United Kingdom Radiological Congress 2014, Manchester

# The impact of hybrid imaging technology on the nuclear medicine workforce: Understanding practitioners' learning and development

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# Professional Doctorate: Research aim

Analyse the potential cultural changes and emerging social meanings within the nuclear medicine workforce, following the introduction of new hybrid imaging technology and the subsequent development of new professional identities and order within the health care environment

# Sub-questions:

- Does the introduction of new hybrid imaging technology influence the delivery of clinical practice in nuclear medicine?

- How does new hybrid imaging technology impact on the professional development of the nuclear medicine workforce?

- What are the associated training and educational challenges of incorporating new technologies specifically within hybrid imaging workforce?

# Research Background

- Analysis of the introduction of new technologies within the hybrid imaging workforce
- Use of organisational ethnography to analyse working cultures social meanings within a number of clinical departments
  - Overt observation and participation
  - Interviews
  - Participant blogs
- Emergence of new professional identities and potential need for future education / training requirements

# Why Organisational Ethnography?
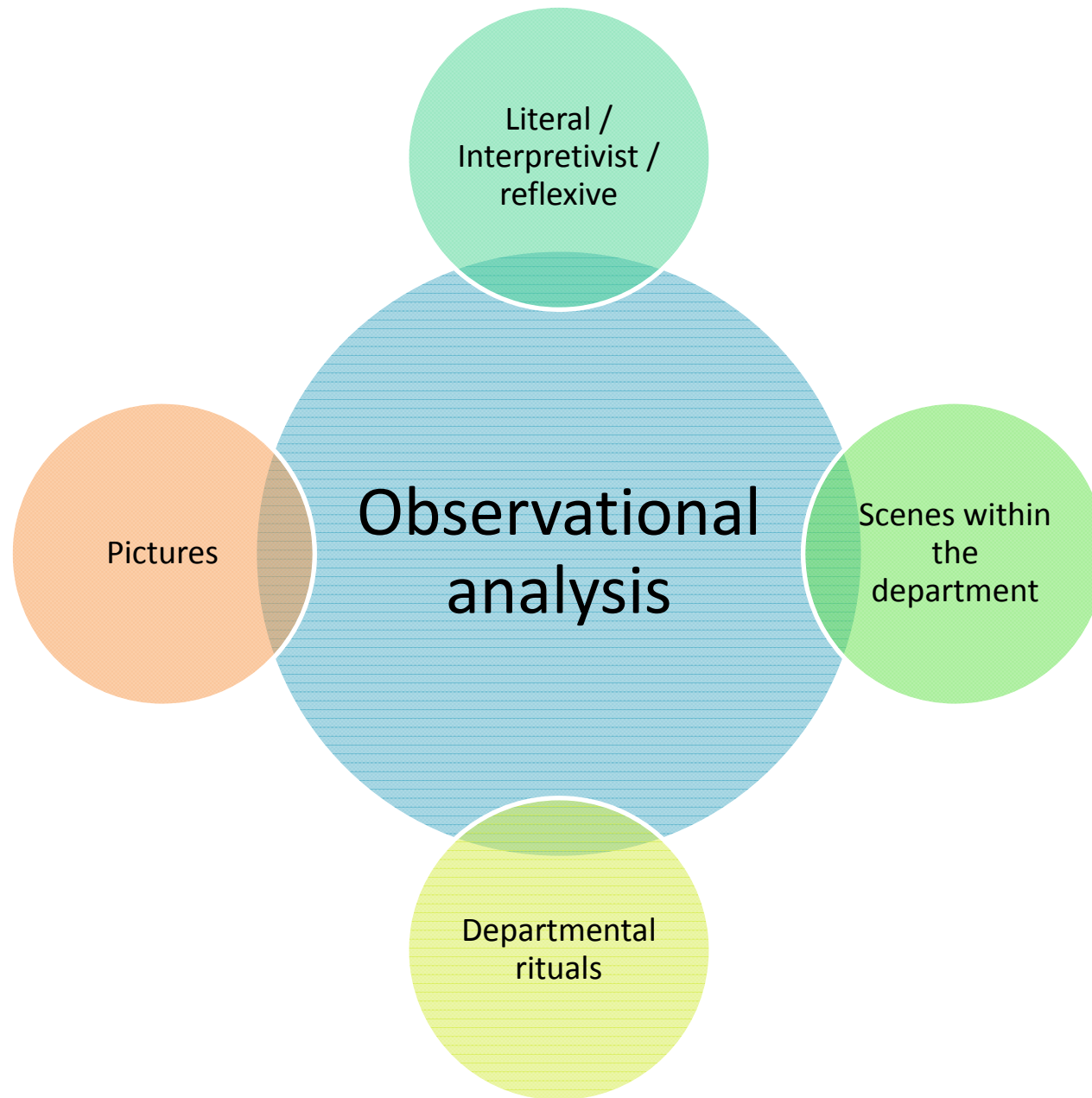
# Ethical considerations

- Integrated Research Application System (IRAS) utilised for ethical approval
- Site Specific Information (SSI) R&D approval
- Multi-site research study (3 sites)
- Honorary contracts obtained at each clinical site
  - Participant observer role adopted
- Consent gained from research participants
- Typical data protection procedures in place
- Purposive sample
- Gaining membership / trust

# Nuclear Medicine Community

- Traditionally perform physiological imaging techniques

- Work within defined protocols, adopting a Gemeinschaft style practice

- Highly skilled & competent practitioners (Griffiths et al., 2010)

- Some level of advanced practice & reflection (Griffiths 2009; Griffiths et al., 2011)

- Some level of mentorship present (Dawson et al., 2009)

# Morphing the environment

# Changing physical environment: Introducing CT

# New identity

# Reliance on technology?

- Electronic Personal Dosemeters – monitoring
- Environmental monitoring
- Pre-set protocols / workflows
- Start / Pause / Finish approach to working practice
- Push / pull of patient data
- Hidden identities of workforce

