Journal of International Women's Studies

Volume 5
Issue 3 *Feminist Challenges: Crossing Boundaries*

Article 2

May 2004

Heresy and Orthodoxy: Challenging Established Paradigms and Disciplines

Marion Hersch

Gloria Moss

Heresy and orthodoxy: Challenging established paradigms and disciplines

By Marion Hersch and Gloria Moss[i]

Abstract

A brief survey of the literature on interdisciplinary work and a discussion of issues relating to orthodoxy and heresy are presented to introduce a questionnaire on current interdisciplinary practice and the effects of engaging in research of this kind. Preliminary results of the survey are presented and it is suggested that women may have a greater tendency than men to engage in interdisciplinary research. They may also encounter more obstacles in their research than men. A number of hypotheses, including the relationship of interdisciplinary work and heresy, are proposed and a plan of further work to investigate them put forward.

Key words: Interdisciplinarity, gender, heresy

1. Introduction: Interdisciplinary Research and gender

There is a large literature examining the nature and consequences of the pursuit of interdisciplinary research, and separately a literature examining the extent to which the field of women's studies is situated within or without disciplines. Largely absent from the literature is an examination of the extent to which women's research in general (i.e. not simply research lying in the field of women's studies) is of an inter-disciplinary nature, and an examination of the consequences of any such engagement. There is also a body of literature on heresy and orthodoxy, but this rarely mentions interdisciplinary work. To fill these apparent gaps, this paper reports on the findings of two questionnaires completed by both male and female researchers engaged in inter-disciplinary research. It considers a variety of questions, including any evidence of a tendency for greater numbers of women than men to engage in research of this kind, the consequences of interdisciplinary work and its possible relationship to 'heresy'.

The paper is organised as follows. Section two discusses heresy, orthodoxy and interdisciplinarity and Section three presents a brief survey of the literature on interdisciplinary work and its effects and the position of women's studies vis-à-vis disciplinarity. The methodology of the two related surveys carried out by the authors on interdisciplinary work is discussed in Section fourand preliminary results of the two surveys are given in Sections five and six respectively. Suggestions for good practice from both surveys are presented in Section seven and conclusions discussed in Section eight.

2. Heresy, Orthodoxy and Interdisciplinarity

2.1 Heresy: Similarity and Passion

The term heresy was first used in religion. Although the term, as such is rarely used in this context, the associated attitudes and treatment have since spread to science and research more generally. Heresy generally has two main features:

- Similarity or closeness: theories, philosophies or ideas are generally only considered heretical when they have a broad area of commonality with the mainstream or orthodoxy, but differ in either significant or trivial aspects. Thus sects of a given religion may be considered heretical, but different religions generally are not. It is this closeness that

probably gives rises to the feelings of betrayal and the intense feelings of bitterness that 'heresy' can generate.

- Fervour or passion: the concept of heresy generally only arises about theories, philosophies or ideas which are taken very seriously. One example is the dispute within the Church of England concerning the ordination of homosexual priests, a dispute which threatens to tear the church apart. Further examples include the debates over GM food, mobile telephones and the war in Iraq. The feelings that can be provoked by differences in opinions can be extreme. Kuhn (1962) considers that resistance (particularly amongst older and more experienced academics) can be 'life-long' and 'indefinite' and that responses can be 'so emotional and erroneous' that they are otherwise difficult to explain.

The problem Kuhn describes is not new and was, for instance, observed by Leo Tolstoy a century ago:

> ….most men … can seldom accept even the simplest and most obvious truths if it can be such as would oblige them to admit the falsity of conclusions which they have delighted in explaining to colleagues, which they have proudly taught to others, and which they have woven, thread by thread, into the fabric of their lives (Jeffreys, 1998).

