Preface: the purpose of higher education

I take a university to be an institution which facilitates the creation and the sharing or diffusion of knowledge in support of society and nation.

This is usually summarised in a vision and mission statement for a university or other higher education establishment.

A university is also a scholarly institution, a community of students, teachers, researchers and administrators. The measure of the quality of a university is the extent of its research achievement and of its teaching excellence.

The priorities for the teacher/researcher can be discussed under these three headings:

0.1 Teaching and Learning

The diffusion of knowledge is facilitated by education, in particular by teaching in support of student learning. It is crucial, and the society and the nation depend upon it.

0.2 Research

The creation of knowledge, primarily by means of theoretical, applicable and applied research, is what distinguishes a university from teaching-only educational institutions.

0.3 Service

A university teacher must contribute in both teaching and learning; but she or he must also contribute to the development of the institution and of society and nation. She must engage with social institutions, particularly commerce and industry, learning with and from them and seeking in some way to contribute to their positive development.

In this document, I shall indicate how I share these imperatives and can contribute to their realisation.

I describe my teaching, research and service philosophy. I have taken the word philosophy seriously. Therefore, in the main sections on teaching, research and service I support certain of my contentions by reference to literature, including that of philosophy.
# Table of Contents

§0 Preface: the purpose of higher education ......................................................... 1
  0.1 Teaching and Learning ................................................................................. 1
  0.2 Research ........................................................................................................ 1
  0.3 Service ............................................................................................................ 1

§1 The principal challenges which face a teacher of information systems .......... 4
  1.1 Teaching and Learning .................................................................................. 4
  1.2 Assessment and learning-by-doing as a means to paradigm change .......... 5
  1.3 Aids to learning and assessment .................................................................. 7
  1.4 Adapting to the level of the student ............................................................... 7
  1.5 Levels in my practice .................................................................................... 9
  1.6 The importance of having fun and gaining confidence .................................. 9
  1.7 Tutorials, coaching and mentoring students................................................ 10
  1.8 Individual assessment in group projects ....................................................... 10
  1.9 Putting this all together (1): TALEnT ............................................................ 12
  1.10 Putting this all together (2): some example assessment designs ............... 14
  1.11 Other forms of learning by doing: what happens in the classroom and after class ..................................................................................................................................... 23
  1.12 Programme and module design ................................................................... 23

§2 My research philosophy ..................................................................................... 24
  2.1 A summary of my views on research methods and philosophy ................... 24
  2.2 Abduction ...................................................................................................... 25
  2.3 My research plan: please see my CV ........................................................... 27

§3 Service ............................................................................................................... 27
  3.1 Research-based future service ...................................................................... 28
§4  Teaching, research, service: concluding remarks .............................................. 29

§5  BIBLIOGRAPHY ........................................................................................................ 30

Table of Figures

Figure 1 Levels within the cognitive domain ........................................................................ 8
Figure 2 Becoming TALEnTed: a diagrammatic representation ........................................... 13
Figure 3 A model of the design of a programme as a series of modules .............................. 23

Table of Tables

Table 1 Related verbs for Bloom’s taxonomy .................................................................... 8
Table 2 Some recent teaching showing the split into TALEnT ........................................... 14
Table 3 The detailed breakdown of a single module, IS402E Electronic Business Management .... 18
§1 The principal challenges which face a teacher of information systems

1.1 Teaching and Learning

The University seeks to transmit knowledge; and student learning is facilitated by excellent teaching. In this section, I want to talk about teaching, about learning and my efforts to make both excellent.

I started my teaching career in a British university. What in Britain are still sometimes referred to as the “new” or “modern” universities (established post-1992) have been for a long while much more conscious of the importance of good pedagogy than have the more traditional Oxbridge and redbrick universities. This is in part because the student body in these newer universities is generally less academic in its outlook and much more practical and pragmatic in what it seeks to achieve. There is much emphasis within this British approach on the significance of three pillars, Teaching, Learning and Assessment - together referred to as TLA.

One of the many questions which needs to be addressed before effective teaching can take place is that of what curriculum is appropriate and what level of learning attainment is realistically achievable, given the aspirations and starting level of the students in question. I have managed programmes in both Great Britain and in France. A very important aspect of programme management is the monitoring of the effectiveness of the curriculum – as judged intrinsically, but also by outside agencies, including employers and their representatives – and planning and managing its development.

We must accept that many students see university as little more than a means to a qualification. Perhaps only a minority place high value on learning itself. But all students must be challenged to learn effectively as they invest several years in the learning process and to surprise themselves by their growing level of achievement.

I have had significant success in maintaining and developing conceptual modelling in the service of real competence in the application of information and communications technology in business and personal life. I believe that this conceptual modelling, together with practical system construction skills, are an essential part of the Information Systems curriculum even for generalist business students. They are of course indispensable for students who are following an Information Systems major or programme. To achieve this, I have gradually refined the modelling techniques which I and colleagues have used. This has recently culminated in the development of the Conceprocity concept process reciprocity modelling approach, which is introduced in the papers (Gregory and Maggilchrist 2014) and (Gregory and Wood-Harper 2017).

