From Geography Department to Business School: strategies for transplanting GIS courses between disciplines

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Abstract
A number of strategies have been adopted for the development and delivery of GIS curricula in various disciplines. The main strategies are described, evaluated and illustrated with reference to recent practice. The author then uses a transplantation analogy to describe the process whereby he adapted his own GIS modules following a move from a modestly sized geography department to a large business school. Several critical questions are posed, including: what is the best strategy for developing GIS courses for business students?; how does one ensure disciplinary and curricular fit in the transplantation process?; and what are the likely reactions and learning experiences of business students who take transplanted modules? Conclusions are drawn on the potential for geographers to assist in the development of GIS courses for other disciplines in the future.

Keywords: GIS, curriculum design, business, curriculum transplantation, geodemographics.

Introduction

This paper tells the story of a university lecturer who, in the late 1990s, became an émigré from the discipline he had studied and taught for most of his professional life. Although he is now a naturalised citizen in his adopted domain of marketing, and works in one of the UK's largest business schools, he has not forgotten his roots in geography, and much of his current teaching and research is informed by working in his previous community of practice. For much of the past decade he has taught .two GIS-related option modules designed specifically for undergraduate business students [1]. These modules ('*Geodemographics*' in semester 1, and '*GIS for Business*' in semester 2) are delivered largely by independent study, using Web-based study materials and practical exercises involving student use of commercial GIS software and 'real' datasets. The fact that both modules were developed from existing modules taught exclusively to geography students raises the central question of this paper: can courses developed in one discipline be effectively transferred to another discipline?

Rather than answer this question by suggesting a model GIS curriculum for business students, as has been done on several occasions for geographers and other geoscientists (Nyerges & Chrisman, 1989; Goodchild & Kemp, 1990; Unwin *et al*., 1990), this paper focuses instead on the strategies whereby such curricula may be developed. It then uses the concept of transplantation as a framework for analysing and evaluating the decision process adopted by the author in developing his own business GIS curricula. Throughout, it seeks to suggest general principles that may be applied by readers in their own institutions and, by implication, for subjects other than business. The term 'programme' will be used throughout the paper to refer to an entire course of study, which at undergraduate

level is typically of three years duration, and 'module' will be used to refer to an individual course unit within a programme, which usually runs for a semester or a whole academic year.

Strategies for the provision of GIS courses for business students

There is little published research on the teaching of GIS to business students. There are a few case studies of the design of particular business GIS curricula (e.g. Miller, 2004), and some general statements of the scale of provision, as in the case of the ESRI report which reported that "few schools of business offer their undergraduates and graduate students opportunities for emphasis in business geography technologies" (ESRI, 2004). This was supported by the results of a recent survey of 236 business school instructors (Brickley *et al.* 2006), which found that only 17% used GIS software, and that in teaching elements of the curriculum involving geographic segmentation, most of the instruction was based on lectures and textbooks. Only 14% reported using geographic segmentation software, and only 6% used GIS software.

Even less has been published on the curriculum strategies involved in developing GIS curricula for business students. One of the few glimpses of the process is provided by the slim pamphlet published by ESRI in 2004, which describes the approaches taken by five business schools in adopting GIS. By combining this scant evidence with Web-based information and personal knowledge, the author has identified six main strategies (Table 1). These are illustrated here in relation to Business Schools, but much the same strategies are available for any discipline in higher education.

<< Table 1 about here >>

Each of these strategies has its own mix of strengths and weaknesses. The first two are variants of the service teaching strategy that is common throughout higher education, perhaps best exemplified by statistics and computer programming, which are frequently taught across diverse disciplines by subject specialists. The degree of success of this strategy is often down to the staff concerned, and to the extent to which they adapt their subject matter, teaching approaches and materials to fit the subject domain of the students they service. The first of the two service strategies is exemplified by those geography departments who welcome business (and other) non-geography students onto their GIS courses, a pattern which developed at the author's own institution. The second service strategy is illustrated by Leeds University in the UK, where geography staff with considerable business consultancy experience devised and delivered an MA course in GIS for Business and Service Planning.

The third strategy for GIS curriculum development in a business context is exemplified by Kingston University, also in the UK, where the School of Earth Sciences and Geography has collaborated with the Business School to deliver an MSc course in Applied GIS and Management Studies. A similar approach is taken at West Chester University, Pennsylvania, where the Geography and Planning Department is part of the School of Business and Public Affairs (ESRI, 2004). The fifth strategy is adopted where business school staff acquire externally produced resources (such as the NCGIA's GIS curriculum materials: Goodchild & Kemp,

1990; Kemp & Goodchild, 1992) and deliver them to their own students. The sixth strategy is represented by the conferences and business partner programmes run at the Wharton School, University of Pennsylvania (ESRI, 2004), and also by the MBA programme at the University of Redlands, California, which has a significant GIS focus (ESRI, 2004). The rest of this paper considers the fourth strategy, which has been adopted by the author at Middlesex University.

It is important to note that this summary of common GIS curriculum development strategies applies most to conventional universities with a relatively well-developed academic departmental structure, in which geographers and geography departments are available to provide GIS expertise for the development of GIS courses adopted within business-related disciplines. Where there are no geographers or geoscientists available in an institution, then the first four strategies outlined in Table 1 may either involve non-geographers (e.g. biologists, historians, archaeologists, economists, computer scientists, sociologists and others), or they may not happen at all. For example, a number of recent studies have revealed that in many small liberal arts colleges in the USA, there is frequently no geography department, and that even where geography courses are offered, there may be little local GIS expertise available and little local access to GIS software and data. In such circumstances, the nurturing and support of GIS and GIS-related curricula may come from a number of alternative sources, including: multi-disciplinary groups of interested academics (e.g. Ekstrom, 2006; Ross, 2006), libraries (e.g. French, 2001; Donald, 2006), central administrative units (e.g. Ekstrom, 2006), or community outreach units (e.g. Ross, 2006). These add further options to those described in Table 1.

A second point worth noting is that the provision of GIS courses does not stand alone, nor is it always as simple as outlined above. One of the reasons for the complexity often found on the ground is that the development of GIS courses can result from developments that may have little immediate connection to education. One of these is research, which has often been the stimulus for harnessing GIS technology within an institution. It may only be later that research projects based on GIS technology leads to the development of GIS courses, and these may lean more towards teaching about GIS rather than teaching with GIS, and perhaps more often at a postgraduate than an undergraduate level. (It should be noted, however, that the presence of GIS-savvy postgraduate researchers in a department may provide invaluable support for GIS courses at various levels.) A second non-educational driver lies in an institution's own demands for GIS expertise, to support anything from student recruitment and services marketing to estates management and regional economic impact analysis (Donald, 2006). A third driver may be a university's community outreach or service learning activities, which aim to solve community problems or to support local regeneration initiatives (Kesler-Gilbert & Krygier, 2007; Mueller *et al*., 2006; Ross, 2006). Such developments may involve the design and delivery of GIS courses for staff or students based within the institution, preparing them for service learning or consultancy activities, and/or for those already working within the community.