Tolstoy was speaking in general terms whereas most of Kuhn's discussion is focused on the natural sciences. However he does also refer to the social sciences and suggests that trying to reach a firm consensus in this field is 'extraordinarily arduous'. Findings in the field of change management mirror Kuhn's observations as to the emotional reactions an actual or threatened paradigm shift can provoke, and they also cast light on the sources of the problems. In terms of reactions, Pugh (1993) notes vividly that resistance may be manifested in 'A series of outraged objections, some relevant … some irrelevant'. He also suggests caution and that rational discussion of the underlying issues may not receive an equally rational response.

Johnson (1988) suggests that one factor underlying these emotional reactions is a perceived diminution of power arising from the threat to the prevailing paradigm. He considers that the most powerful people in organisations derive this power at least in part from their association with 'the constructs of power', making it very difficult for members of the organisation to challenge or change aspects of the paradigm unless such changes are evolutionary. In addition challenges to the organisational paradigm are frequently perceived as 'political' and 'cultural', rather than matters lending themselves to intellectual debate. As a result, analytical challenging of the status quo may lead to a 'political' rather than an 'intellectual' response in the form of action to preserve the integrity of the existing paradigm and resistance to the adoption of the new one.

Another interesting aspect is the denial through appeals to a higher authority of the fact that such reactions are emotional rather than intellectual. Using emotive words, such as traitor and heretic, in discussing 'threats' to the established order, whether in religion, research or politics, is portrayed as a reasoned rather than an emotional reaction. This also indicates a fear of acknowledging and expressing strong emotion. Research by Baron-Cohen (2003) and others, indicates gender differences in the capacity to experience emotion. However it may be rather that there are gender differences in what causes strong emotion, with threats of loss of power more likely to lead to strong emotional reactions in men, whereas suffering by themselves or others produces similar types of emotion in women. If this is the case (which remains to be proven) it would indicate a tendency for men to have a more egocentric and women a more holistic perspective. It should also be noted that all these propositions are generalisations which if proven to hold will not be true of all individuals.

This also raises question of whether women are likely to be more tolerant of heresy i.e. differing viewpoints than men or whether there are gender differences in the types of beliefs and behaviour considered heretical.

Another factor that affects the opinions considered legitimate are commercial interests. The extent to which scientific research is now underpinned by external sponsorship is underlined by a 1996 study by Krimsky and Rothenberg (2001) at Tufts University, Boston. Of a group of 1000 scientists publishing in 14 major scientific and medical journals in 1992, one third had commercial sponsorship. Increasing pressures to obtain commercial or military funding may lead scientists and engineers in particular to carry out research in areas likely to attract funding or slant their research in directions of interest to potential funders. For instance acceptance of a Ministry of Defence grant by the Bristol University veterinary school after rejection of the original project by a research council led to a change in research aims. Rather than studying the effects of four airborne organisms on the health of farm animals in closed environments, the study changed to the effects of the single organism Klebsialla pneumoniae, which does not endanger animals, but causes possibly fatal pneumonia in humans (Evans, Butler and Gonçalves, 1991). Thus the control of a high percentage of research funding by the military (and industry) may have already led to a shift away from long term fundamental research to short term applied work with immediate applications, resulting in a de facto limitation of academic freedom. There is also the question of whether it is appropriate that the research agenda should be determined by the military and industry and whether they are likely to do so in the interests of society as a whole. The need to seek financial disclosure from authors was discussed in Nature in 1997 (Editorial, 1997) and this is now a condition of publication in the Lancet and the Proceedings of the National Academy of Sciences.

The concept of religious heresy is generally meaningless in modern secular society, though not in societies in which religion plays a dominant and often also oppressive role. Religious tolerance seems to often be in part a consequence of the fact that religion does not matter enough for concern about doctrinal differences Thus raises a number of questions, including whether passion and tolerance are compatible and how tolerance can be achieved without a loss of passionate interest in and dedication to the subject. Another important question relates to the future of research. Will the increasing bureaucratisation and commercialisation of research lead to a reduction in concern about dissenting or heretical views or will the orthodoxy to be protected shift from established disciplinary expertise to bureaucratic procedures and commercial interests.

