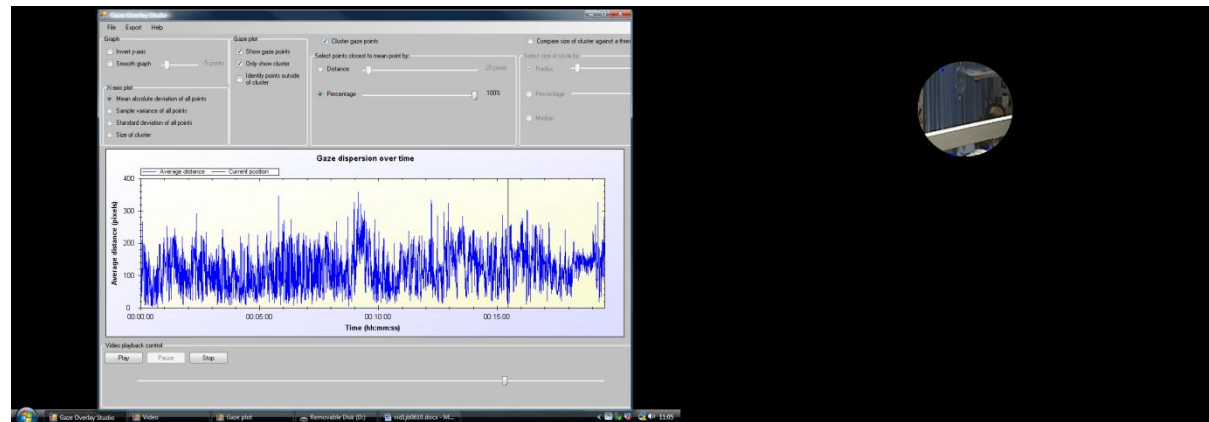
H(1) 1515 this is highly unsafe some of these students are near

G(2) 1515 oh back oxygen on, doing observations

15.30   √

B 1528 I think shes noticed that the airways not that good

G(2) 1530 first time I think shes spoken

B 1534 I think she seems quite competent

H(1) 1534 its alright establishing the history after the event

D 1536 she put the oxygen back on shes doing the obs straight away

F(1) 1538 shes keeping a good eye on the patient and the monitor, is it the monitor, didn't hear what she said but obviously shes got a concern about the airway. He was straight, straight on it, he knew what he was looking for

G(2)1538 staying with the patient, monitoring her

G(2) 1545 some team work between these two

H(1) 1550 good airway management then ?????

240

F(1) 1601 just his movements are telling me hes appreciating the urgency

16.10   √   H(1) 1605 theres an awful lot going on here, they need anaesthetic support

G(2) 1607 taking the pillow away which is good to see

F(1) 1612 I like that he dropped the pillow on the floor, this girl shes got a really interesting role

G(2)1615 Making the environment safe which is good to see

E(2) 1616 the sats are dropping and shes not breathing well. They've managed to get her head back now

G(2) 1620 done it again

F(1) 1620 shes picking up around the edges shes done this a lot shes doing things like taking the pillow off him, shes facilitating the rest of the team, shes aware of what is going on, she understands whats going on but shes supporting these two guys who are the lead players. Shes just not communicating as much about it as she could do

H(1) 1626 it was unclear what was going on in the conversation between the dr and the other nurses that wasn't actually articulated to the ones actually working with the patient sorting out the airway
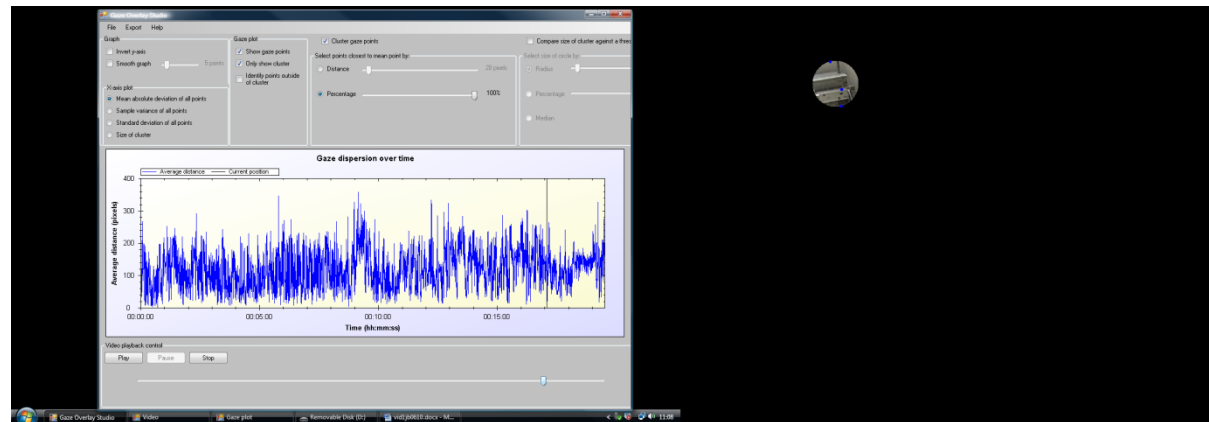
D 1625 shes clearing up after the others, taking things off the floor