Transplantation as a conceptual framework

The process of taking mature and thriving courses from one environment (a geography department) to another environment (a business school) is perhaps

best described in terms of transplantation, in which a person responsible for an original course uproots it and takes it with them to be planted in another discipline. The ecological version of the transplant analogy highlights the degree of fit between organisms and their environment, and the competition that exists between organisms (both existing and newcomers) in those environments. Unlike the models of spatial social organisation developed by the human ecology school at the University of Chicago in the 1930s (Hawley, 1950; Park, 1952), the transplant analogy will not be stretched beyond its point of maximum usefulness.

In the following sub-sections, five key elements that need to be considered in ensuring effective transplantation will be explored. Some of these were anticipated by the author and incorporated into his initial curriculum designs; others only became apparent after his GIS modules had been running for some time. Readers may find that additional factors are important in their own context, and this may necessitate a variation of this framework to meet their own circumstances.

Identifying a disciplinary best-fit

From a disciplinary point of view, the business school is by no means a homogeneous environment. Within Middlesex University Business School, for example, eight broad subjects are taught: accounting, business and management, finance, economics, human resource management, law, marketing, and statistics. Elements of geography and geographical thinking are already included within some of these subject areas, though not necessarily in the form they might appear within the discipline of geography. In business studies, for example, geography finds a home in the second 'E' (environment) of the PESTEL framework for thinking about influences in the business environment (Figure 1). Elsewhere, in human resource management (HRM), spatial considerations also arise in the planning of recruitment policies, and in the management of staff across multi-site organisations.

<< Figure 1 about here >>

In marketing management and strategic marketing, geography is also found in the analysis of strategies for rolling out marketing campaigns on the international stage, where issues such as globalisation and localisation are discussed (e.g. Lynch, 2005). In consumer marketing, geography was one of the four 'Ps' (place) in the original marketing mix (McCarthy, 1960; Gronroos, 1997), and it features strongly in retail location planning, consumer targeting, retail distribution, logistics and e-fulfilment. (See Figure 2.) It is hardly surprising, then, that several studies in the USA (e.g. Erevelles *et al.*, 1998; Hess *et al.*, 2004; Miller, 2006) have indicated the close potential fit between elements of GIS (and especially geodemographics) and the discipline of marketing. By contrast, broader GIS applications and principles tend to fit better with business and management, where they can be dealt with at both operational and strategic levels. At Redlands University, for example, where GIS is viewed as a decision science which underpins business decision making, GIS has been developed as a significant element of the MBA programme (ESRI, 2004).

<< Figure 2 about here >>

In order to maximise disciplinary fit at his own business school, the author decided to design two GIS modules, each addressed to a different constituency. The 'Geodemographics' module was aimed primarily at undergraduate marketing students, and the 'GIS for Business' module was pitched at the broader audience of mainstream business and management students. In designing his modules to fit these disciplines, the author was fortunate in having undertaken a considerable amount of GIS consultancy work while working in his former geography department. This gave him a direct understanding of the GIS needs of both businesses and public service organisations, and enabled him to create business-focused versions of his modules more rapidly and more effectively than if he had begun by learning about the theories, models and principles of business subjects from standard textbooks. This firsthand awareness of the business problem-solving capability of GIS also helped the author in crafting the detailed study materials for his modules (see below). Readers with less experience of the academic business environment are encouraged to develop partnerships with interested colleagues working in business disciplines to help guide their design of relevant courses. (This is the essence if the collaboration strategy in Table 1.)

The question as to whether the disciplinary fit worked out as planned leads to an interesting set of answers. The evidence suggests that things turned out rather differently to that envisaged at the planning stage. In the first year of running the 'Geodemographics' module (2005-2006), for example, only one of the 39 students who took the module were registered on a single-honours marketing programme, and in the case of 'GIS for Business', only 11 out of 54 students was registered on a single-honours marketing programme. A majority of the students came from the Joint Honours programme, which permits students to combine two business subjects in a major-minor combination. The majority of 'Geodemographics' students have been studying marketing as a major, while the majority of the 'GIS for Business' students have management or business as their major. However, a number of HRM students and business students have also opted for 'Geodemographics' each year, and several Computing Science students have taken 'GIS for Business'. Attempts at ensuring a close disciplinary fit for GIS may therefore be complicated by pragmatic curricular considerations, and especially by the arcane practice of student module choice.

Establishing an effective curriculum

The question of how best to introduce some desired new subject matter into an existing curriculum is one that is posed on a regular basis in relation to many subjects, including: statistics (MEANS, 1998), 'greening' (Shepherd, 1995), key skills (Hilliger, no date) and, more recently, ethics (Illingworth, 2004; Brennan & Eagle, 2006). There are perhaps three main ways in which GIS may be introduced into the business school curriculum: as a complete specialist programme in GIS; as one or more free-standing modules; or as GIS lectures and/or workshops added to existing substantive modules. (Unwin, 1997a, reviews other approaches to GIS curriculum design.) The first approach is the *specialist degree programme in GIS*. This requires a critical mass of specialist staff to design and deliver, and is an exception in the UK, even in large geography departments. Because the author joined his business school as a lone specialist (as he had been in his former geography department), this option was clearly impractical. The alternative option of *embedding lectures and workshops into existing modules*, by contrast, has

several appealing qualities: it requires minimal staff inputs; it causes the least disruption to the existing curriculum; it requires the minimum amount of additional learning by the relevant module leaders; and it chimes with the views of academic staff in marketing departments, at least in the USA, the overwhelming majority of whom would not wish to have a standalone GIS course in their department (Brickley & Micken, 2007). The embedding option has been championed by the Geographer's Craft project at the University of Texas at Austin (Foote, 1994), in the form of 'add-ins' to existing modules, and is also illustrated by the GIS 'tutorials' devised at Murray State University, which are embedded in existing marketing modules (Miller, 2006a; 2006b; 2006c; 2007; Miller *et al.*, 2007). In this particular initiative, it was possible to reach all marketing students by embedding GIS tutorials in seven different modules, and this represented a far broader exposure to GIS than would have been achieved if a single GIS elective module had been designed.

Despite these advantages, it was the third approach, the *free-standing module*, which appealed most to the author, partly because it was the approach he had used to teach GIS in his former geography department. However, it is often difficult to insert new modules into well-established programmes, because the latter usually have clearly-defined lists of carefully selected electives. This is a common problem, and often inhibits curricular innovation. At Roger Williams University in the USA, for example, one faculty member who helped to introduce GIS modules reports that "each major has limited room for [new] electives", and that he had to "convince the faculty that GIS adds to the skill set for their students and that the course complements their major" (Brickley, 2006). At the author's own university, the solution to this problem rested in the institution's modular framework, which gives marketing (and other) students the opportunity to select one or more modules outside the tight core of subjects which they are directed to study on their specialist programmes. This flexibility made it possible to design GIS modules which were available to students across the business school, and beyond. What would be lost in universal exposure to undergraduate marketing students would hopefully be gained in broader exposure across various business-related subjects.