Teaching is intended to assist and enable learning which must be student focused. There is always a temptation for a teacher to be a primadonna,
someone who shows off her abilities. This rarely helps students in the learning process. Instead, I suggest that the ideal learning situation is one in which the teacher accompanies and mentors the student in her specific learning process. This is particularly true when the subject matter in question, in my case information systems, has aspects which are deeply conceptual and require development of the abstraction capabilities of students (Kramer 2007; Bennedsen and Caspersen 2008). I call mentored accompaniment an ideal situation because it is not always possible to devote the time necessary to making this happen in the best possible way. Therefore, pragmatic expedients continue to be employed: mass lectures, small group tutorials, and the like. But many of us know from our own experience how much better the learning process is when it is a more or less active mentored learning partnership: the old (and new) apprenticeship schemes, “learning with Nellie”, are exemplars of this. The compromise which I seek to achieve in my own classes is to split the learning materials up into short, sometimes sharp, nuggets – sometimes more than one per class. Each nugget has associated measurable learning outcome, direct teaching, learning resources, in-class confidence-building exercises, sometimes homework, and always application within the context of an assessment project. Each nugget is introduced and in some way initially applied in-class. Then the student will be encouraged to undertake either immediate reinforcement or face the same issue as part of an assignment or team project. I always make available online resources; as a minimum, these include PowerPoint used during the week’s classes. The course outline (module specification) highlights essential and amplificatory documentary resources.

A planned paper will discuss the Conceprocity approach specifically in the context of student teaching and learning. Initial mentored action research (Gregory, Kehal, and Descubes 2012) has involved using Conceprocity as a principal teaching vehicle in three courses in France and two in Coventry University Scarborough. Some of my most recent teaching experience (2016/7) has been very close to this ideal mentored accompaniment. I have been privileged to teach database modelling, information systems analysis and construction to a very small group of students at Coventry University Scarborough.

1.2 Assessment and learning-by-doing as a means to paradigm change

Given the constraints of real-world teaching and learning in which mentored accompaniment can only ever be the exception rather than the rule, I have always placed a very strong emphasis on extremely practical, often demanding project-based assessment strategies. The student must be incentivised to learn effectively. Aiming to do well in assessments (exams, project assignments et cetera) does motivate students (perhaps sometimes only by fear of failure; we hope more often by the desire to excel). I therefore try wherever possible to
design assessment in a way that challenges the student to extend her learning by means of immediate and practical application of course-derived and course-related knowledge. This starts in the classroom, with “toy” exercises and immediate feedback; but it goes forward in the formal assessments of the course. I am no lover of exams and, wherever possible, I seek to avoid too much emphasis on multiple choice assessment. That is because it is extraordinarily difficult to design multiple-choice questions which genuinely challenge the student to further learning. We have to use exams: and good exam questions are searching in a way which multiple-choice questions usually are not. But I prefer to use an approach in which there are both an exam and a project (assignment), with as high a weighting as is possible on project work. Why? Because deep learning associated with actual application enables paradigm change in the student herself or himself.

I have already published one conference paper in this area and I am working with a former colleague on a second paper which we shall shortly submit as a journal article. The first paper, (Gregory, Kehal, and Descubes 2012), describes our approach to mentored action learning in the context of doctoral research. The second paper, provisionally entitled “Conjectures on the morphogenesis of meaning and its part in learning”, posits that learning in society and in the individual proceeds by a process of paradigm shifts (Macgilchrist and Gregory 2017 forthcoming). That is because learning involves the replacement of inadequate paradigms by newer, better “more effective” ones. The learner’s understanding of meaning advances by a process of evolution and revolution. Influences on our thinking include the triadic semiosis process described by Charles Sanders Peirce (Peirce 1902; Atkin 2013) and the categorical prototype approach developed by (Rosch and Mervis 1975; Rosch 1977), expounded by (Lakoff [1987] 1990) – and powerfully argued against by (Vervaeke and Green 1997), criticisms which we have also taken into account. We argue in our paper that Rosch’s categorical prototypes can be viewed as more or less sophisticated paradigms. In effect, the belief system of the layman is made up of hierarchies of prototypes that interact much like objects in an object orientated program. We believe that all semantics (at least as far as understood by human agents) is encapsulated within “paradigm belief systems” which in turn can best be described by the set of characteristic epistemics which control their morphogenesis (Archer 1995). Hence, meaning is subject to evolutionary forces that manifest themselves in the form of topological trajectories where the concept of decidability plays the role of a “potential” – here we are following the thinking of René Thom. His catastrophe theory (Thom [1980] 1993, 1994) examines, through differential geometry, the ways in which qualitative changes or “jumps” take place following small quantitative changes. (Petitot 1985), later translated as (Petitot 2004), has described the mechanism of semiotic morphogenesis. We particularise this as semantic morphogenesis in the paper (Macgilchrist and Gregory 2017 forthcoming). We hold semantic morphogenesis (evidenced by paradigm shifts in vocabulary) to be of primary
importance for all learning cybernetic systems but it is particularly applicable to student learning.

At some stages in her or his learning development, it is appropriate to accompany the student in a process of evolutionary and not particularly radical development, building confidence at one level. However, at other points, it is right to challenge the student to break away from an inadequate belief system and to advance towards a no-doubt more difficult but also more pragmatically useful and “truer” paradigm. For example, students who previously were content with flowcharts or with pseudocode (or without any attempt at prior conceptualisation) can be challenged with techniques which encourage real analysis of requirements before design.

Our article, (Macgilchrist and Gregory 2017, forthcoming), will be submitted for publication before the end of the year.

1.3 Aids to learning and assessment

I emphasise the need to accompany the student during all learning and especially in the changes of level, the paradigm shifts, just identified. I have developed two aids to this process.

One is the use of my own Conceprocity concept process reciprocity visual modelling language and approach. Here, the student is initially encouraged to combine informal images with semi-formal structural models of how she sees concepts relating to one another. As the student develops the model, she can see gaps and inconsistencies in her understanding which she then seeks to rectify – e.g. by reading or by interaction with a teacher. She is in effect carrying out what (Magnani, Nersessian, and Thagard 2012; Nersessian 1999) identify as model-based reasoning.