# Environmental considerations



Nuclear Medicine Department
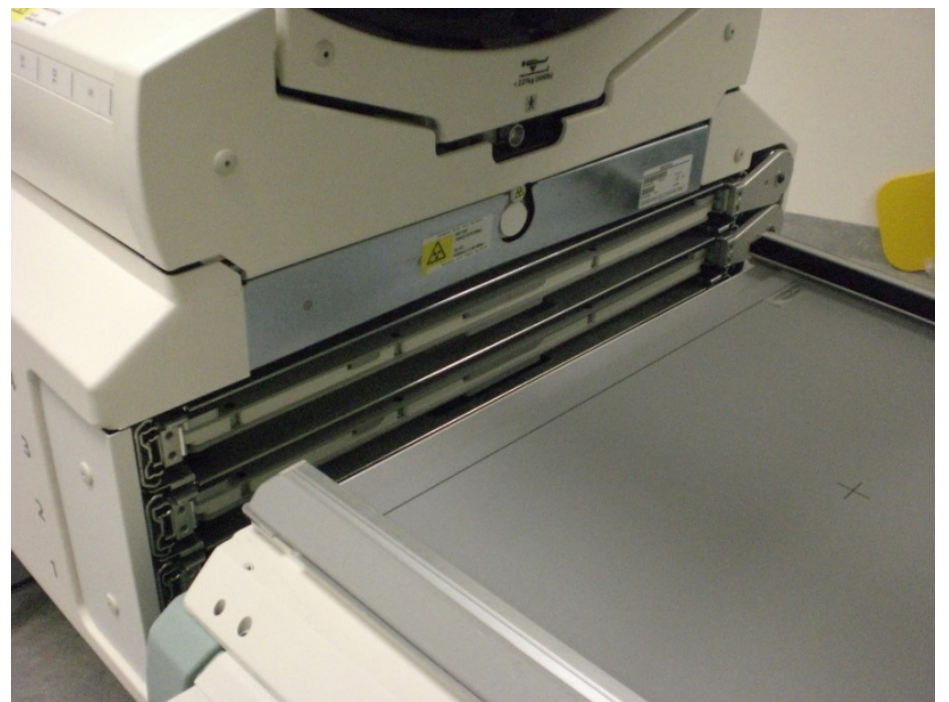
Symbia T
SPECT CT Gamma
Camera
Control Room
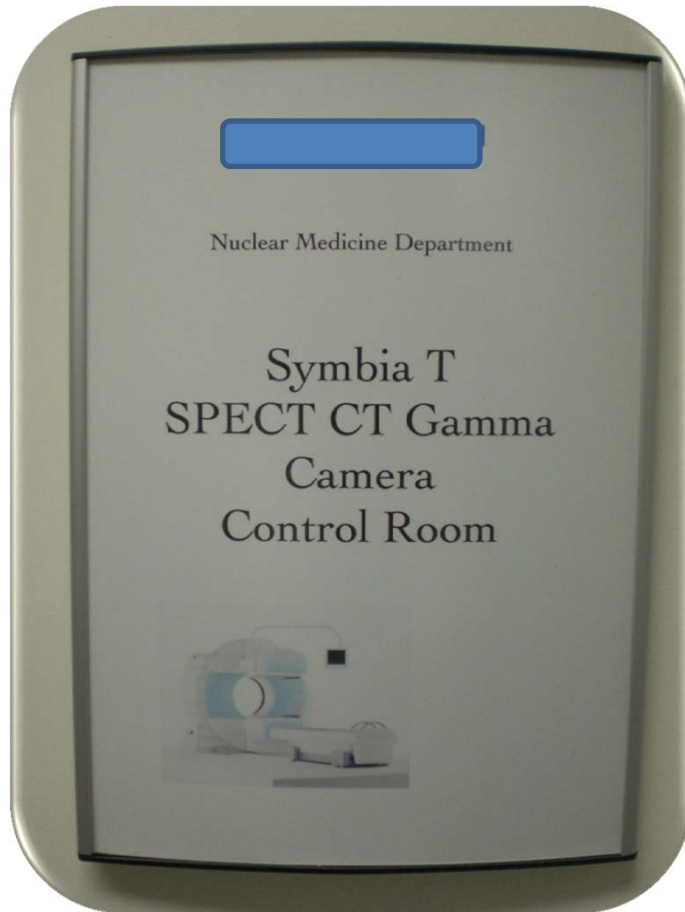
- Noise within the clinical imaging room (air conditioning for CT unit)
- Physical barrier introduced
- Emergence of additional workstations
- New language and imaging protocols
  - *"Draw up the juice"*
  - *"Punch the tube"*
  - *"How many clicks?"*
  - *"Pend, suspend, activate, archive"*
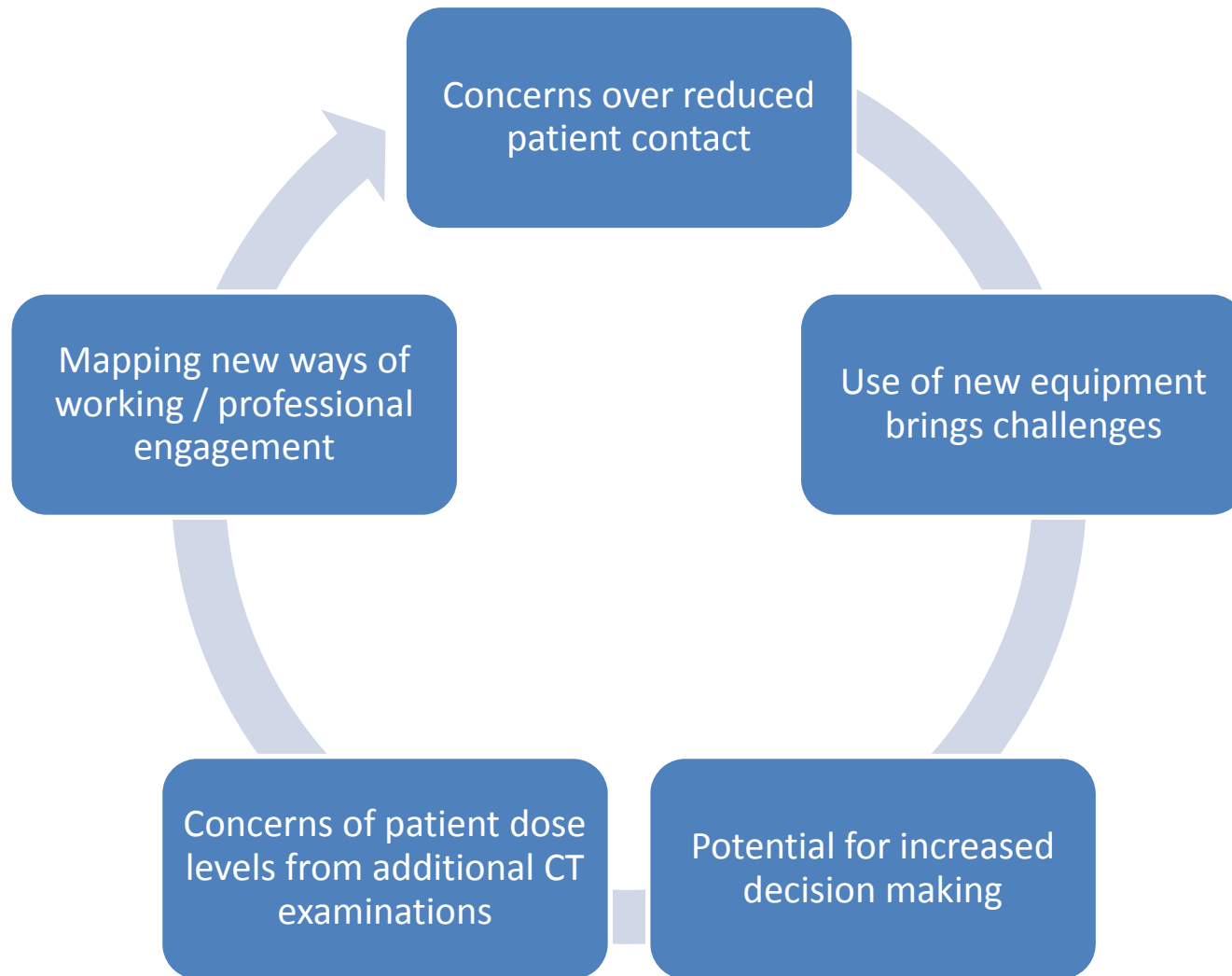- New radiation monitoring requirements