However well designed a module may be, and however well it is made to fit existing curricular structures, it is dead in the water if students don't actually opt for it! The author's approach was the traditional, and rather idealistic (some would say naïve) one, best summed up by a well-worn marketing phrase: 'Build it, and they will come'. He believed that not only was GIS intrinsically interesting, but that it would provide students with highly marketable skills. Unfortunately, it is students who generally decide on the 'interestingness' of various subjects in the curriculum, not their tutors, and every business school tutor nowadays highlights the employability benefits of their particular modules. It was something of a surprise, then, to find that within a year of their launch, the 'Geodemographics' and 'GIS for Business' modules were attracting an average of 33 and 55 students respectively, which was approximately three times the number of students who had taken the author's original GIS modules in geography. So, what did he do right in the design and marketing of these modules?

The answer to this question is a salutary one, and illustrates the significance of the hidden curriculum among business students, and especially why they choose particular modules. Essentially, the students at the author's institution learnt very quickly that the new GIS modules were assessed purely on coursework, and this was a major attraction to many of them. Indeed, because almost all existing business modules include a formal exam, the coursework-only assessment of the GIS modules became their unique selling proposition (or USP) for many students. Other students were also attracted by the promise of a largely lecture-free module. After the modules had run for two years, it became clear that these factors were at least as important in attracting students as was the subject matter or vocational relevance of the modules.

Although an awareness of these issues are useful in building an effective strategy for marketing new courses in an alien and competitive environment, other unintended consequences also need to be taken into account. For example, a considerable number of students attracted to the author's modules for the reasons outlined above were found to have neither the required expertise (e.g. in ICT and/or marketing) nor sufficient motivation (e.g. in terms of independent study) to complete them successfully. In order to correct for this, and to ensure that students knew what they were letting themselves in for, time was set aside in the introductory class for both modules to talk students through a handout entitled: 'Is this module for me?'. The marketing dictum of knowing your customers well is equally sound advice for those delivering educational courses as it is for those selling products in the outside world.

Choosing what, and how much geography, to include

Despite what was said earlier about the potential disciplinary fit of GIS to certain elements of business, it is a mistake to think that business students will be familiar with geographical ways of thinking. For example, the majority of students (83.8%) taking the author's 'GIS for Business' module in 2005-2006 reported that they had little or no familiarity with the main geographical terms and concepts introduced in the module. Moreover, the vast majority (94.6%) of students that year, and two thirds (68.4%) of those taking it in the previous academic year, reported that none of their previous business modules had addressed geographical/spatial issues. This is rather surprising, given the presence of geography as space or place in both marketing and business, as described earlier. However, it is in line with the perhaps surprising results of a recent survey by Brickley and Micken (2007) which revealed that only about 30% of academic staff in a large sample survey in the US were familiar with GIS software at some level.

It is also a mistake to think that geography is equally as interesting to students outside the discipline as it is to lecturers within it, or that geographers have some kind of duty to introduce as much geography, or GIS theory, as they can on the back of their GIS curriculum. (A reminder was provided of this tendency by the module feedback comments of a recent student who asked rather bluntly for "less theory and more exercises".) The geography tutor who intends to transplant a GIS module into another discipline should therefore resist the urge to make only minor revisions to what he or she is currently teaching. The temptation is exacerbated because there is so much literature and free data available from the 'geo' communities that it is all too easy to include these in a business-related GIS

module. The author has learnt by experience that in order to reach out to the business student, he has had to actively distance himself from much of the geography inherent in GIS, and focus instead on the essentials. But, what are these essentials? And what are the possible ethical, scientific and/or educational implications of making such a decision?

There is perhaps an obvious need to teach relevant georeferencing -- with the emphasis on the relevant. For example, on the ‘GIS for Business’ module, which involves student use of the ArcView software, only latitude and longitude are introduced, because most of the datasets used on this module are available in world coordinates. (Of course, while these omissions may be reasonable for introductory modules, it would lead to considerable under-skilling of students wishing to create Web mashups to plot business information on Google Maps or Google Earth, where there is likely to be a need to convert between coordinate systems and projections.) By contrast, on the ‘Geodemographics’ module, which involves the use of the MapInfo software, students are introduced to Cartesian coordinates, because the majority of the datasets used are for the UK, and these use the National Grid coordinate system which is based on a transverse Mercator projection. However, georeferencing stops here on both modules; map projections are never mentioned. Beyond this, there is no hard and fast rule about how much -- and what -- geography should to be taught. For example, a professor of computer information systems who has introduced GIS into marketing at Roger Williams University in the USA has commented: “I'm spending very little time on geography concepts - perhaps a mistake. You have to talk about geographical and projection coordinate systems - but that's about as far as I go.” (Brickley, 2005).

The geographical knowledge and skills that are perhaps most difficult for business students to acquire are ones that trained geographers tend to take for granted. These include our obvious habit of referring to 'west' or 'northeast', rather than the student’s habit of referring to 'the left of London’, or 'the top right of the USA'. Also, when asked to interpret maps of geodemographic data, many business students simply have no concept of a spatial or geographical 'pattern', and need to be given many examples of different kinds of population or customer distributions in order for them to become confident in identifying 'clusters', 'dispersed distributions', 'linear concentrations', and the like. They can then move on to thinking about what these patterns might mean, both in terms of possible causes and also in terms of marketing strategies. A further set of spatial thinking capabilities includes the ability to compare patterns (e.g. is this cluster of ethnic minority population more concentrated and therefore easier to market to than another cluster?), and the ability to find associations between spatial patterns (e.g. are these customers located in areas that are well served by existing stores?). Most business students need a solid grounding in essential spatial thinking skills, of the kind that was the staple diet of many geography students half a century ago.

Further ideas on what geography to include may be gained by looking in standard business or marketing textbooks, or in the more wide-ranging report of the National Research Council (2005) into spatial thinking skills. However, several troubling questions emerge from such an exercise. The first is the danger of adopting a strongly or exclusively positivist approach to geographical thinking and

analysis, one that has been well explored in the geographical literature (e.g. Sheppard, 1993). A second danger is the adoption of a strongly technocratic approach to solving business and other problems (Taylor & Johnson, 1995). (Those unfamiliar with the academic literature of marketing may be interested to learn that there has been a growing groundswell of resistance to the highly managerialist and technologised approach represented by the models and tools promulgated in leading textbooks, and especially those numerous ones form the pen of the doyen of this approach, Phillip Kotler (e.g. Kotler, 1982; Kotler & Fox 1985; Kotler & Clarke 1987*;* Kotler *et al.*,1993; Kotler & Armstrong, 2004). A third problem, for some, is the way in which GIS may be pressed into service in support of the consumer society, rather than placed in the hands of community groups seeking to use it in alternative ways to serve their own ends (Dunn, 2007). Finally, there are the privacy and confidentiality issues related to the capture, integration and use of spatial surveillance data on individuals, from electoral roll and point-of-sale data (Curry, 1994; 1997) to the detailed street-level photography currently being undertaken by Google and others (Anon, 2008).