2.2 Heresy, Interdisciplinarity and Truth

There has been relatively little discussion of heresy and interdisciplinarity in the literature. For instance Gürsoy (1996) mentions it, but only in passing.
Interdisciplinary research may challenge two different (but related) orthodoxies:

- The orthodoxy of disciplinarity according to which all research activities should be carried out within a particular discipline.
- The orthodoxy of the particular discipline which interdisciplinarity challenges by bringing in ideas from outside and mixing them (in new ways) with the orthodox disciplinary ideas.

At the same time interdisciplinary research may seem close enough to the original disciplines to appear heretical rather than a new discipline with which the original disciplines do not have to concern themselves.

The difference between orthodoxy and 'heresy' in a particular context is largely determined by the relative power of their proponents, rather than necessarily any specific differences in characteristics of the different ideologies, theories or philosophies. One of the ways of maintaining orthodoxy is through gatekeeping, in which access to resources and publication in respected journals is restricted to individuals who are considered to conform and who present ideas or projects within the canon. As a consequence, indigenous knowledge, for instance, of edible plants, is disappearing or even being suppressed, since it is not recognised as valid or authoritative (Ilkkaracan and Appleton, 1995). The mechanisms by which this occurs are different in different contexts and include the lack of transparency and gender and race discrimination in the peer reviewing process for academic journals and the deliberations of research councils and other funding bodies.

It has been suggested that change often happens at the margins. Interdisciplinarity occurs at the margins or boundaries between disciplines and therefore often brings change, whether in terms of giving rise to new disciplines, which then may become part of new orthodoxies, or in the generation of new ideas. This mixture of creative potential and being situated at the margins or boundaries may also be a cause of hostility and suspicion.

Orthodoxy is often distinguished by a particular concept of the Truth, which is considered to be unique and knowable or revealed to particular (male) experts or leaders, whether scientific or religious. Heresy is therefore presented as based on lies and distortions and consequently requires to be challenged and suppressed because it denies this one Truth. However more tolerant or broad based approaches recognise that our theories and ability to perceive the Truth are only partial and that there are many possible approaches to finding or determining the Truth. An interesting perspective on this is given by one of Brecht's (1930) didactic plays in which a young comrade who tends to go his own way is told by four fellow activists: 'Don't separate yourself from us. You could be right and we could be wrong'. Their immediately preceding comment on 'heresy' is equally interesting: 'Show us the way we should go and we will follow it with you, but don't go the right way without us, as without us it is totally the wrong way.' There are parallels with interdisciplinarity, which can be considered to undermine the disciplinary Truth. The unfortunately disablist story about the blind men and the elephant is relevant here. While it should be recognised that blind people are no more likely to have limited perceptions than sighted people, it does illustrate the problem of restriction of viewpoint. In disciplinary terms the approaches and perspectives of a number of different disciplines may be required to comprehend the whole picture.

Power, passion and Truth have all been mentioned. Sometimes passion for defending the Truth is the main driving force behind the fight against heresy, whereas in other cases the rhetoric refers overtly to defending the Truth, but the real issues are concerned with defending establishment power. However a genuine belief in a particular Truth can coexist with use of belief in this Truth to preserve the status quo.

Interdisciplinary work often involves boundary crossing, which can be understood in the following ways:

- Acting as a bridge between different disciplinary languages and cultures. This is a very important aspect of interdisciplinary work and the existence of 'bridges' between the different disciplines, whether in the form of individuals or particular project activities is often a prerequisite for success. However, without taking the metaphor too far, it should be noted that bridges get trodden on. This is a serious potential risk for individuals who have a bridge-building role.
- Crossing or moving outside the boundaries of disciplines or paradigms. As discussed in the literature (Kuhn, 1962), this can often also be a risky strategy.
- Crossing the boundaries of orthodoxy into 'heresy', as discussed above.