The second is an information system, which I call Acquis, academic quality information system. One of the use cases supported by this system enables me to give targeted and focused feedback to students on their work based on the recognition that some error patterns are common and that some are unique to individual students.

1.4 Adapting to the level of the student

Clearly, the intended learning outcomes, teaching, in-class exercises, directed reading and project work have all to be adapted to the level and status of the student.

Classically, learning levels are classified in accordance with Bloom’s taxonomy. The levels within the cognitive domain are shown as Figure 1.
A very good summary of the issues involved can be found at:
[http://assessment.uconn.edu/primer/taxonomies1.html](http://assessment.uconn.edu/primer/taxonomies1.html). See (Heywood 2000) and (Eder 2004) for a broader consideration of these issues.

I have successfully taught at every level from foundation to executive MBA by means of outcomes-based assessment informed by Bloom’s taxonomy. Operationally, this is crucially informed by the use of outcome keywords suggested by Bloom and his colleagues, summarised in (Eder 2004) who states that he is following Lynda Harding, California State University, Fresno; these keywords are reproduced here as Table 1:

Table 1 Related verbs for Bloom’s taxonomy

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>Understanding</th>
<th>Application</th>
<th>Analysis</th>
<th>Synthesis</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>define</td>
<td>arrange</td>
<td>apply</td>
<td>analyze</td>
<td>arrange</td>
<td>appraise</td>
</tr>
<tr>
<td>identify</td>
<td>classify</td>
<td>compute</td>
<td>calculate</td>
<td>assemble</td>
<td>assess</td>
</tr>
<tr>
<td>indicate</td>
<td>comprehend</td>
<td>construct</td>
<td>categorize</td>
<td>collect</td>
<td>choose</td>
</tr>
<tr>
<td>know</td>
<td>describe</td>
<td>demonstrate</td>
<td>compare</td>
<td>compose</td>
<td>compare</td>
</tr>
<tr>
<td>label</td>
<td>discuss</td>
<td>dramatize</td>
<td>contrast</td>
<td>construct</td>
<td>contrast</td>
</tr>
<tr>
<td>list</td>
<td>explain</td>
<td>employ</td>
<td>criticize</td>
<td>create</td>
<td>decide</td>
</tr>
<tr>
<td>memorize</td>
<td>express</td>
<td>give</td>
<td>debate</td>
<td>design</td>
<td>estimate</td>
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<tr>
<td>name</td>
<td>identify</td>
<td>examples</td>
<td>determine</td>
<td>formulate</td>
<td>evaluate</td>
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<tr>
<td>recall</td>
<td>locate</td>
<td>illustrate</td>
<td>diagram</td>
<td>integrate</td>
<td>grade</td>
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<tr>
<td>record</td>
<td>manage</td>
<td>interpret</td>
<td>differentiate</td>
<td>organize</td>
<td>judge</td>
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<tr>
<td>relate</td>
<td>paraphrase</td>
<td>investigate</td>
<td>disassemble</td>
<td>perform</td>
<td>measure</td>
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<td>repeat</td>
<td>recognize</td>
<td>operate</td>
<td>distinguish</td>
<td>plan</td>
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<td>select</td>
<td>report</td>
<td>practice</td>
<td>examine</td>
<td>prepare</td>
<td>revise</td>
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<tr>
<td>underline</td>
<td>restate</td>
<td>predict</td>
<td>experiment</td>
<td>produce</td>
<td>score</td>
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<td>review</td>
<td>schedule</td>
<td>inspect</td>
<td>propose</td>
<td>select</td>
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<tr>
<td>suggest</td>
<td>shop</td>
<td>inventory</td>
<td>set up</td>
<td>value</td>
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<tr>
<td>summarize</td>
<td>sketch</td>
<td>question</td>
<td>synthesize</td>
<td>weigh</td>
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<tr>
<td>tell</td>
<td>translate</td>
<td>relate</td>
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<td></td>
<td></td>
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<tr>
<td>translate</td>
<td>use</td>
<td>solve</td>
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</tbody>
</table>

These words are used in the construction of module and programme learning outcomes.
1.5 Levels in my practice

Students learn better when they enjoy the process. At Rennes School of Business, where for a long time I was the only specialist information systems teacher, I successfully lobbied for, maintained and developed the information systems aspects of a core generalist business curriculum in which:

1. At level 4, students learned how to design and build databases and to implement websites. This is practical and it is confidence building. All students took this course.

2. At level 5, students learned how to analyse requirements using techniques such as use case diagrams, entity relationship modelling and event process chains\(^1\). These serve practice; and they enable the generalist student to understand the language and thinking of the systems specialist. All students took this course.

3. At level 6, students learned the significance and benefits of e-commerce, began to understand the potential strategic contribution of information systems and the “contribution” of poor systems, technology and organisation to competitive disadvantage for many enterprises. Students who chose an Information Systems minor and students who studied on the MSc in Digital Marketing undertook this course.

The three levels identified here approximately correspond to the first three levels in Bloom’s taxonomy; but I would comment here that each level has to be adapted to the type of students in the classroom. Thus level 4 for a student studying an Information Systems major might correspond to level 5 for a student of general business if the learning outcomes concern database analysis and design.