The duration of the GIS curriculum will play a large part in determining how much time can be made available for the consideration of such issues. If student exposure to GIS is only through occasional lectures, tutorials or workshops within substantive modules (the second of the embedding models discussed earlier), then it may be necessary for discussion time to be allocated within other classes run by the relevant module leaders. One of the advantages of a semester-long module is that it is at least possible to discuss some of the thornier design and interpretive problems that surround the use of GIS technology, including the principles of rule-based visualisation (e.g. Bertin's graphical sign system). This is increasingly important at a time when easy-to-use GIS facilities are becoming available on the desktop or through the Web which almost guarantee that users will make elementary mistakes both in the construction of spatial visualisations and in the interpretation of spatial patterns and processes.

Designing an appropriate pedagogy

Although it might be assumed that most business students are studying a vocational subject, which is meant to equip them for a career as practitioner, few of them have encountered what we might call active or experiential learning. Many learn their subject largely through a diet of lectures and seminars. As a result, a majority of them are unused to learning through doing, unlike many geography students who have encountered it through a strong diet of laboratory- and field-based practical work. Because it was the author's intention to equip business students with 'marketable' skills, and because the author generally believes in the efficacy of learning through guided and reflected-upon doing, he decided to design both of his modules around a sequence of study units that required the analysis and interpretation of real datasets using commercial software. At first, these modules were taught through supervised labs, but as student numbers rapidly increased, and no dedicated GIS laboratory was available in which to hold the classes (discussed further below), this approach became impractical, and both modules were converted to delivery by independent study.

The approach taken to independent study was based on a series of online study units, made available through the university's virtual learning environment (or

VLE). These units are organised around a standard weekly study load of about 10 hours. In their design, they do not descend to the same level as the 'bite-sized learning chunks' advocated in some quarters, and considerable effort was spent to ensure that they would avoid the superficiality of the 'cookbook' treatment common in many practical geography courses. Moreover, unlike Miller's Tutorials in Marketing Project (Miller, 2006a; 2006b; 2006c; 2007; Miller *et al*., 2007), where the GIS tutorials are almost entirely case study based, the author's study units may deal variously with specific GIS skills and/or real business problems.

Another pedagogical challenge facing students of transplanted modules is that they have to bridge the often significant gap in knowledge and experience that often exists between student knowledge of business concepts and practices on the one hand and their knowledge of the principles and approaches involved in an alien subject such as geography. One of the solutions adopted to mitigate this problem has been to divide each study unit into a small number of sections, each of which adopts a standard, 4-stage sequence of elements:

- An opening statement of the section's aims, including any overarching concepts, and how these might relate to mainstream business concepts or problems;
- one or more worked examples, indicating how the GIS software should be used to analyse the accompanying digital data;
- a follow-up exercise, on a closely related example, and a model answer for this exercise, which is meant to be consulted after the student has attempted to solve the problem themselves;
- supplementary comments that reinforce, highlight or otherwise extend the material introduced in the section, and invite the student to reflect on their learning.

In broad terms, this approach reflects a combination of the well-known 'ruleg' and 'egrule' principles of organising learning materials (Ref.), which are complementary ways of sequencing student exposure to principles and examples. (Ruleg is involved in the first two steps, and egrule is involved in the third and fourth steps.) This approach also articulates what Perkins and Salomon (1988) refer to as forward and backward reaching. For example, by illustrating the aims and principles with everyday examples, each section is designed to reduce the transfer distance between the new material and the students' existing knowledge. Worked examples are similarly intended to bridge the transfer of learning gap that exists between the principles and the exercises. Finally, frequent references to some of the students' own academic subjects serve to connect to their previous degree programme study. For example, an early study unit of the geodemographics module includes a broad overview of consumer profiling, segmentation and targeting, which they will have encountered previously, and this provides a suitable marketing context for introducing the geographical approach to segmentation (Harris *et al*., 2005).

Through this pedagogic strategy, students are confronted by a triple learning challenge. In the space of a single semester they have to learn about: GIS technology (software and digital data); geographical ways of thinking; and the independent style of learning. Although there is no room to discuss the issue

further here, it is worth recording that the greatest difficulty for many students has been the independent style of study introduced on these modules, rather than the necessity for geographical thinking and the use of GIS technology. Although there is ample student evaluation evidence that the online, resource-based approach works well, it is sometimes seen by weaker students as involving "too much reading", and it is noticeable that procedure-following problem solving is something that many students are inexperienced in undertaking. A significant minority of students try to avoid working their way through the online study units, and try to get by with looking over other students' shoulders, or else by exploratory pecking at likely-looking GIS software icons. In addition, however well-intentioned one's curriculum design ideas, there will always be those individuals who will subvert even the most carefully crafted learning process. A recent example is provided by one bright student who admitted that he always looked at the model answer first, then tried to figure out why it solved the stated problem, before trying to find a better solution of his own.

Acquiring the necessary resources

GIS is often viewed as a specialist subject requiring high-tech support. However, this need not necessarily be the case (Unwin, 1997b). The level of resources needed for successful teaching in this area depends largely on the approach one takes to teaching the subject. Three basic decisions need to be made up front which contribute to the most appropriate resource mix required. The first concerns whether one is teaching *with* GIS or teaching *about* GIS. The former may be delivered with relatively few specialist resources (e.g. relying heavily on online mapping software), while the latter will almost inevitably require a higher level of specialist resources (e.g. including specialist GIS software and associate digital data). However, with the ever increasing availability of free, GIS-like software on the Web, including 2D and 3D mapping systems, which are accompanied by multiple global spatial datasets, the costs of supporting GIS teaching is falling rapidly. Indeed, with the availability of sophisticated mapping and geovisualisation software that can be programmed through their highly accessible APIs (application programming interfaces), even advanced courses based on the creation of online mashups (the relatively ad hoc linkage of software components and dispersed datasets) may now be taught without having to purchase specialist software. (See, for example, Brown, 2006.)

A decision on resource needs also depends on a second decision, which concerns whether or not there is to be 'hands on' student use of the technology. If teaching is to be confined to introducing the principles of GIS and/or working through application case studies, then a low resource base may be sufficient. (These could consist, for example, of a mixture of slideshows, videos, handouts and web resources.) The third decision concerns the balance between the educational and training objectives of one's GIS courses. In an educationally oriented course, which focuses (say) on introducing GIS principles, there may be only a modest need for specialist software and data resources. By contrast, if one is preparing students with the skills to equip them in a career using GIS, then one has the added burden of acquiring software and data that reflect those currently in use in the real world. This can become something of an arms race as one attempts to mirror in the laboratory what is going on in the outside world. Paradoxically, perhaps, although a high proportion of business school courses are vocationally

oriented, few of them train students for specific business roles or jobs. The call for GIS training in a business school environment may there be muted or non-existent.