2.3 Scapegoats and Whistlebowers

Another concept drawn from religion and myth, which is unfortunately of relevance to interdisciplinary research, is that of the scapegoat. Scapegoating is only effective when there is an element of delusion, which allows guilt, suffering and responsibility to be transferred to its victims (Girard, 1987). Scapegoating must remain unconscious to allow persecutors to chose their victim for inadequate reasons or randomly (other than being in a vulnerable position). The scapegoat is chosen to bear responsibility for reasons totally independent of any actual guilt, but there is still a question as to whether the scapegoat's objective innocence is important. The group of possible human victims is distinguished by being outside or on the fringes of society, ranging from the king who is isolated by being higher than everyone else, to the pharmakos (who was frequently both already condemned to death and considered very ugly, chosen to bear all the ills of the community and then burnt to death) who is lower. Individuals are more likely to become scapegoats if they are not well integrated into society and there are unlikely to be reprisals or vengeance for their deaths. Thus interdisciplinary researchers make 'good' scapegoats because their work occurs at the boundaries and can therefore easily be marginalized. They may also be less well integrated into the department both academically and socially than its other members.

Scapegoat myths generally have 'happy endings' with the collective murder or expulsion ending the problem by removing the 'trouble maker' who must therefore be guilty, or achieving some unexpected positive benefit which has little logical connection with the situation. Historical examples of scapegoating have generally had much less dramatic benefits. They have tended to unify the group or community against the alien 'threat' represented by the scapegoat, and thereby promote cohesion and group feeling. However this unification is based on exclusion (of the scapegoat) rather than inclusion. In addition to the suffering caused to the actual scapegoat, the scapegoating process legitimates discrimination and violence and the benefits are based on delusion or a lie. In both the mythic and historical contexts the collective violence against those who became the founding ancestors and tutelary divinities can also lead to the birth of a new cult, establishment of a totemic system or development of a new culture. Parallels probably exist here as well. Disciplining or expelling an interdisciplinary researcher may 'tame' their heretical ideas and enable their serious consideration and acceptance, as part of a new orthodoxy. Although scapegoating is only one of many mechanisms, it may be becoming increasingly important with the growth of a cult of blame in universities and many interdisciplinary researchers do suffer in their careers.

Another relevant parallel is to the treatment of whistleblowers who publicise wrong-doing in organizations (Hersh, 2002). Many surveys and other accounts indicate that whistleblowers experience retaliation, sometimes of a very severe kind. In a proposed four-stage model of retaliation (O'Day, 1972) the second and third stages are isolation and defamation of character, raising the idea of the whistleblower as heretic. The problem, as presented, is not in the organization, but in the whistleblower's false views.

This then raises the question of how to investigate the relationship between heresy, boundary crossing and interdisciplinary work and there are a number of associated difficulties. In particular definitions of 'heresy' and orthodoxy are likely to vary and many researchers, particularly in more traditional disciplines, may be uncomfortable with the concepts. Researchers may also not wish to label themselves as either orthodox practitioners or heretics.

The first approach to investigation has been through the use of a questionnaire, including questions about whether researchers challenge the paradigms of their disciplines and whether they consider themselves as insiders or outsiders in their work and in their lives. While there is some relationship between being an outsider in work and life and frequently

challenging disciplinary boundaries, it does not follow that these researchers should all be considered 'heretics' and those who rarely go outside disciplinary boundaries and consider themselves insiders in both work and life should be considered orthodox. The use of indepth interviews, focus groups and power relationship diagrams may be helpful in investigating these issues further.

3. Interdisciplinary Research and gender: the literature

Research has been conducted on the nature of inter-disciplinary work and its consequences and separately from this the position of women's studies vis-à-vis disciplinarity. A brief overview of this literature is presented in sections 3.1 and 3.2 respectively.