1.6 The importance of having fun and gaining confidence

We are always learning, especially as teachers! The process of creating nuggets – I call it nuggetisation of learning resources – is one that I have only recently introduced into my teaching. Similarly, I have been slow to realise the importance of short, sharp, fun mini-exercises in the classroom. Thus, when first creating a Conceprocity model, I now encourage the use of rich pictures rather than more formal modelling – which can come later. It is a mistake to force students to apply diagramming rules before the spark of interest and creativity has been fanned into a small fire… I have not myself yet used serious games in information systems teaching, and would welcome the opportunity to learn more in this area.

\(^1\) All three of these modelling approaches are possible in Conceprocity, which also unifies the conflicting semiotics of earlier multi-model approaches such as UML. Conceprocity results from a principled approach to the design of a visual language. This approach responds to many of the issues raised by (Moody 2009).
1.7 Tutorials, coaching and mentoring students

When I was teaching in the University of Huddersfield, we observed a high dropout rate in the early weeks of programmes. As an admissions tutor, I saw it as a very important part of my role to seek to orientate students to the right programme before they were recruited – even if that was one that we did not offer. This is I think ethically essential. I also proposed and implemented two major innovations. One was to treat a suite of programmes as a single management task – thus I became course manager for the suite of business computing programmes. The second was to introduce personal tutoring for all first-year students with the option that the tutor-student relationship continue in subsequent years (or be replaced by the supervised work experience tutor). At Rennes School of Business, I was programme manager of the Master of Arts in International Business MAIB programme. Both in recruitment and in day-to-day interaction with students, I sought always to understand their needs and where possible to meet them.

A particular strength of the MAIB programme, frequently recognised by UK-based external examiners, was the research methods training and very demanding research project undertaken by each MAIB student. This required close and time-consuming supervision of the student – but often led to research that was sufficiently good to form the basis of academic publications.

1.8 Individual assessment in group projects

In order to give students significant and worthwhile projects, without overloading them with work, I prefer to make extensive use of group projects in which each individual is assessed and in which the grade that she gets is based both on her own work and on the performance of her team. What follows is my current approach; I will of course adapt that to whatever curriculum I am asked to participate in.

There are four notions initially in play here: allocation; achievement – mark; weighting; and contribution.

- **Allocation** is the extent to which a student participates in a specific task.
- Grade / mark / achievement is the measure of success in the task as a whole.
- **Weighting** is the significance of a given task in the overall project in which the student has participated.
- The **contribution** of a given task is the product of allocation and achievement scaled by the inverse of weighting within the overall list of tasks, which is the project.

I apply the following principles in projects which I give to students: A project is a set of tasks. Some tasks are more significant or demand more effort than other tasks. I call this level of significance credit, to distinguish it from weighting.
Students may collaborate on a single task; if they do so, they share the allocation. The extent of sharing is called participation. It is common practice among teachers to assume that participation is the same for all students for all tasks, that is, achievement is measured only for the team as a whole. That has always seemed to me to be wrong for a number of reasons which constitute principles:

1. Team members do not apply the same amount of effort or intellectual capacity to a project or task.
2. They should therefore be rewarded or penalised in consequence. To do otherwise is to deresponsibilise students.
3. Team membership brings responsibilities and privileges. An assessment scheme should therefore reward both individual effort and team success.

It is common practice among teachers not to apply these principles for at least two reasons:

- Firstly, the effort required by the teacher to treat each task specifically (rather than the project as a whole);
- Secondly, the computational difficulty associated.

The second can be completely overcome by the use of appropriate ICT, e.g. spreadsheet.

The first is undeniably increased effort – but less than might be expected, particularly if the criteria for assessment are made very clear in advance. The reward for the teacher comes in knowing that she has applied principles which lead to fairer assessment and increased student engagement.

Summarising, we have the following notions:

- achievement
- allocation; this is usually shared equally between students participating in a task
- effort
- contribution
- weighting (or credit – the terms are synonymous)
- participation

Students working in a team should divide up the tasks in a project. I as the teacher measure their success in each individual task as a grade for that task. The reward for a specific student should be based both on their specific task contributions and on the achievement of the team as a whole. Taking into account team achievement is essential if unproductive competitive behaviour within the team is to be minimised.

I allow and encourage teams to over-achieve, that is to undertake more tasks than the minimum necessary to a project. If they choose to do this, their reward is to be assessed on the basis of the better among their tasks; concretely, once
they have achieved a threshold contribution, further less effective work is not considered.

This all sounds horribly complicated! In fact, once explained to the students, they quickly take to the approach and embrace it. I have used and progressively developed this approach over two decades. It is relatively straightforward to apply in practice, because I have created information systems support for it in the form of my Acquis academic quality information system.

1.9 Putting this all together (1): TALEnT

I have sometimes presented TALEnT to the students in the following way. Please note that this whole approach is one that I have developed but which has been refined in collaboration with teachers who have taught with me.

Teaching, learning and assessment: TALEnT

The learning approach used in this course is called TALEnT.

During the course, teachers and students tell each other TALEs:

T: Taught Theme – The teacher instructs the students, in-class on a chosen theme or topic. This teaching exists to introduce some of the key concepts, techniques and methodology of the module. Each concept – we call it a nugget – has a name, for example “identify stakeholders and actors”.

A: Activity in-class – Students reinforce their learning by means of in-class activities and feedback their understanding as they explain it to and between their colleagues; the teachers provide immediate in-class assistance and feedback. Wherever possible, these mini-exercises are designed to be fun and therefore to engage the learner.

L: Learning out-of-class – Students reinforce their learning by using e-learning resources, reading, learning software, etc. Reading should include both chapters from the recommended textbook and other relevant texts and journal articles. Students should make brief notes of problems which they encounter, ready for the next class.