Each of these decisions is closely tied to curricular and pedagogic concerns, out of which they naturally emerge. One of the key issues is whether GIS software and digital spatial data need to be acquired to support student practical work. When this decision has been taken, another is needed for the realism level at which one wishes to operate. By realism level is meant the degree of fit between what students do in the classroom and what happens in the real world. This has two complementary dimensions. The first is whether students are to be given exposure to commercial-strength GIS (in this case, the software commonly used by business analysts), and the second is whether students are to be given access to actual data (in this case, the datasets that are commonly used in arriving at business decisions). There are some positives and some negatives that are worthy of brief note. On the plus side, there is a growing array of free, web-based services which may be used as the resource backbone of courses introducing GIS (or, more broadly, location technology). On the negative side, specialist software and digital data often cost significant amounts of money. (UK readers need to be aware, for example, that it is often preferable to incorporate digital data from the USA, where it is essentially free rather than to use domestic digital data which has to be bought from the national mapping agency, the Ordnance Survey, because it operates as a revenue-earning trading fund.) Again, somewhat paradoxically, some key business data (e.g. showing shopper locations), can be difficult to obtain because of commercial sensitivity and/or privacy issues. This is where it is useful to develop partnerships with colleagues who may have acquired such data through research or consultancy projects.

The ‘GIS Lab syndrome’, which is the urge to set up one’s own dedicated laboratory in which to run GIS courses, is a perennial concern in many institutions, and often attracts considerable debate. While working in his former geography department, the author set up a 20-seat GIS Lab over a period of years, arguing for the need to provide students with protected access to ‘specialist’ IT resources, and for the benefits of having a dedicated laboratory technician on hand to provide immediate support for students during the learning process. Additionally, it was argued that the lab would provide a base for running training courses and providing curriculum development support for academic geography staff, and for housing more specialist equipment (e.g. table digitisers and plotters) used by staff in creating digital maps for research and other purposes. Well-funded GIS Labs are undoubtedly popular in many parts of the world where GIS is taught. This is especially so where they also service the needs of specialist GIS research, consultancy and community outreach activities involving a strong geographical dimension (Refs). The Regional Research Laboratories and the GMAP consultancy at the University of Leeds (Birkin *et al.*, 1996) are powerful examples of this linkage in the UK. In the USA, there are numerous GIS labs located at prestigious universities, with the Harvard University Laboratory for Computer Graphics and Spatial Analysis (Chrisman, 2005) being among the more notable examples. However, even relatively small liberal arts colleges have gone down this route (Caris, 2006; Muleller *et al*., 2006), attracting funding from a mixture of local departments, college-wide units and external agencies.

Despite this common practice, however, dedicated laboratory space is not a universal requirement for teaching GIS. Indeed, the presence of specialist laboratories tends to be specific to particular disciplines in higher education institutions. Geography, for its part, has always had its fair share of laboratories, (including map rooms, geology labs, wet and dry sedimentation labs, drawing offices, and field equipment stores), so the idea of setting up a GIS laboratory is by no means an alien concept. Within business schools and their constituent disciplines, by contrast, the laboratory concept is far less well developed. As a result, far more effort may need to be expended on obtaining the required room space and attracting the necessary funding to establish a GIS Lab. (For a review of the issues surrounding the kitting out of a GIS Lab, see Unwin, 1997b.)

At the author's own business school, not only was the laboratory concept largely non-existent, but there was a general shortage of space because of the large number of students and the number of academic staff employed to teach them. Moreover, at the time of his transfer from geography, a general policy was being rolled out across the institution that all computer-related laboratories were to be made open-access, and therefore available to students requiring general-purpose IT facilities. In this new regime, the author made numerous attempts to book general-purpose computer labs for GIS teaching, but the continual interruptions of non-GIS students wandering in and out during lectures and demonstrations led to this approach being dropped. As a result of this resource constraint, his two GIS courses were remodelled for independent study, as described earlier. Apart from the loss of a protected learning space, one of the other things lost by not having a dedicated GIS Lab is the high degree of control over the software and data resources that can be available on lab PCs. At the author's own institution, for example, applications have to be made six months in advance for new software to be made available on machines in open-access computer labs, and considerable effort sometimes has to be made to convince the university's software panel that certain educationally valuable software (including Google Earth) should be installed. (Issues such as network bandwidth and security are important considerations.)

In discussing the technical resources needed in support of GIS teaching, care must be taken not to lose sight of perhaps the single most important kind of resource: the human (Unwin, 1997b). For the author, the loss of his GIS Lab was offset by the fact that his former GIS Lab technician migrated with him to the business school, and for half a dozen years provided sterling support for his GIS students. (Because of his expertise, he was then appointed as head of the school's newly established online learning support unit.) Because of the lack of a single base, the technician's previous mode of working with students in a single laboratory had to be significantly modified. On some occasions, he would arrange to attend specific open-access rooms at certain prearranged times where students would be able to seek his help working on their GIS study units. On other occasions, he would be just an email or an internal phone call away, and to this end every page of the online study materials for both GIS modules contained a link to an email template so that as soon as students encountered a problem, they could contact the technician and request that he come across to the particular computer room they were working in and help them find a solution. (Following the

promotion of his technician, the author himself now provides versions of these kinds of support for his students.)

Conclusions

The first conclusion is that there is ample evidence that GIS curricula can be successfully transplanted from a geography department to a business environment in higher education. The author's GIS modules have attracted large numbers of business students over the past 7 years, though it should be noted that a not inconsiderable number of them find the subject hard going. Comments in module evaluation questionnaires reveal that this is partly due to the fact that hardly any of them have previously encountered GIS (only 5% of them in 2004-2005). Nevertheless, despite their study difficulties, 90% of students in 2004-2005 and 92% in 2005-2006 indicated at the end of the module that their view of the role of GIS in business was that it was either 'fairly important' or 'very important', and 32% of students in 2004-2005 indicated that they would consider specialising in GIS in the future.

However, despite this success story, not every institution will be able to provide the appropriate environment for a successful transplant of GIS into their business curricula. The author is aware of at least one other UK university where a lecturer attempted to transfer GIS to a business department in a similar career move to his own, but which failed to work out as planned. Indeed, following an aborted attempt at introducing a GIS module into the business curriculum due to lack of student takers, the tutor involved reflected that students in his particular department "just don't get it [i.e.GIS]".

A second general conclusion is that there are several alternative strategies for developing and introducing GIS to business students. It is probably a fruitless exercise attempting to rank the six strategies identified earlier, in order to identify a single 'best' approach. Moreover, as has been repeatedly indicated, there are many complex issues relating to curriculum design and delivery that would make it almost impossible to undertake a strict head-to-head comparison of these strategies. The best advice that the author is able to offer is that those interested in developing and delivering GIS curricula for business students should consider each of the strategies in relation to their own situation, and adopt and adapt the one(s) that best suit their local needs.

A third conclusion is that the crafting of a successful curriculum can never be a once-only design exercise. Even when full cognisance is taken of contextual factors, a curriculum must be continually adapted and improved if it is to continue to attract and satisfy students.

A fourth conclusion, which has been illustrated several times, is to expect the unexpected. Not only will one's most cherished educational principles be challenged by reality on the ground, but students will frequently do things in ways that appear to subvert the designer's best-laid plans -- sometimes with unexpectedly beneficial results.