# Shop front

# Automation

# Observational analysis: Main Points

# Interview data: Thematic analysis

- Braun and Clarke's (2006) thematic analysis utilised

- Categories created, which in turn created themes

- Several key themes identified within the interviews

- All themes relates to research aim and objectives

# Themes

- Change in working practice, the environment and emerging clinical practice
- Role development / innovative practice and emerging sub-communities
- Role erosion and automation / technological determinism
- Emergence of new professional identity and intercollegiate working
- Need for new professional guidelines and training frameworks to be established
- Occupational shift and domain ownership
- Impact of technology on patients and creating a patient centric approach to hybrid imaging service delivery

# Theme #1:

- Change in working practice, the environment and emerging clinical practice:

  – Change to the flow of patients through the NM department
  – Emerging cultures developing
  – **Rebalancing of existing professional domains / identities**
  –  Appropriate diffusion and adoption of new hybrid technology within the NM community
  – Some evidence of skill mix / team working present
  – **Potential for a 'protocol driven culture' exists**

# Making the best use of new technology



**INVENTION**
The originating idea for a new service or product, or a new way of providing a service
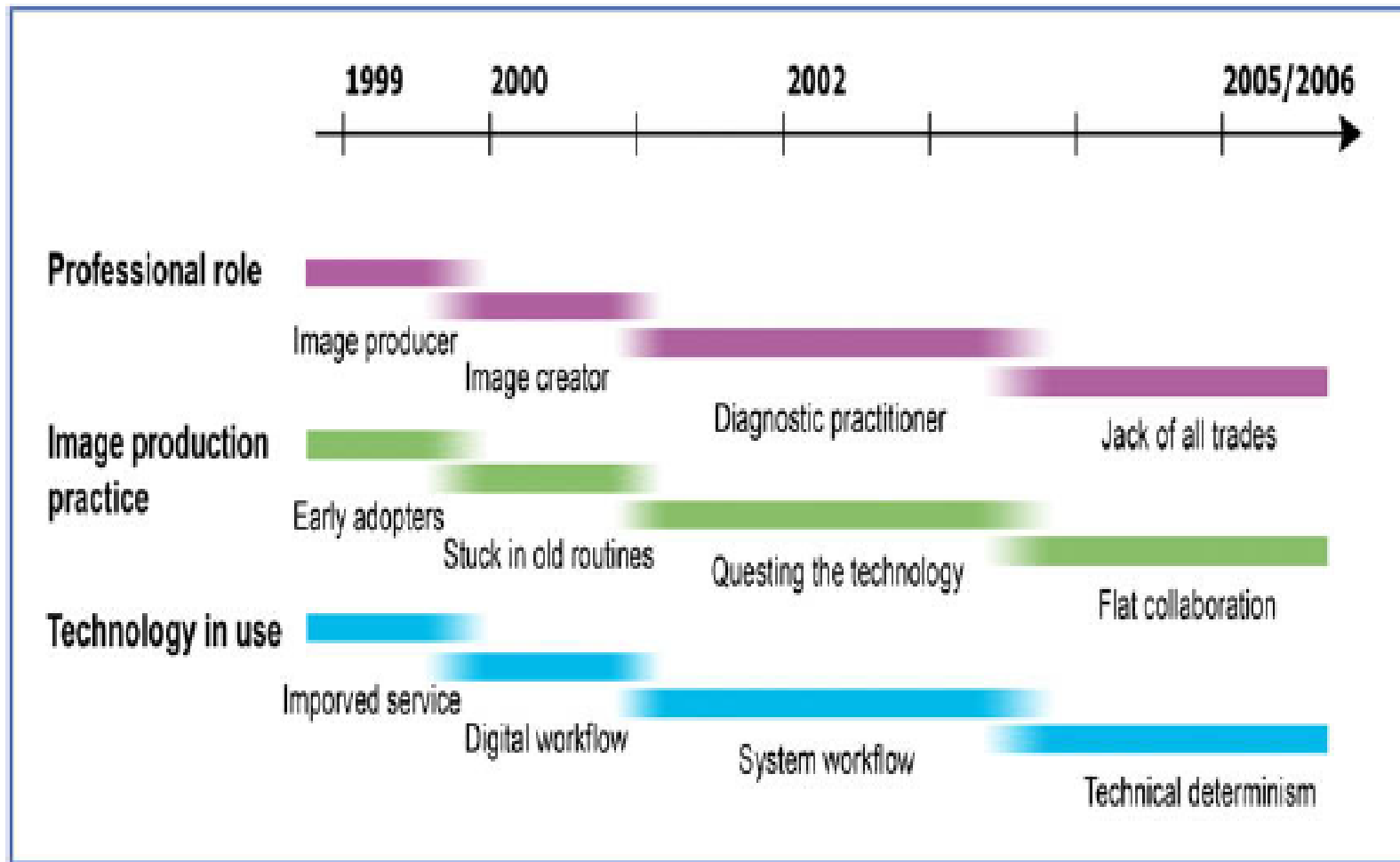
**ADOPTION**
Putting the new idea, product or service into practice, including prototyping, piloting, testing and evaluating its safety and effectiveness

**DIFFUSION**
The systematic uptake of the idea, service or product into widespread use across the whole service.

New equipment

New techniques

New working culture
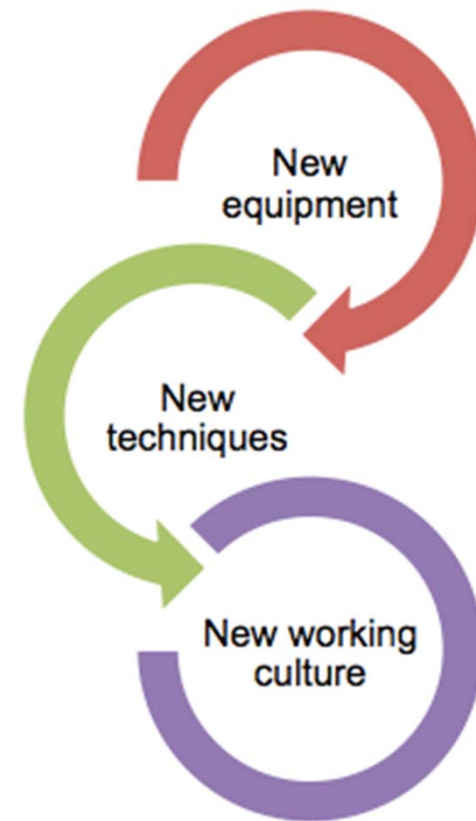
# Impact of technology: Radiography



*Concept map demonstrating the consequences of PACS on radiographers' professional role, image production practice and technology in use (Fridell et al., 2009)*

# Hybrid workflow



Patient preparation → Nuclear Medicine examination → CT Examination → Quality checks → Processing → Storage of data on PACS → Retrieval of data from PACS

Wynn Jones et al., (2013)

Attenuation Correction → Localisation → Diagnostic Registration & clinical reporting → Separate modality functionality

Griffiths, (2014)

# Interview quote: Isolation

'Patients sometimes become intimidated by the hybrid equipment, by the shear size in the machines and you've got your claustrophobic patients, they don't really enjoy the situation but most of them are ok'

# Interview quote: Role development

Interviewer: 'Have the changes from the introduction of hybrid  technology evolved your approach to work differently?'