3.1 Interdisciplinary research

Interdisciplinary research involves the study of the scholarly and institutional relationships among various branches or fields of knowledge and the exploration of how those fields might be brought together (Salter and Hearn, 1996). A large literature exists looking at issues surrounding this kind of research. Dating from the 1950s (Qin, Lancaster and Allen, 1997) it offers definitions of interdisciplinary research (distinguishing it from multidisciplinary research) (Rossini and Porter, 1981; Salter and Hearn, 1996), profiles of those likely to engage in this research, in terms of age, status and gender (Birnbaum, 1981; Bruhn, 2000)–with one study reporting that over 90% of interdisciplinary researchers in the sciences were male, and without concern for tenure, either because they already have obtained it, or because they are not in tenure track positions (Birnbaum, 1981) - and the pitfalls and benefits of this kind of research (Birnbaum, 1982; Bruhn, 2000; Rossini and Porter, 1981; Wilson, 1996; Younglove-Webb et al., 1999). The problems highlighted by the literature can be separated into those focusing on input issues–problems of communication and teamwork – and those focusing on output issues-from ease of publication to overall impact on an interdisciplinary researcher's career. Salter and Hearn (1996) highlight two key communication issues namely the 'translation problem' (arising from differences between disciplines in the way information is presented) and the 'language problem' (the same words are used in distinct ways in different disciplines).

Not only, according to the literature, is interdisciplinary research problematic, but it can be hazardous as well. The literature links this to the fact that interdisciplinary research can conflict with the traditional academic system of most universities (Robertson, 1988), as well as the fact that the system of rewards in academia may be geared to single discipline research rather than to interdisciplinary work (Nelson, 1980). Part of the problem may lie in the fact that interdisciplinary work may be refereed by scholars who lack expertise in some of the fields represented in the work and may as a consequence receive lower ratings as compared to single disciplinary work. According to Rossini and Porter (1981), interdisciplinary projects are rated less favourably than single discipline work and peer review is 'fundamentally and ineluctably anti-innovation', favouring well established research areas over nascent ones. Therefore it is not surprising to discover that interdisciplinary researchers can find that their careers suffer as a consequence of their involvement in interdisciplinary research (Bruhn, 2000). The literature tends to downplay the problems facing interdisciplinary researchers, one study speaking in heroic terms of interdisciplinarians as 'hybrid scholars', 'border crossers', less anxious in high stress situations than others or as scholars who refuse to let their creativity be politically controlled (Bird, 2001).

While the literature plays down the problems associated with interdisciplinary research, it deals eloquently with its benefits. These include: increased productivity (Younglove-Webb et al., 1999), gap bridging (Nelson, 1980), problem solving (Nelson,

1980) and more creative and original work (Younglove-Webb et al., 1999). One study goes so far as to suggest that new disciplines are 'often created by researchers at the margins of their field' (Editorial, 1997), typically those engaged in interdisciplinary research. Elsewhere, those scientists involved in work of this kind are described as 'defy[ing] the crowds' (Bruhn, 2000). Given that Wilson (Wilson, 1996) regards specialisation as, in part, a defensive strategy against overload, and given that, according to Birnbaum (1982) problems are becoming more complex, one can see how interdisciplinary work could bring associated benefits.

3.2 Women's studies and disciplinarity

According to research conducted in the early 1980s (Allen and Kitch, 1998), more than 90% of interdisciplinary researchers in the sciences were male. Since the majority of researchers in the sciences are male, a more relevant question would be on the relative proportions of male and female workers in interdisciplinary and single disciplinary research. This question is equally relevant to interdisciplinary research outside the sciences. The closest seemingly relevant studies are focused on the field of women's studies and their relationship to interdisciplinary research. According to Pryse (2000), women's studies is situated within an interdisciplinary environment that is ill defined, yet promoting of cross-cultural insight. She discusses the institutional barriers and challenges such work presents to the 'exclusionary logic' of disciplinary structures.

This theme of the oppositional nature of disciplinary and interdisciplinary research is developed elsewhere. Bird (2001) describes disciplines as 'particularistic' and interdisciplinary work as 'holistic'. Allen and Kitch (1998) define 'disciplines' as 'domains of inquiry that share objects of study … governed by a general set of rules and categories' and interdisciplinarity as the 'integration of disciplines' to create a new epistemology that rebuilds the prevailing structures of knowledge. They define interdisciplinary scholarship to be of fundamental importance in recasting women's studies investigations beyond conventional limits on to innovative terrain. Boxer (2000) takes a disciplinary approach back to the

> 'powerful authoritative voices, largely male, that two centuries ago … began to corral all kinds of knowledge into the disciplinary forms that came over the last century to structure academies of higher learning'.