A fifth conclusion concerns the potential benefit of introducing GIS to business students or, indeed, to students of any discipline. A recent initiative in the USA

advocates the use of GIS as a means of helping students to develop their 'spatial thinking' skills across the entire K-12 curriculum (National Academy, 2006). Longley *et al.* (2001, p.443) suggest that GIS enables students to learn how to pose -- and supports them in trying to answer -- four significant spatial questions: what is?, where is?, why is?, and what if? In this context, it is perhaps worth considering Unwin's (2005) suggestion that GIS-centred geography, with its emphasis on spatial problem solving, may have more to offer the 'outside world' than conventional academic geography, with its emphasis on theory building. He indicates various lines of evidence that GIS-centred geography is already beginning to shape external perceptions of the discipline.

A sixth conclusion is that different disciplines will probably require their own migration paths, and will certainly throw up unique sets of problems, and because disciplines are constituted differently in different countries, these problems are likely to have an additional cultural twist. What is becoming clear is that in many institutions, the adoption process has only just begun. As Sinton recently observed in a US context (2006, p.2), "most colleges and universities are still trying to figure out how to make it all work well within the context of their campuses". Insights into how the adoption is working out in non-business disciplines may be seen in a number of recent studies (Sinton & Lund, 2007; Milson & Alibrandi, 2008).

As a final thought, it may be surmised that although geography has traditionally been thought of as the 'home' or 'guardian' of GIS (an assumption critically explored by Longley, 2000), the potential exists for the subject to lose this cachet in the near future. GIS technology is now becoming so widespread across university disciplines that secondary (or even primary) transplantation from disciplines other than geography can be expected to occur far more frequently in the future. In addition, other IT-based disciplines, including visual analytics (Thomas & Cook, 2005) and the inevitable geospatial visual analytics (ICA, 2008), have recently begun to attract considerable interest, in part because of their interdisciplinary approach to problem solving. If it is true that 80% of all business data are geographically referenced, then it can be argued that expertise in GIS should be viewed as a strategic asset for all business school students and business practitioners. If recently developed technologies such as web-based mapping and location-based services (LBS) are added to the traditional mix provided by business geographics and geodemographics, then GIS -- and its attendant geography -- belong firmly in the business sphere. Moreover, the large numbers of students enrolled in business schools compared to those in many geography departments make this a large and fertile market. Perhaps the time is ripe for more geographers to consider taking 'their' technology into business and other disciplines, or face the prospect of finally relinquishing ownership of what many now view as a pan-disciplinary toolkit.

Notes:

1. During the 2007-8 academic year, following a radical review of its entire course portfolio, the author's institution retired all existing semester-long modules (including both of the author's) and replaced them with new, year-long modules. As a result, elements of both of the author's modules described in this paper were integrated into a first-year core marketing module ('Marketing

Intelligence') which is taken by all undergraduate marketing students. The curricular implications of this change will be explored in a future paper.

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References

Anon (20080 Couple sues Google over 'Street View', *The Smoking Gun*, 1 April, www.thesmokinggun.com/ archive/years/2008/0404081google1.html (last accessed 30 January 2009).

Birkin, M, Clarke, G. Clarke, M. & Wilson, A. (1996) *Intelligent GIS: location decisions and strategic planning* (Cambridge: GeoInformation International).

Brennan, R. & Eagle, L. (2006) *Teaching Business/Marketing ethics – Who, when, with what objectives, via what methods – and what difference can it make?* Discussion Paper 39, Middlesex University Business School.

Brickley, M. (2006) Personal communication, 27 January 2006.

Brickley, M., Micken, K. & Carr, B. (2006) Can GIS play a role in the business curriculum?, *Proceedings, Northeast Decision Sciences Institute*, March 2006.

Brickley, M., Micken, K. (2007) GIS in the undergraduate curriculum: embraced or ignored?, ESRI Professional Papers, available online at: gis.esri.com/library/userconf/educ07/educ/abstracts/a1581.html (last accessed 19 May 2008).,

Brown, M. C. (2006) *Hacking Google Maps and Google Earth* (Indianapolis, IN: Wiley Publishing, Inc.).

Caris, J. (2006) Support model puts GIS on the map at Smith College, *Transformations*, 1 May 2006, pp.3-8.

Chrisman, N. (2005) Charting the Unknown: how computer mapping at Harvard became GIS (Redlands, CA: ESRI Press).

Curry, M. R. (1994) Image, practice, and the hidden impacts of geographic information systems, *Progress in Human Geography* 18, pp.441-59.

Curry, M. R. (1997) Digital people, digital places: rethinking privacy in a world of geographic information, *Ethics and Behavior*, 7(3), pp.253-263.

Donald, J. (21006) Supporting GIS at Trinity University: a role for libraries *Transformations*, 1 May 2006, pp.25-29.

Dunn, C. E. (2007) Participatory GIS - a people's GIS?, *Progress in Human Geography*, 31(5), pp.616-637.
Ekstrom, C. (2006) GIS support: an interdisciplinary approach, *Transformations*, 1 May 2006, pp.9-12.
Erevelles, S, Viswanathan, N. & Huntley, C. (1998) The use of GIS in marketing, in: J. Hair, C. Lamb & C. McDaniel (eds) *Great Ideas for Teaching Marketing* (Cincinnati, OH: South-Western College Publishing).
ESRI (2004) *Approaches to School Business GIS Programs* (Redlands, CA: Environmental Systems Research Institute).
Foote, K. E. (1994) The Geographer's Craft: a new approach to teaching geographical methods in the liberal arts curriculum, *The Pennsylvania Geographer*, 32, pp.1-25; available online at: www.colorado.edu/geography/gcraft/about/penngeog/penngeog.html (last accessed 30 January 2009).
French, M. (2001) Creating support mechanisms for library GIS services: a perspective, *Current Studies in Librarianship*, 25(1-2), pp.39-48.
Goodchild, M. F. & Kemp, K. K. (1990) *NCGIA Core Curriculum in GIS* (3 volumes) (Santa Barbara, CA: National Center for Geographic Information and Analysis).
Gronroos, C. (1997) From marketing mix to relationship marketing – towards a paradigm shift in marketing, *Management Decision*, 35(4), pp.322-339.
Harris, R., Sleight, P. & Webber, R. (2005) *Geodemographics, GIS and Neighbourhood Targeting* (Chichester: Wiley).
Hawley, A. H. (1950) *Human Ecology - a theory of community structure*.
Hess, R., Rubin, R. & West, L. (2004) Geographic information systems as a marketing information system technology, *Decision Support Systems*, 39(2), pp.197-213.
Hilliger, K. (no date) Teaching and learning strategies for embedding key skills: reshaping a marketing programme, available online at: www.business.heacademy.ac.uk/resources/reflect/conf/2001/hilliger/hilliger.pdf (last accessed 14 December 2006).
ICA (International Cartographic Association) (2008) Geospatial Visual Analytics, available online at: geoanalytics.net/GeoVisualAnalytics08/ (last accessed 30 January 2009).
Illingworth, S. A. (2004) *Approaches to Ethics in Higher Education: Teaching Ethics across the Curriculum*, (Leeds University, UK: Philosophical and Religious Studies Subject Centre), available at: www.prs.heacademy.ac.uk/projects/ethics/ethics_across_curriculum.pdf (last accessed 30 January 2009).
Kemp, K. K. & Goodchild, M. F. (1992) Evaluating a major innovation in Higher Education: the NCGIA Core Curriculum in GIS, *Journal of Geography in Higher Education*, 16(1), pp.21-36.
Kesler-Gilbert, M. K. & Krygier, J. B. (2007) Campus-community collaborations: integrating partnerships, service learning, mapping and GIS, in: D. S. Sinton & J. J. Lund (eds) *Understanding Place: GIS and mapping across the curriculum*, (Redlands, CA: ESRI Press).
Kotler, P. (1982) *Marketing for Nonprofit Organisations* , 2nd edition (Englewood Cliffs, NJ: Prentice-Hall).
Kotler, P. & Fox, K. A. (1985) *Strategic Marketing for Educational Institutions* (Englewood Cliffs, NJ: Prentice Hall).