E: Engagement: formative assessment – students choose or are assigned to small teams. Each team carries out a significant project over a period of several weeks. It is my normal practice to require each team to define its own project in such a way as to minimise the likelihood of excessive pollution between teams. Students work on aspects of their team project week by week. Each team maintains online resources shared between all team members and with the teacher. Therefore, the teacher always has visibility of the work of individuals and of teams.

Thus, TALEs exist to exchange knowledge and skills, from week to week of the course.

At the end of the course, students have proven new TALEnT because, in addition to the TALE-telling, they have been Tested:

T: Taught Theme

A: Activity in-class
L: Learning out-of-class

En: Engagement: formative assessment

*T: Testing: summative assessment – project (major team project) and conventional exam

TALEnT is therefore proof of effective learning.

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Figure 2 Becoming TALEnTed: a diagrammatic representation
## 1.10 Putting this all together (2): some example assessment designs

Table 2 demonstrates the TALEnT structure of certain courses which I have taught recently.

### Table 2 Some recent teaching showing the split into TALEnT

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<tr>
<td>CUSC111IT</td>
<td>• What is a database? &lt;br&gt;• Why is database important to business and to individuals? &lt;br&gt;• How can I analyse the need for a database? &lt;br&gt;• How do I build a database? &lt;br&gt;• How do I best communicate my developing work to customers and users?</td>
<td>Entity relationship attribute modelling exercises. Use of Microsoft Access to build and relate tables, queries, forms and reports. Work together on the (existing) OWL Online Warehouse Limited e-commerce case study.</td>
<td>Deepening experience of Access. Preparing presentations and management reports. Reading on information systems.</td>
<td>Use case modelling and entity relationship attribute modelling, gradually developing towards the assignment work – see Testing.</td>
<td>Assignment 1: Design Happy Homes data dictionary and database. Students had to present requirements analysis, business process modelling, and database design to develop a new relational database for Happy Homes Limited. Assignment 2: implement a relational database incorporating tables, queries, forms and reports supporting customer order processing, and reports to management on which items are proving popular for sales and which are not, current trading position (their profit so far) and the customers who buy the most items to send them promotional mail shots. No exam.</td>
</tr>
<tr>
<td>Managing Networks</td>
<td>• Fundamentals of networks, operating systems and system software. &lt;br&gt;• Understanding of number systems, hardware, operating systems, systems software, networks and system</td>
<td>Workshop on hardware installation &lt;br&gt;Workshops on setting up a small network of Raspberry Pi computers within a Windows Server 2012 network.</td>
<td>Directed reading, e.g. (Hallberg 2014).</td>
<td>Undertake a practical assessment and an online quiz to demonstrate and explain your computing and networking skills. Use a personal computer or Raspberry Pi to test your knowledge on the following:</td>
<td>“You are required to write a 1750 word report on the recommended design of a network for multiple sites, using LANs, WANs, and Wireless networking, with IP addresses and Subnets. You will also include a topology diagram for the given brief. You will then work out least cost paths using the Bellman-Ford, Kruskal’s or any 2 alternative algorithms for the network.”</td>
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<td></td>
<td>performance considerations given to designing a network for business use.</td>
<td>• Skills required effectively to design, develop and manage networks in a variety of settings.</td>
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<td></td>
<td></td>
<td>• Opportunity to experience practical aspects of building a network.</td>
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<tr>
<td>IS402E Electronic Business Management</td>
<td>• Introduction to the course: What Businesses Do, How They Use Processes and the Role of Information Systems</td>
<td>50% exam; <strong>50% team project.</strong> In business, business professionals specify and procure information systems which then support the business processes for which they are responsible or in which they participate.</td>
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In business, business professionals specify and procure information systems which then support the business processes for which they are responsible or in which they participate.
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<tbody>
<tr>
<td></td>
<td>• How the Internet and Information Systems are Restructuring Companies and Industries</td>
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<td>• The objective of this project is to have each team of 3-4 students demonstrate their understanding of the linkages between business strategy and operations and the core ICT principles and methods taught in this course.</td>
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<td>• How Companies Organize Processes and Process Innovation</td>
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<td>1. The assessment task is to develop aspects of a business plan for a company which depends upon electronic business and makes very extensive use of information and communications technology ICT. You should normally propose an imaginary and completely new business. Alternatively, you may work with a real company. It is YOUR DECISION as to what you will sell: what product or service or both you will offer. You may be selling to other businesses (B2B company) or to end-consumers (B2C). We advise against most personal services since they cannot usually profit much from e-business. The outcome will be a report to business and technically literate venture capitalists whom you want to invest in your enterprise.</td>
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<td>• How to identify the Right Process</td>
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<td>2. Propose a business within an industry segment. Your turnover in the second or third year of the project must exceed 1 000 000 € and you must make a profit in or before the third year.</td>
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<td></td>
<td>• Using Event Process Chains</td>
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<td>3. Do some systems analysis for that business, using techniques including:</td>
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<td>• Getting the right process right</td>
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<td>(a) Identify the business context using a rich picture</td>
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<td>• Identifying and Organizing Business Data: Introduction to Structured Data and Data Dictionaries</td>
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<td>• Documenting Data Relationships - Entity Relationship Diagrams</td>
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<td>• Unstructured Data and Content Management</td>
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<td>• Using Data to Plan and Manage Performance</td>
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<td>• Wrap-up and Presentations</td>
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<td>(b) Identify main stakeholders and actors and how they are involved in the processes and activities in a work system using a use case diagram</td>
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<td>(c) Identify main business processes – event process chain diagram</td>
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<td>(d) Decide what data is needed in each process and all processes – dataflow diagram</td>
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<td>(e) Design a database by means of an entity relationship model</td>
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<td>4.</td>
<td>Why this team project? You:</td>
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<td>(a) Begin to understand that a business is made up of processes and activities which are coordinated by data</td>
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<td></td>
<td>(a)</td>
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<td>(b) Link business strategy and operations to the information systems strategy and the ICT upon which all modern business is based</td>
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<td>(c) Use certain techniques</td>
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<td>(d) Learn by doing</td>
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<td>(e) Set requirements which are then used to guide the work of the people or organisations (“the geeks”) who meet those requirements with websites, databases and the like. Thus you will learn something of the challenge and difficulties associated with setting requirements and meeting them</td>
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<td>(f) Reflect on learning</td>
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<td>5.</td>
<td>The team project is individually assessed, but you must work alongside two</td>
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Table 3 demonstrates the detailed breakdown of a single taught module.