Participant: 'Definitely, it's made everyone's, before there was a hierarchy within the department but now with this new technology that's come in, everyone's on a even footing to start with because we're all introduced to it at exactly the same time and it's the people who are more enthusiastic, who want to do more, who read more about their way to study more, finding themselves going further forward'

# Technocentric approach?
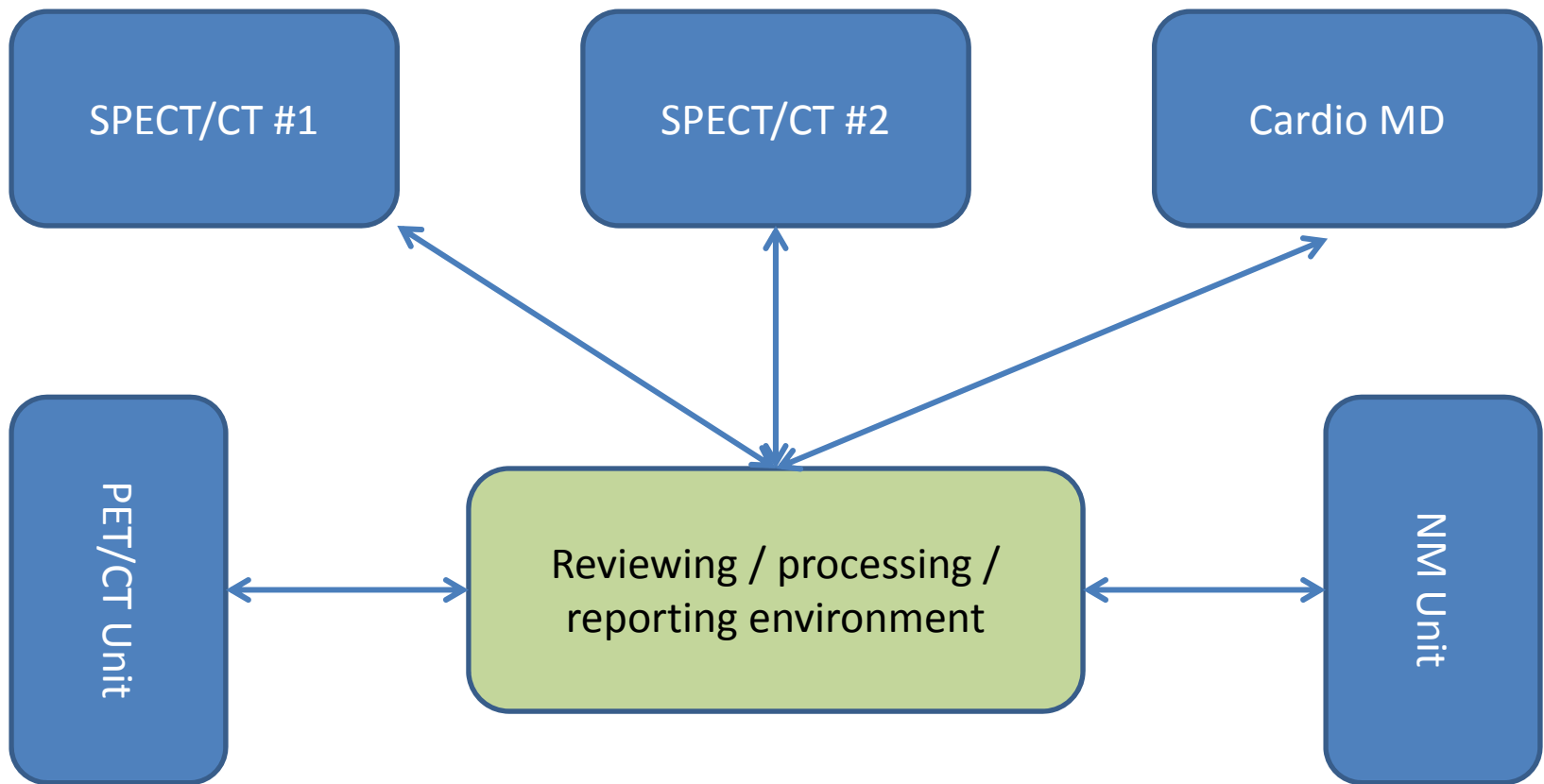
# Theme #2:

- Role development / innovative practice and emerging sub-communities

  - **Evidence of role development exists**
  - Need to reflect on the introduction of the new hybrid imaging technology
  - **Emergence of new patient pathways**
  - Creation of sub-communities – early adopters / cultural lag
  - Lack of collaboration at times
  - **Flat collaboration also present, but limited**

# Cultural Lag
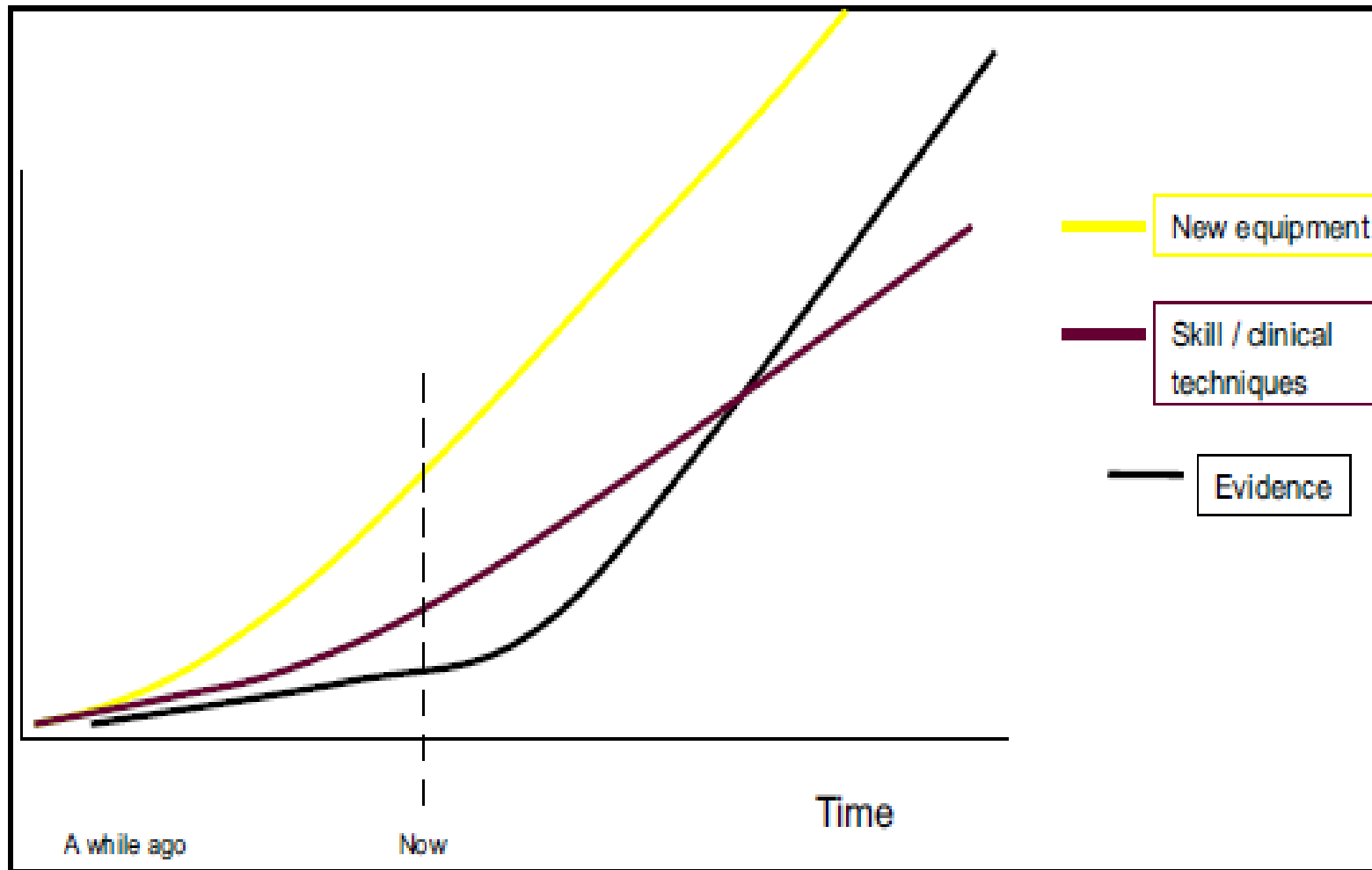


*Projected lag in the development of new skills / techniques following the introduction of new technology (Hogg, 2012)*