Kotler, P. & Clarke, R. N. (1987) *Marketing for Healthcare Organizations* (Englewood Cliffs, NJ: Prentice Hall).
Kotler, P., Heider, D. H. & Rein, I. (1993) *Marketing Places: Attracting investment, industry and tourism to cities, states and nations* (Free Press).
Kotler, P. & Armstrong, G. (2004) *Principles of Marketing*, 10th edition (Upper Saddle River, NJ: Pearson).
Longley, P. A. (2000) The academic success of GIS in geography: problems and prospects, *Journal of Geographical Systems*, 2, pp.37-42.
Longley, P. A., Goodchild, M. F., Maguire, D. J. & Rhind, D. W. (2001) *Geographic Information Systems and Science* (Chichester: John Wiley & Sons).
Lynch, R. (2005) *Corporate Strategy*, 4th edition (London: FT/Prentice Hall).
McCarthy, 1960) *Basic Marketing: a managerial approach* (Homewood, IL: Irwin).
MEANS (1998) *Matching education, assessment and employment needs in statistics: final recommendations, Royal Statistical Society Centre for Statistical Education*, available online at: http://old.rsscse.org.uk/means/means.html (last accessed 30 January 2009).
Miller, F. (2006a) A modularized approach to GIS instruction in business school curricula: the GIS Tutorials in Marketing project, Proceedings, ESRI International Educators Users Conference, August.
Miller, F. (2006b) Assessing alternative delivery methods for GIS instruction in university business courses, Proceedings, Northeast Decision Sciences Institute, 31-24 March.
Miller, F. (2006c) Integrating geographic information systems (GIS) applications into business courses using online business geographics modules, *The Journal of Education for Business*, 87(2), pp.74-79.
Miller, F., Holmes, T. L. & Mangold, W. G. (2006) Integrating geographic information systems (GIS) into the marketing curriculum, *Marketing Education Review*, 17, pp.49-63.
Miller, F. (2007) *GIS Tutorial for Marketing* (Redlands, CA: ESRI Press).
Milson, A. J. & Alibrandi, M. (eds) (2008) *Digital Geography: geospatial technologies in the social studies classroom* (Charlotte, NC: Information Age Publishing).
Mueller, T. R., Mitchem, J. & Moses, L. (2006) Service learning and GIS: the key to funding opportunities, *Transformations*, 1 May 2006, pp.17-20.
National Research Council (2005) *Learning to Think Spatially: GIS as a support system in the K-12 curriculum* (Washington, DC: The National Academies Press).
Nyerges, T. L. & Chrisman, N. R. (1989) A framework for model curricula development in cartography and geographic information systems, *Professional Geographer*, 41, pp.283-293.
Padgett, D. A., Li, L. & Mignolo, A. (2000) Developing a GIS curriculum: the small liberal arts college experience, *Geographical Information Systems*, 10(4), pp.36-39.
Park, R. E. (1952) *Human Communities: the city and human ecology* (Glenn Coe, ILL: Free Press).
Perkins, D. N. & Salomon, G. (1988) Teaching for transfer, *Educational Leadership*, 46(1), pp.22-32.
Ross II, G. (2006) The GIS Initiative: a community outreach approach, *Transformations*, 1 May 2006, pp.21-24.

Shepherd, I. D. H. (1995) Integration Methods, in: G. Watkin *et al.* (Eds) *Taking Responsibility: Humanities and Social Sciences*, pp.35-45 (London: Pluto Press).
Shepherd, I. D. H. (2000) *Key Skills: teaching and learning for transfer* (London: DfEE, and Cheltenham: Geography Discipline Network, University of Gloucestershire).
Sheppard, E. (1993) Automated geography: what kind of geography for what kind of society?, *The Professional Geographer*, 45(4), pp.457-460.
Sinton, D. S. (2006) Managing and Supporting GIS in higher educational contexts: Editor's introduction, *Transformations*, 1 May 2006, p.2. (This and other articles in this special issue are available online at: www.nitle.org/index.php/nitle/transformations (last accessed 25 January 2009).
Sinton, D. S. & Lund, J. J. (eds) (2007) *Understanding Place: GIS and mapping across the curriculum* (Redlands, CA: ESRI Press).
Sleight, P. (1997) *Targetting Consumers: how to use geodemographic and lifestyle data in your business*, 2nd edition (Henley-on-Thames: NTC Publications).
Taylor, P. J. & Johnston, R. J. (1995) GIS and geography, in: J. Pickles (ed.) *Ground Truth: the social implications of geographic information systems*, pp.51-67 (New York, NY: The Guildford Pres).
Thomas, J. J. & Cook, K. A. (Ed.) (2005) *Illuminating the Path: The R&D Agenda for Visual Analytics*, National Visualization and Analytics Center.
Unwin, D. J. (2005) Fiddling on a different planet, *Geoforum*, 36(6), pp.681-684.
Unwin, D. J. (1997a) Unit 159 - Curriculum design for GIA, NCGIA Core Curriculum in Geographic Information Science, available at: www.ncgia.ucsb.edu/education/curricula/giscc/units/u159/u159.html (last accessed 29 January 2009).
Unwin, D. J. (1997b) Unit 160 - Teaching and learning GIS in laboratories, NCGIA Core Curriculum in Geographic Information Science, available at: www.ncgia.ucsb.edu/education/curricula/giscc/units/u160/u160.html (last accessed 29 January 2009).
Unwin, D. J., Blakemore, M. J., Dale, P., Healey, R.G., Jackson, M., Maguire, D.J., Martin, D., Mounsey, H. & J. Willis (1990) A syllabus for teaching geographical information systems, *International Journal of Geographical Information Systems*, 4(4), pp.457-465.