Table 3 The detailed breakdown of a single module, IS402E Electronic Business Management

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<tr>
<td>Week 1: Introduction to the course: What Businesses Do, How They Use Processes and the Role of Information Systems</td>
<td>Course overview. Describe what businesses do for a living and how they set goals in general. Describe business models. Discuss how businesses use processes to organize, structure and get work done. Catalogue and describe a fundamental process - order entry and order fulfilment.</td>
<td>Explain and demonstrate how pervasive and vital Information Systems have become for businesses by beginning a real understanding of Amazon. Introduce the term project, the principal way of learning in this module.</td>
<td>Laudon chapter 1. Chaffey chapter 1.</td>
<td>Meet your team to begin to identify term project company TPC. Homework H01 Rich Picture of TPC</td>
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<td>Week 2: How the Internet and Information Systems are Restructuring Companies and Industries</td>
<td>Value Chains and Competitive Analysis. Differentiation. What is Innovation: products, processes, customer relationships, systems? Impact of the Internet: E-Business and New Business Models. IS-enabled innovations that have changed and are changing industries. Businesses as systems and as processes.</td>
<td>Spreadsheets as a means of understanding the fundamentals of business: profits equals revenues minus costs.</td>
<td>Laudon chapter 2. Chaffey chapter 2. (Kim 1995)</td>
<td>Homework H02 Describe and quantify Term Project Company Can your team quantify?</td>
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<td>Week 6: Identifying and Organizing Business Data: Introduction to Structured Data and Data Dictionaries</td>
<td>Structured data compared with unstructured. Website + Database = how e-commerce works. Introduction to Data Bases and Data Dictionaries.</td>
<td>In-class test (first 30 minutes) Data Dictionary and actual data.</td>
<td>Laudon chapter 5. Chaffey chapter 11 pp. 592-3.</td>
<td>Initial Data Dictionary. Initial Content Dictionary. H06 Sample data and Data Dictionary – Google Spreadsheet</td>
<td>In-class test (first 30 minutes) How should I describe and structure my data? How should I store data in a spreadsheet or a database so that I can get answers to my questions about the data?</td>
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<tr>
<td>Week 8: Unstructured Data and Content Management</td>
<td>Introduction to the concepts of Content Management and of Big Data. How social networks and non-traditional data affect company plans and operations. How new technologies and convergences reshape companies and industries.</td>
<td>How companies use Content Management (unstructured data) for their online activities. Using Google Sites (etc.) to create simple content-oriented websites.</td>
<td>Laudon chapters 9, 10. Chaffey chapter 8, 9.</td>
<td>Refine ERD. Describe content. Review all project components. H08 Content Dictionary</td>
<td>Hand in team project at end of this week</td>
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<tr>
<td>Week 10: Wrap-up and Presentations</td>
<td>Information Strategy, systems planning and systems development. Conclusions and Review for Final Exam</td>
<td>How to prepare for the final exam Project presentations by student teams</td>
<td>Laudon chapter 13. Chaffey chapter 5. (Christiansen et al. 2002).</td>
<td>H10 Sample exam</td>
<td>Hand in optional team database or website What have we learnt? How can we use this knowledge to improve our careers?</td>
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</table>

In this module, each member of the teaching team worked together with the students in their class so as gradually to build up, week by week, the final team term project. This module was taught to a very large number of students by a teaching team of three. The complicated task of assessing the student work was undertaken using the Acquis information system which I developed specifically to enable the rapid assessment of large, multitask, multi-member team projects with a combination of team and individual assessment.
1.11 Other forms of learning by doing: what happens in the classroom and after class

As demonstrated in Table 2 and in Table 3, I seek whenever possible to intersperse didactic, lecturer-first episodes with short sharp practical exercises, more often as not relating directly to elements of the overall term project/assignment. Similarly, I often set “homework”, again as direct preparation for the assigned coursework. I try whenever possible to make this classroom and independent study both directly relevant and fun. A recent example, CUSC112IT Managing Networks above, required as part of the in-class activity getting students to wire up their own RJ45 terminated cables, then using them to build a network of Raspberry Pi computers.

1.12 Programme and module design

Figure 3 A model of the design of a programme as a series of modules
Figure 3 is an extended event process chain diagram (Kim 1995; Scheer, Thomas, and Adam 2005) illustrating one aspect of programme management, that of mapping programme learning outcomes to module learning outcomes and ensuring that a module design conforms to the requirements placed upon it. In my role as a programme manager, I have not only had to decide which modules will form a part of a programme, but also to demonstrate the mapping of programme learning outcomes to module learning outcomes at an institutional level. The diagram\(^2\) can also be regarded as the design of a work system (Alter 2008).