# Cultural lag: Impact on service provision

Ogburn (1966) refers to the term *'cultural lag'* as a means of defining a period of maladjustment within society following the introduction of new systems / machinery etc, which may in turn lead to anxiety, confusion and the inefficient deployment of resources

Cultural lag is considered an important aspect of social change and evolves, accumulating as a result of invention, discovery and diffusion (Brinkman and Brinkman, 1997)

Any delay in developing the appropriate knowledge and skills may impact on the efficient use of established resources within the healthcare environment (Kings Fund, 2012)

# Interview quote: Ownership & identity

'*We have always previously provided the information and evidence for other professions to then go on and own the techniques and technology. This is now beginning to change, with both clinical scientists and practitioners developing the evidence base for themselves and their respective professions*'

'*Competency based approach, improving the overall autonomous nature of the Nuclear Medicine Practitioner. However this can also lead to an apprehensive workforce, if they are unfamiliar with the protocols and setup of the department*'

# Theme #3:

- Role erosion and automation / technological determinism:

  - **Deskilling of the NM workforce observed**
  - Professional erosion / social impact of new hybrid technology
  - Technological determinism reported
  - **Tribal instincts present in some instances, preventing flat collaboration opportunities**
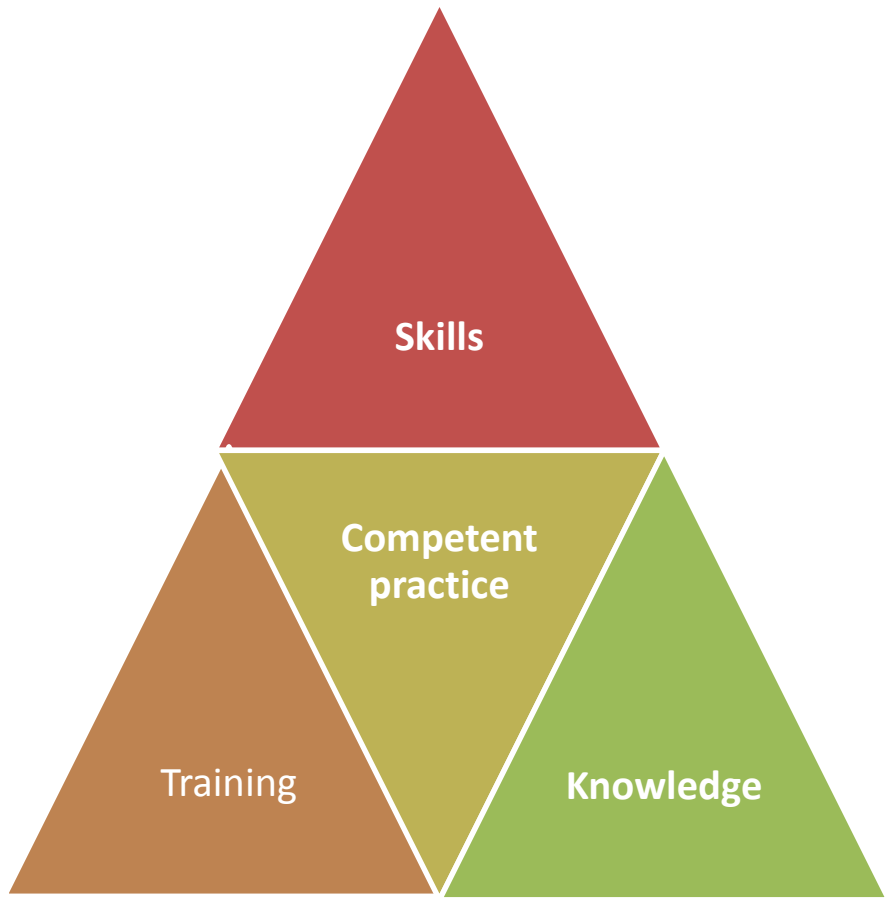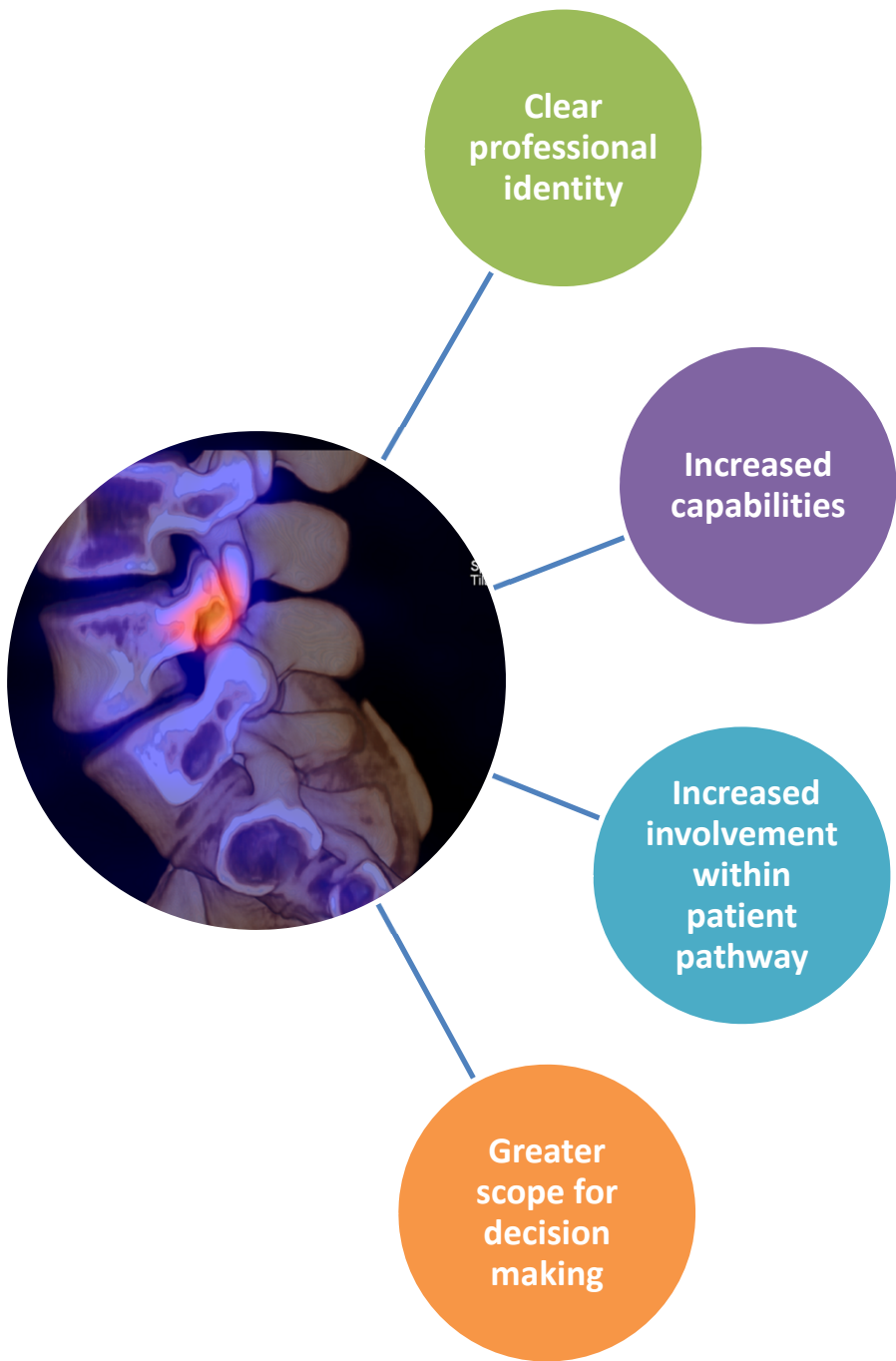
# Interview quote: Automation