Strategy	Description
Service #1 (off-the-shelf)	Geography departments recruit business students onto their mainstream GIS courses
Service #2 (tailored)	Geography departments design and deliver GIS courses tailored for business students
Collaboration	Geography departments and business departments combine existing modules to create a hybrid GIS/business course
Transplantation	Geography staff move to a business school and develop embedded GIS courses
Buy-in	Business school staff acquire and deliver an off-the-shelf module in GIS
Home-grown	Business school staff design and deliver GIS courses for business students

Table 1. Strategies for creating GIS courses in Business Schools.

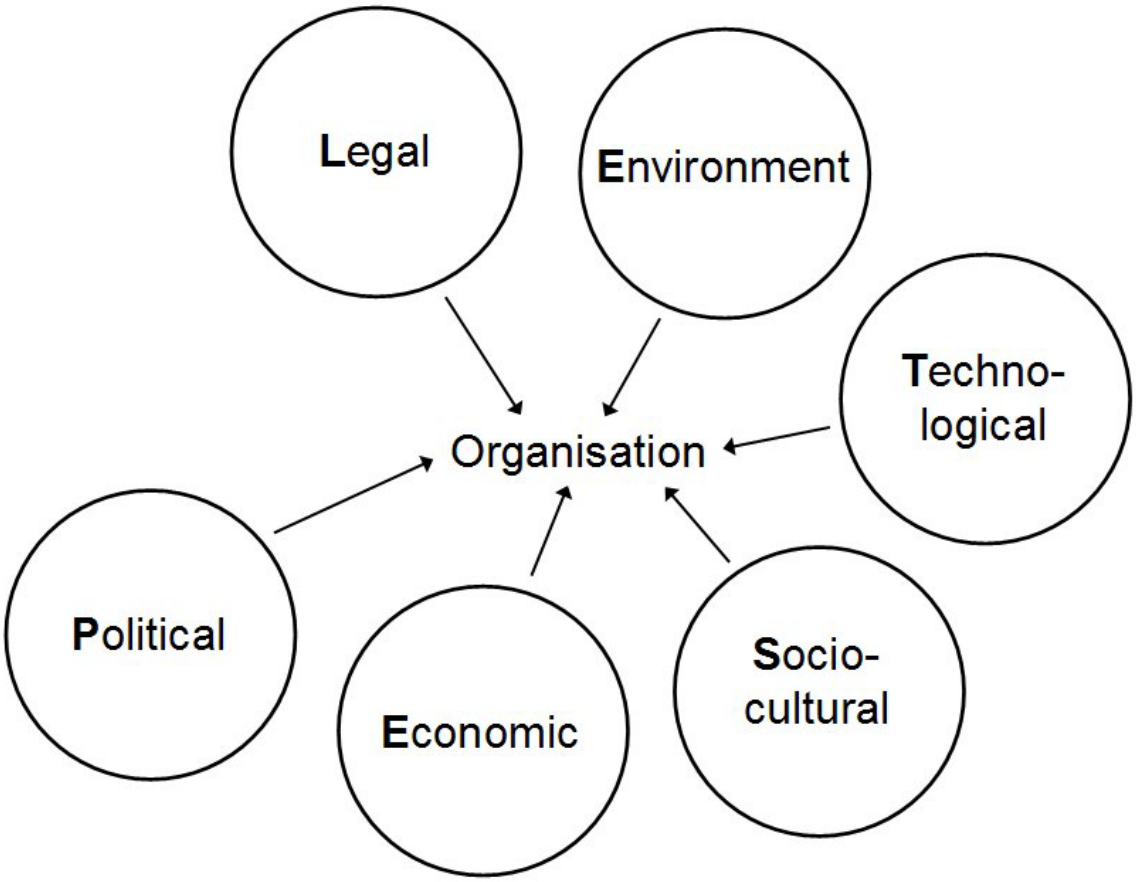

Figure 1. The PESTEL framework for understanding influences operating on the organisation.

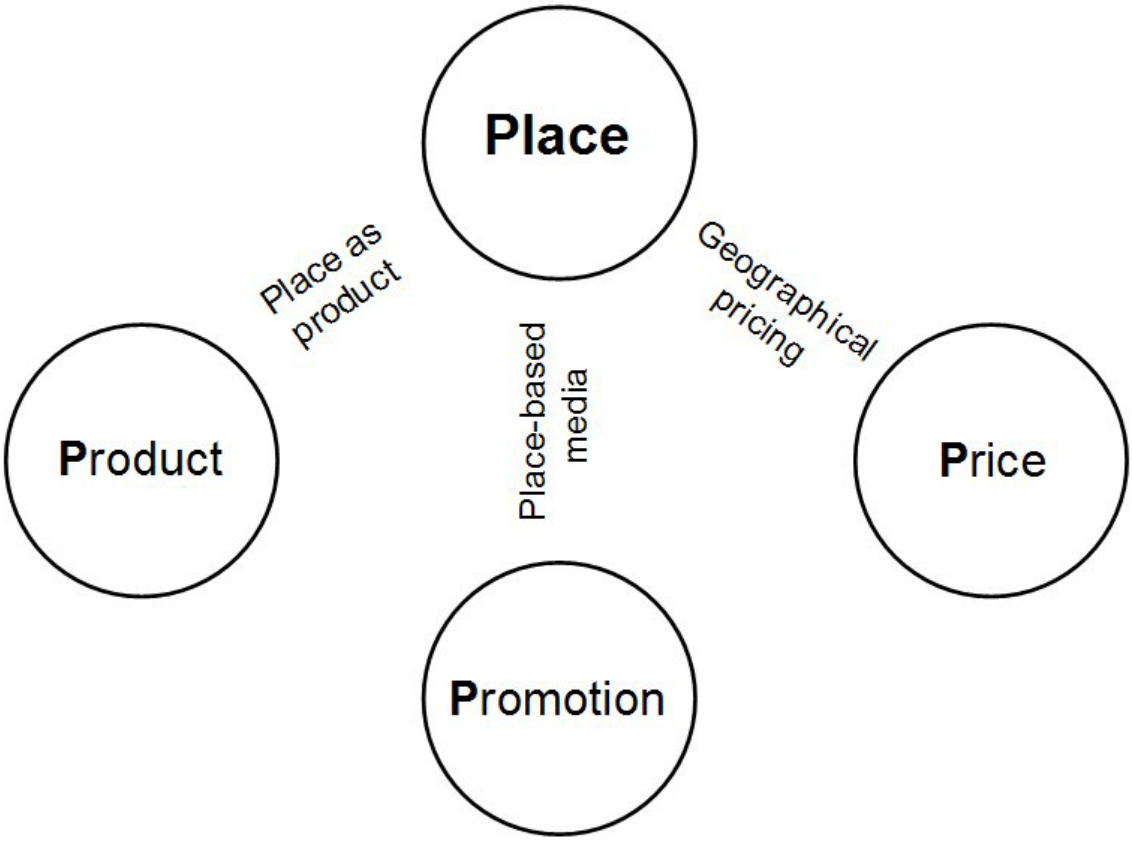

Figure 2. The 4 Ps of the traditional marketing mix, indicating suggested relationships between Place and the other three Ps.