### §2 My research philosophy

You will see from the foregoing that I am passionate about effective teaching and learning. I initially came into higher education two decades ago as a practitioner hired to undertake teaching. That was for many years my emphasis, and I dedicated myself to it. Only in recent years have I gained the competence and the confidence to undertake research. It too is now my passion. When nine years ago I began seriously to think about doing a PhD, I knew that whatever I undertook as research would have to really motivate me. Looking for a research gap in a crowded literature and undertaking focused quantitative research was not, for me, going to provide that motivation. I was therefore delighted when I first came across the paper (Klein and Rowe 2008), which discusses the difficulties encountered by post-experience PhD students who start their research later in life and suggests amendments to the conventional doctoral research route which play to their strengths. I decided to explore a long-standing personal obsession, that of understanding why we as knowledge workers manage our personal information in the service of personal work so very ineffectively. That exploratory research has been based on unusual but appropriate research methods, those of *auto-ethnography*, *design science research* and of *mentored action research*. They have already led to significant paradigm changes: in me!

#### 2.1 A summary of my views on research methods and philosophy

Diversity in research methods is a hallmark of my discipline, that of Information Systems. This is especially so outside North America; inside North America, the orthodoxy of a dominantly quantitative approach still largely holds

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\(^2\) The particular representation used in Figure 3 is the TROPICPEA usage profile of the Conceprocity knowledge mapping language and toolkit which is a product of my research. This map models only one aspect of programme management, that of deciding the module structure of a programme. It is therefore incomplete in its representation of the operation of a module. The model illustrates several features of Conceprocity, including the use of swimlanes to show the allocation of responsibility for processes; the use of typed relationships including prompting (causation), aggregation and composition; and an instance of a for-each loop within a work system.
sway. Where a question can be framed in definite terms, focused experimental or quantitative research are often appropriate. Where the nature of the question requires first to be understood, exploratory, investigative and interpretive approaches must be employed.

Even the identification of the concepts with which we are dealing can sometimes be difficult. One of my own learning paradigm shifts has been to become much more serious about the study of philosophy as what Roy Bhaskar calls an under-labourer and occasional midwife in the service of effective research.

(Pratt 2011) cites (Judd 2005) concerning the philosophy of critical realism originated by the philosopher Roy Bhaskar:

“Judd sums up Bhaskar’s contribution to philosophy by pointing out that, in developing the critical realist approach, Bhaskar has made two important shifts away from traditional philosophy: a shift within ontology from events and affairs to the mechanisms which cause them, and a shift from epistemology to ontology, redefining the role of philosophy in the process:

‘In making these shifts, Bhaskar has displaced philosophy as the highest form of human knowledge which all other disciplines must emulate; rather Bhaskar sees philosophy as the handmaiden of science. Philosophy’s job is not to provide us with irrefutable foundations for knowledge but to tell us in a general way what the world must be like in order to make sense of science as a practical and rational activity. But it cannot tell us the specifics of the world; that is the job of science.’ (Judd 2005, 703)

” (Pratt 2011, 21)

This statement gives prominence to critical thinking in general and to critical realism as a particularly ontological stance.

Concerning critical thinking, see (Ennis 2013), from whom we learn that critical thinking is “reasonable reflective thinking focused on deciding what to believe or do”. Robert Ennis suggests that full expression of critical thinking requires a set of dispositions, abilities and methods of inference. Ennis makes explicit reference to what he calls inference to the best explanation, which he regards as a form of inductive inference. Others use the same term as more or less a synonym for abduction – cf. (Lipton 2004). I myself believe abduction to be a crucial part of a troika of inference methods which includes all of deduction, induction and abduction. The basis for this belief is now briefly described.

2.2 Abduction

(Psillos 2009) shows how the early 20th century philosopher Charles Saunders Peirce wrestled with and gradually refined abduction as the fundamental basis of his remarkably rich thinking.
Mark Gregory

(Marostica 1993) states:

“According to Peirce, abduction is the process of making an explanatory hypothesis for a surprising fact. The hypothesis is conceived as a mere conjecture, or a fair guess. Broadly speaking, abduction covers all the processes by ‘which theories and conceptions are engendered.’ (Peirce, 1935, CP 5.590, 1906). For Peirce, the natural form of that inference is:

The surprising fact, C, is observed;

But if A were true, C would be a matter of course,

Hence, there is reason to suspect that A is true. (Peirce 1935 CP 5.189, 1903)

In this inference, (C) is the statement expressing the surprising fact, and (A) is the statement expressing the explanatory hypothesis.”

(Psillos 2009) quotes (Peirce, 1935 CP 6.469, 6.470, 6.472), writing in 1908 [emphases mine]; note that Peirce frequently refers to retroduction when he means abduction - particularly in the context of abduction concerning historical events based on historical documents:

“The whole series of mental performances between the notice of the wonderful phenomenon and the acceptance of the hypothesis, during which the usually docile understanding seems to hold the bit between its teeth and to have us at its mercy, the search for pertinent circumstances and the laying hold of them, sometimes without our cognizance, the scrutiny of them, the dark laboring, the bursting out of the startling conjecture, the remarking of its smooth fitting to the anomaly, as it is turned back and forth like a key in a lock, and the final estimation of its Plausibility, I reckon as composing the First Stage of Inquiry. Its characteristic formula of reasoning I term Retroduction, i.e. reasoning from consequent to antecedent (6.469).