'You set the patient up; you just click the bone scan protocol you don't have to set your window peak.  You don't have to set your window width.   You don't have to set any of the parameters, if you don't want to.  It sets automatically the programme speed for you and then when you process it, you just load up that data into the bone scan protocol and windows it for you to…..'

'There are other tasks that all of a sudden, now you're trusting these computers to do this stuff.  You have to almost go through and double check their workings out and then the actual technological skill involved in the computer knowledge has had to increase exponentially, with regards sort of the processing of the data as well.'

# Theme #4:

- Emergence of new professional identity and intercollegiate working:

  - Some evidence of flat collaboration occurring
  - **New culture emerging**
  - Professional pride established
  - **New opportunities for preceptorship and mentorship**
  - **Autonomous practice (dedicated CT patient worklists)**
  - Practitioner driven protocols

Clear professional identity

Increased capabilities

Increased involvement within patient pathway

Greater scope for decision making

Skills

Competent practice

Training

Knowledge

Gibbs and Griffiths, (2013)

# Interview quote: Flat collaboration

*'There has been the development of problem solving abilities during the installation and in-house training of the SPECT/CT equipment within the Department. Working as a team, rather than individuals.'*

# Interview quote: Emerging culture

'*Introducing hybrid imaging technology has brought challenges in that there's a steep learning curve for us, we've sort of drifted along, we've done nuclear medicine for a long time and all of a sudden there's this new thing to learn.*'

'*I think it's increased the scope of the nuclear medicine technologists, the practitioner, the radiographer or whatever, because then they are more multi skilled.  They can do nuclear medicine and they can do CT and those skills are transferable, the nuclear medicine practitioner could do a CT list as long as they're educated properly enough and confident enough.*'

# Theme #5:

- Need for new professional guidelines and training frameworks to be established:

  - **Lack of formal training and educational guidelines**
  - Limited professional networks in existence
  - **Distinct lack of career support mechanisms in hybrid imaging**
  - **Concerns over the mapping of new aspects of service redesign and role development opportunities**
  - Limited support from equipment manufacturers post installation of new kit
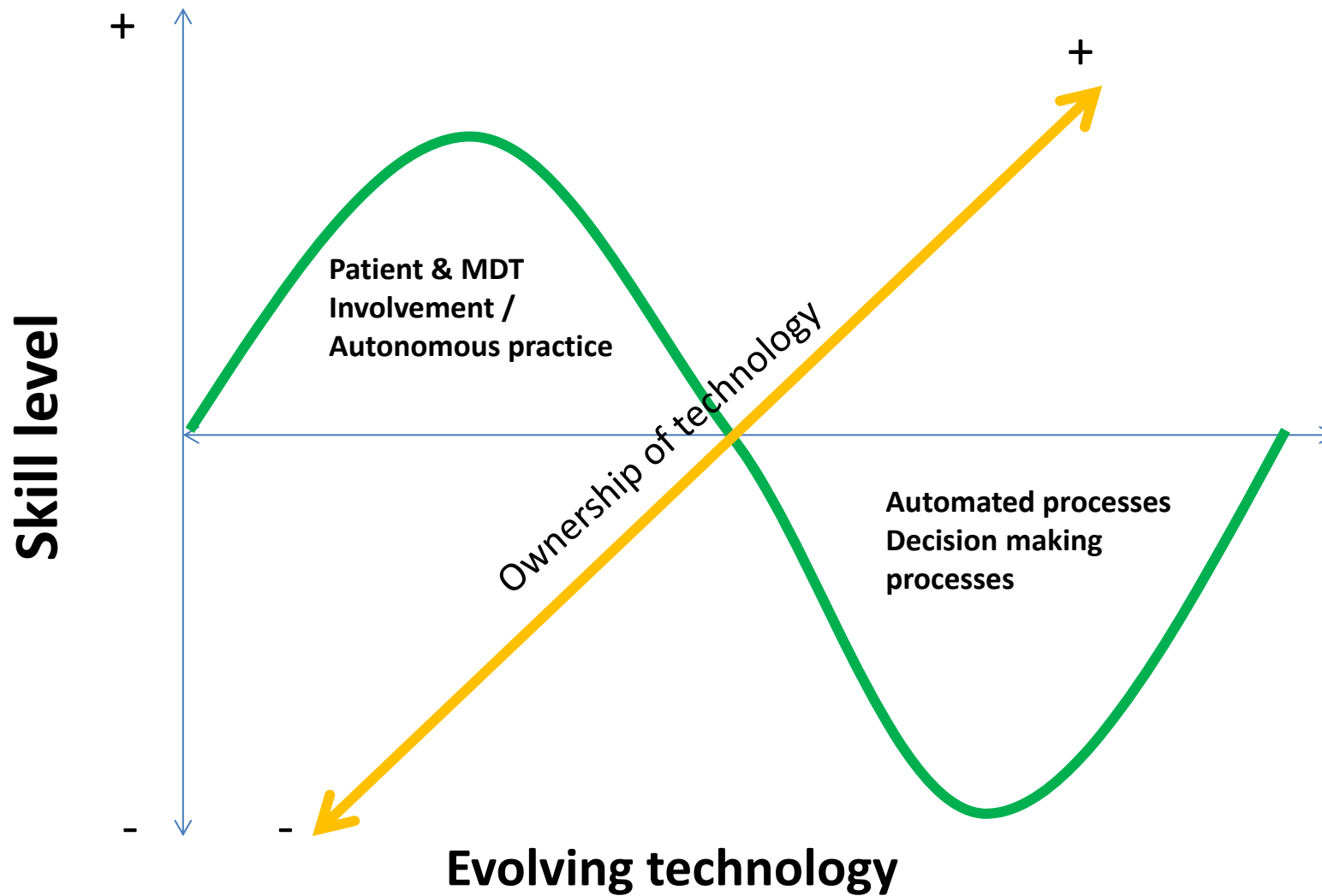
# Interview quote: Corporate responsibility