E(2) 1648 before the dr left they should have asked for a plan, I suppose the next stage would be specialist care

F(1) 1648 I like her focus on the patient. Standing there looking down on the patient staying very close to the patient

17.00   √

G(2)1700 shes moving around well to keep out the way, but not too far

D 1701 the one by the monitor, she paying attention shes aware of the whole thing

E(2) 1705 I worried about this girls ability

B 1708 I cant believe they don't know

G(2)1708 staying with the airway

F(1) 1715 it's the big picture. That's what reassuring about her shes.. that's where she started she started looking at the charts and the notes, she made sense of what was going on whilst other people were assessing the patient. Shes the one that then presents that back at the end, as if to say this is where were at

D 1726 the one on the other side of the bed, shes not really been involved and she hasn't been looking at the patient or the monitor or anything, her head movements the whole way through seemed to be random really. She hasn't seemed to be assessing the patient in the same way that the others are

B 1730 that s good choice but that's not her decision to make

G(2)1730 none of them are talking to the patient. Keeps looking to everyone else to make decisions and say things
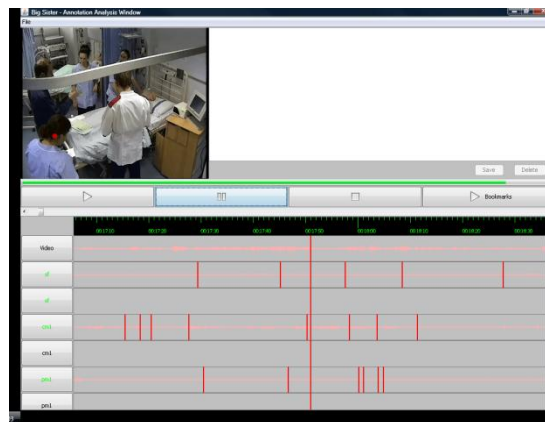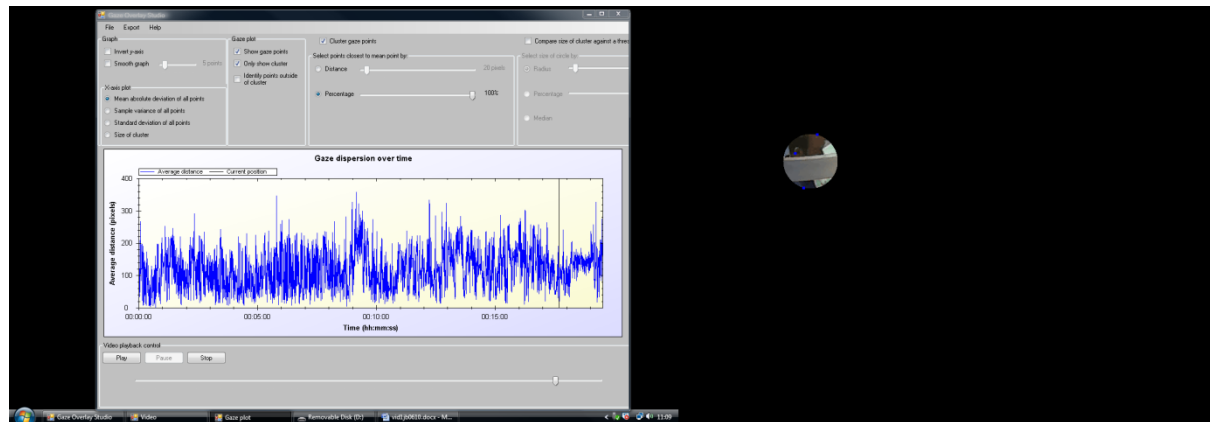
17.50   √

B 1745 good that shes writing it down

H(1) 1748 its kind of strange to see the disengaged way they are discussing the case in front of the patient

G(2) 1750 making notes as she keeps everybody on track

F(1) 1750 again shes not even being addressed but shes the one that's writing all this down

H(1)1757 hes not writing any of this down

18.00   √   B 1800 this girl and this girl seem to know what they are doing, him Im not sure. She also needs some gases doing but has anyone mentioned that

F(1)1802 good ideas

E(2) 1802 and now they are stating to think about what might have caused this in the first place ????

G(2) 1805 good suggestions to the drs

F(1) 1805 again just the fact that shes asking questions about things like electrolytes tells you quite a lot that she understands what might be going on

D 1808 writing down the instructions

G(2) 1815 repeating back information which is good to hear

G(2) 1825 good information and thinking

D 1831 she said it back to him to check that she was correct

B 1850 that's a good point

G(2) 1850 good questions

F(1) 1855 OK again it might be a simulation setting but.....   its also appropriate stuff

19.10   H(1) 1919 was that sort of a handover. someone was accepting instructions and somebody else was writing it down

Table 16: Dialectic for Video 2

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