Retroduction does not afford security. The hypothesis must be tested. This testing, to be logically valid, must honestly start, not as Retroduction starts, with scrutiny of the phenomena, but with examination of the hypothesis, and a muster of all sorts of conditional experiential consequences which would follow from its truth. This constitutes the Second Stage of Inquiry. For its characteristic form of reasoning our language has, for two centuries, been happily provided with the name Deduction (6.470).

The purpose of Deduction, that of collecting consequents of the hypothesis, having been sufficiently carried out, the inquiry enters upon its Third Stage, that of ascertaining how far those consequents accord with Experience, and of judging accordingly whether the hypothesis is sensibly correct, or requires some inessential modification, or must be
entirely rejected. Its characteristic way of reasoning is *Induction* (6.472).

"My early thinking about the importance of abduction both in research and in teaching gave rise to the conference paper (Gregory and Descubes 2011). I and my co-author are working on a journal article based on and extending this research for publication during this calendar year.

### 2.3 My research plan: please see my CV

My first priority has been to complete my doctorate. Getting a doctorate has taken longer than I had planned, but has also enabled me to develop a series of conference papers. From these conference papers and from the thesis I expect quickly to be able to publish a significant number of journal articles. *The currently-planned list appears as a table in my curriculum vitae*. Beyond that, I anticipate developing my research into personal work models by means of further mentored action research.

### §3 Service

Knowledge is not (or ought not to be) an end in itself. Instead, knowledge enables action about whose outcomes it is possible to make moral judgements. Effective action requires excellent self-management within an appropriate organisational hierarchy. It needs also to be guided by some kind of moral values. The conflicting sources and nature of those moral values is well analysed by Alistair MacIntyre (MacIntyre 2007).

Even before the term “servant leadership” (Greenleaf 1973, 2002) was generally popular, my personal convictions had led me to decide that I would not seek a senior management career path. Instead, I have always sought to do a useful “frontline” job with as much integrity as I can muster, in collaboration with managers, colleagues and above all students – students whom we serve as we lead.

My service within the academy has included programme management, subject leadership, significant curriculum development initiatives, the recruitment and admission of students, managing the e-learning provision of a business school and managing a department. However, teaching has always had primacy in my school life. Conversely, the teacher often does have to lead in the classroom context – it is an unavoidable management challenge which I have been glad to embrace.

I was privileged to manage the Master of Arts in International Business MAIB programme at Rennes School of Business. In that context, I had to project-manage the revalidation in 2012/3 of the whole institution by the British Open University, in conjunction with whom we ran that programme. At the same time, I assisted in the initial accreditation of the School by AACSB. This means that I have good knowledge and awareness of the requirements of external accreditation and of the practical difficulties involved in initiating and furthering them.

In wider life, I have served as a governor (director) of a public secondary school (US: high school; France: lycée).
3.1 Research-based future service

Some of the contributions of my doctoral research which I now intend to build upon include:

1. The beginnings of an understanding of the importance of what I call the Working Model of the knowledge worker. That working model – which is rarely surfaced – expresses itself in the personal work system that each and every one of us possesses. In turn, that personal work system is supported by a more or less developed personal information management system. I expect to find – but this remains a conjecture for which I have insufficient empirical evidence – that some knowledge workers will benefit from surfacing their personal working model and personal work system and from improving their personal information management. My forthcoming empirical research may prove to have wide applicability.

2. I have found it essential in undertaking research in this area to rethink in a fairly fundamental way, what we mean by an information system. Adopting a critical realist stance (Bhaskar 1975; Harré 2009; Mingers, Mutch, and Willcocks 2013; Mingers and Willcocks 2014), I now see the creation of a personal information management system and its evolution over time as an amalgam of explicit design and of inexplicit bricolage (Lévi-Strauss 1966; Ciborra and Jelassi 1994). The challenge is to help students and practitioners at all levels to understand their working model and to learn ways in which to improve it in conjunction with an appropriate and therefore deeply-personal information management system. This PIMS may simply be an ad hoc assemblage of tools and apps; but it may also benefit from some degree of conscious analysis and design.

3. The Conceprocity concept process reciprocity modelling language. I originally developed Conceprocity in order to permit conceptual modelling of the personal work system of the individual knowledge worker. I have already used Conceprocity in my teaching. Students have reported a high degree of satisfaction when using Conceprocity to analyse the structure of journal articles. Conceprocity has also been designed for requirements analysis, where I expect to find that less-technical students will find it much easier to learn than the UML language (which latter I see as being more useful in design than in analysis). A limited experiment while teaching the implementation of business information systems in Rennes, and a more extensive experiment with HNC students in Scarborough, tends to support this usefulness.

4. I have used Conceprocity as I developed and wrote my PhD thesis. Much of the literature concerning conceptual modelling assumes that that modelling takes place in the context of the development of Information Systems. It is my belief that conceptual modelling has a much wider role to play in learning, personal development and research enquiry. This is why I prefer
the French phrase ‘cartographie de connaissances’ (knowledge mapping) to ‘conceptual modelling’.

§4 Teaching, research, service: concluding remarks

I am sure that you will agree that I take all of teaching, research and service very seriously. I also very much like to work as a team member. However, ultimately we are each responsible for our own action and self-development. That is why structured reflection must be a part of the professional responsibility of any and every knowledge worker: see (Gregory and Descubes 2011). I have been glad of the challenge of such reflection on my own practice, which was specifically requested by an American university to which I recently made a job application. I have only made a beginning.
An introduction to Conceprocity can be found at my research website, www.MarkRogerGregory.net.
§5 BIBLIOGRAPHY