*'We didn't have anything from the equipment suppliers. I feel that has been a lack of interest in the first place. Considering the number of cameras that we've got and the fact that we are a centre of excellence, I would have expected them to come in and be a little bit more involved in what's going on……and now things are much more complex in terms of what you can possibly do.'*

# Theme #6:

- Occupational shift and domain ownership:

  - Traditional roles being eroded
  - Impact of the digital push / pull culture in the clinical environment
  - **Tensions around domain ownership by sub-communities within the clinical environment**
  - Pressures being placed on NM workforce to manage the processing and data mapping
  - **Embrained and Encoded skills (Larsson et al., 2009)**
  - **Opportunities for service redesign**

# Professional 'ripple' and reorder



Skill level

+

+

Patient & MDT
Involvement /
Autonomous practice

Ownership of technology

Automated processes
Decision making
processes

-

-

**Evolving technology**

# Practitioner blog entry: Breaking the ceiling

*18th Nov: Success!! Have got the IR(ME)R authorization criteria signed off by all five ARSAC licence holders for Senior Technologists to authorise hybrid imaging, and been added to the trust IRMER protocols as a group to perform CT and as practitioners to authorise SPECT/CT.*

# Theme #7:

- Impact of technology on patients and creating a patient centric approach to hybrid imaging service delivery:
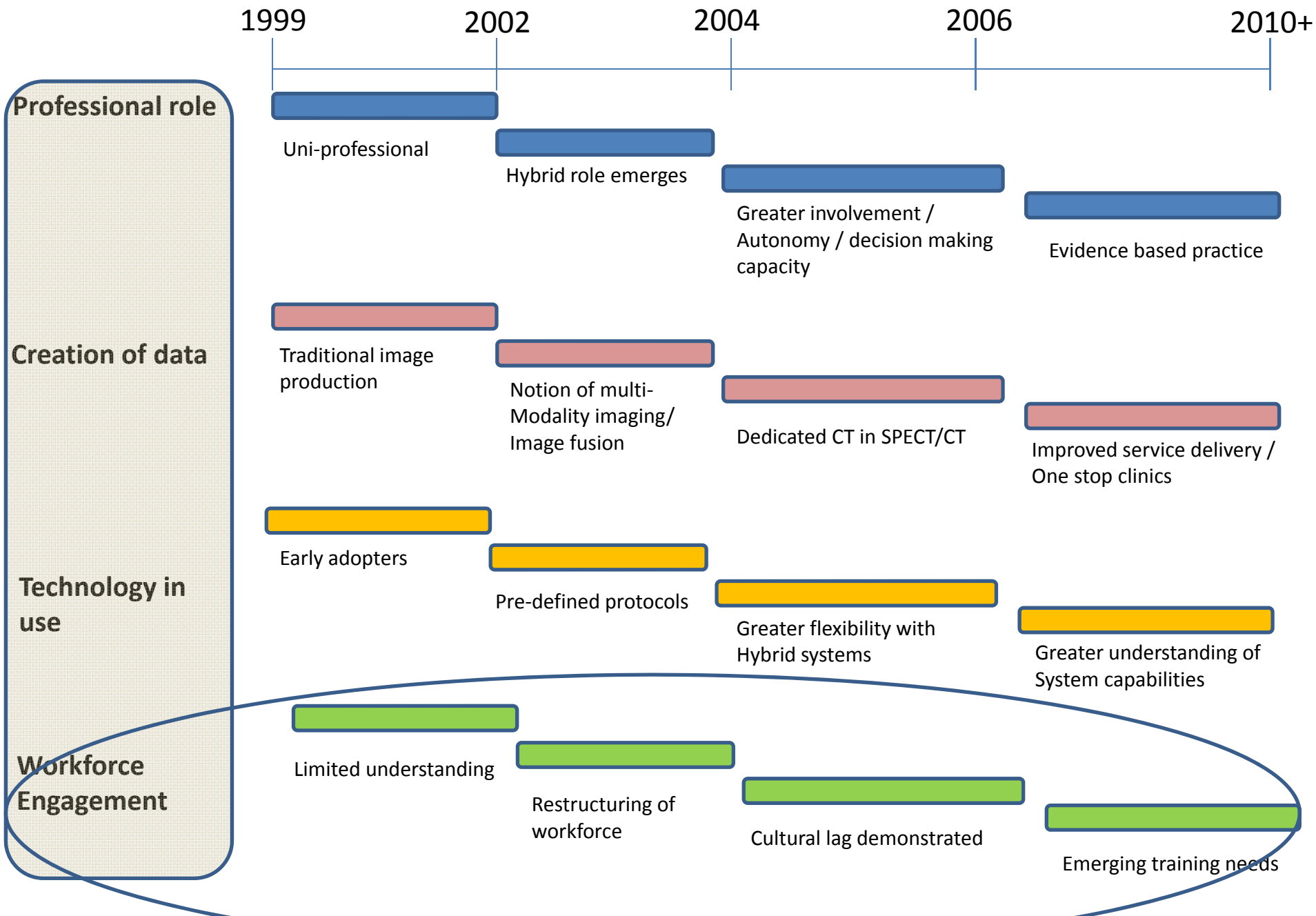
  - – Balancing the training needs of the NM Practitioner with the needs of the patient (i.e. patient centric approach)
  - – **Physical barriers now present between practitioner and patient**
  - – Sense of isolation for the patient and the practitioner
  - – Practitioners are trying to create a **patient centric** approach to the delivery of care
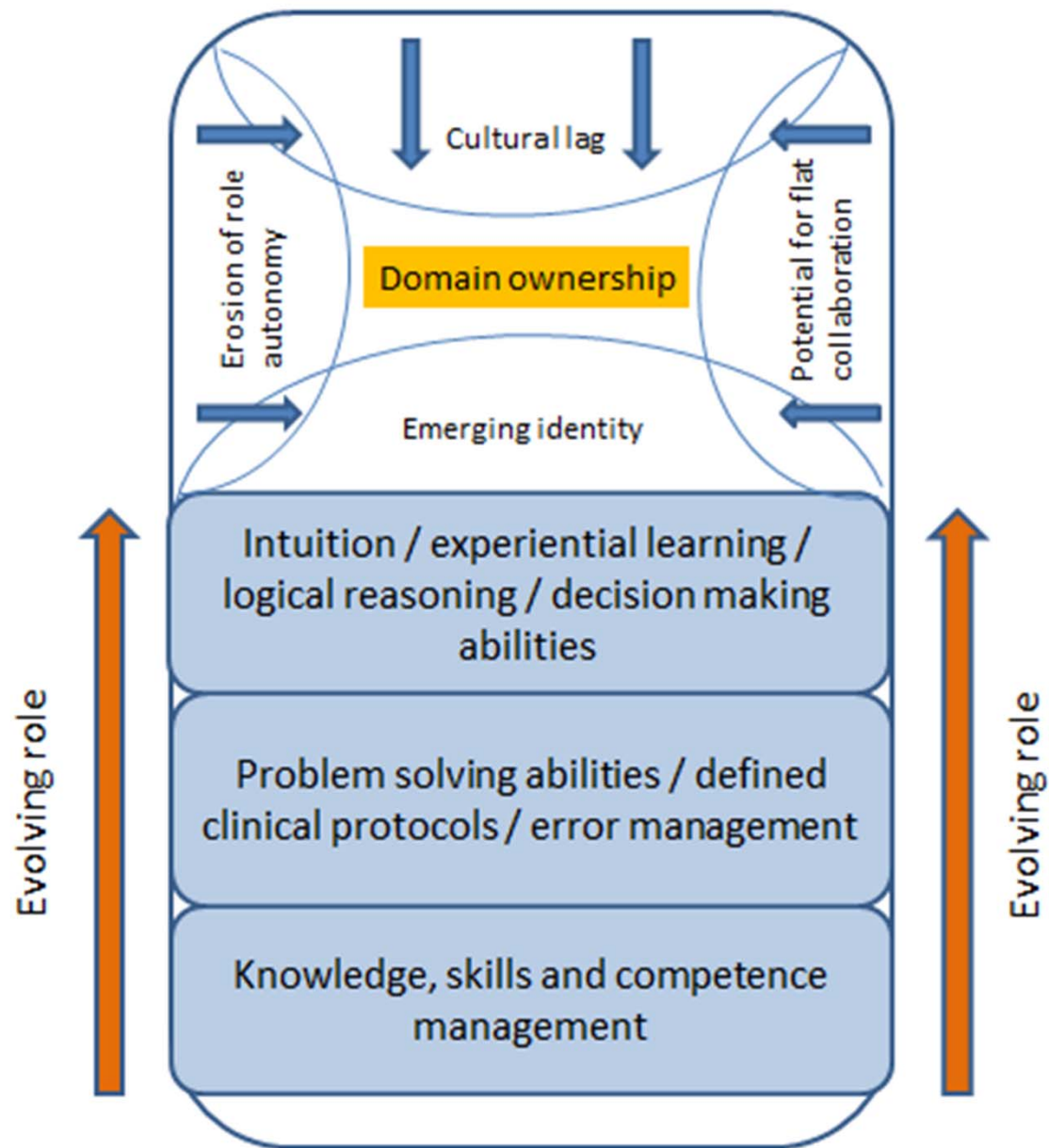
# Summary: Learning and development needs

# The emergence of a new workforce?

- New language/working practices & culture
- Complexity of software and '*movement*' of digital data & impact on patient contact
- Different physical identities
- Education and training considerations

**Timeline:** 1999 — 2002 — 2004 — 2006 — 2010+

**Professional role**
- Uni-professional
- Hybrid role emerges
- Greater involvement / Autonomy / decision making capacity
- Evidence based practice

**Creation of data**
- Traditional image production
- Notion of multi-Modality imaging/ Image fusion
- Dedicated CT in SPECT/CT
- Improved service delivery / One stop clinics

**Technology in use**
- Early adopters
- Pre-defined protocols
- Greater flexibility with Hybrid systems
- Greater understanding of System capabilities

**Workforce Engagement**
- Limited understanding
- Restructuring of workforce
- Cultural lag demonstrated
- Emerging training needs

Griffiths, (2014)

# Example competencies

**Protocols in SPECT/CT**
- Appropriate use of CT
- Value of AC & one stop shop imaging approaches

**Quality control measures**
- Optimising techniques
- Dose considerations & QC checks

**Knowledge & Skills development**
- Knowledge and understanding
- Radiation safety considerations

# Impact



Griffiths et al, (2014)
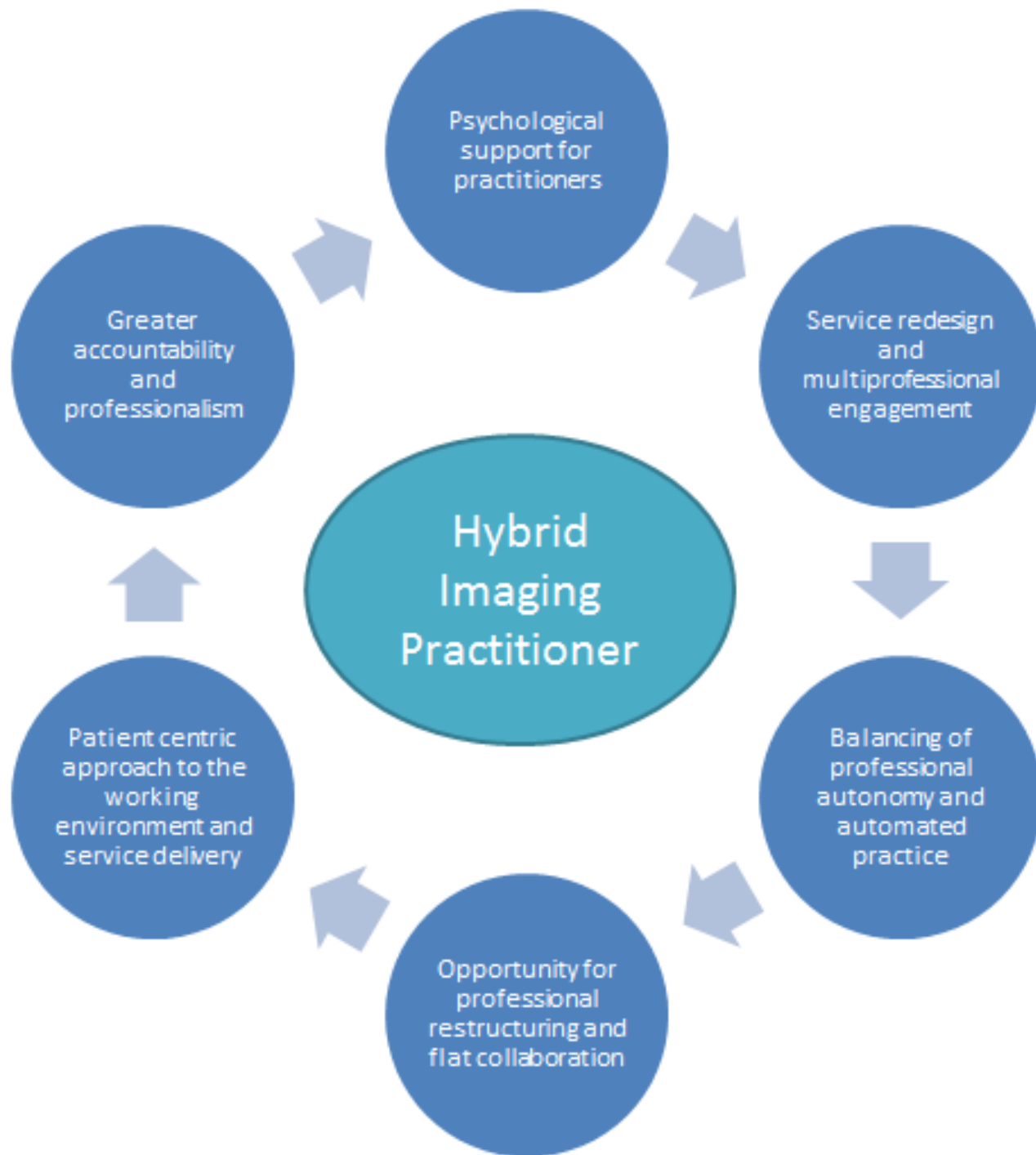
# Acknowledgments

- Clinical staff within the NHS
- Dr Theresa Mitchell & Dr Viv Gibbs
- Gary Dawson
- Nuclear Medicine Community
- Rachel Harris / College of Radiographers (CoRIPS Grant)

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