She contrasts this with feminist work that has 'resisted some of the disciplinary rules' and situates this in the context of Klein's model, allowing for 'normal' boundary crossing at one end of the extreme, to 'oppositional' boundary crossing (which challenges the disciplinary order) at the other.

However there is no or little discussion in the literature of the following questions:

- Any differences in the ways in which women and men carry out interdisciplinary work
- Any gender-based differences in experiences of interdisciplinary work, including barriers, problems and consequences for career progression.
- The extent to which men and women carry out interdisciplinary work
- The interaction of other identity factors, such as race/ethnicity, age and class with gender in determining experiences and practices of interdisciplinary work.

In order to investigate the answers to some of these questions, a questionnaire was prepared and posted on two sites:

1. http://www.elec.gla.ac.uk/projects/Leonardo/leonardo/ques_interd.html and publicised on a number of mailing lists which include high proportions of researchers working in the areas of assistive technology and rehabilitation engineering. The questionnaire was also offered in alternative formats to make it accessible.
2. The website of the Institute for Feminist Theory and Research http://www.iftr.org.uk.

Although the authors recognise that women researchers are not a homogenous group and that other identity factors may also be significant, it was decided to focus initially purely on gender. The influence of other identity factors may form the subject of further work.

4. Methodological Issues

The results reported in this survey are based on two related questionnaires. Both questionnaires are divided into four sections. The first section requests information about the respondent's gender, employment situation, level of seniority, concerns about job security, disciplinary background and similarity of this background to that of the department or section. This information will be used to investigate correlations between interdisciplinary research and other factors. The second section investigates involvement in interdisciplinary research, the nature of the interdisciplinarity in terms of an individual working across many disciplines and/or project groups involving people from different disciplines, the disciplines involved, the gender balance of interdisciplinary and other project groups and the benefits and disadvantages of an interdisciplinary approach. Section three investigates perceived benefits and problems associated with interdisciplinary research. Section four looks at suggestions for good practice.

The first questionnaire focuses specifically on researchers working in the areas of assistive technology and rehabilitation engineering, which is believed to be strongly interdisciplinary. It therefore includes questions on interdisciplinary research both in the area of assistive technology and in other areas. The second questionnaire has a stronger gender focus and is aimed at all researchers rather than those working specifically in the area of assistive technology. Thus it asks about interdisciplinary work in general rather than focusing on interdisciplinary work in assistive technology and other areas. It also contains questions on multi-tasking and identity as an insider or outsider. Analysis of the first questionnaire led to additional response options being offered to some of the questions.

Information about the questionnaires was sufficiently widely distributed to avoid bias from this source. However it is very difficult to avoid self-selection bias with this type of questionnaire. Although difficult to prove, it is considered likely that a higher proportion of the respondents are involved in or supportive of interdisciplinary research or consider it important to project success than in the total population. However it is considered unlikely that there was respondent bias in the areas of personal characteristics, approaches to carrying out interdisciplinary research or the barriers encountered. The likelihood of self-selection bias has been taken account of by the collection of a mixture of qualitative and quantitative data and the application of more qualitative rather than statistical techniques of analysis. This also helps identify specific factors and individual circumstances.

4.1 Results

To date 51 completed questionnaires have been received, 30 from the first survey and 21 from the second survey. Not all respondents answered all (applicable) questions. The results of the two questionnaires, other than suggestions for good practice, will be reported on separately and then compared and contrasted. The suggestions for good practice from the two questionnaires will be combined since there are no methodological reasons for not doing this.

However any differences in approaches to good practice between the two groups will be noted.

The relatively small number of responses received makes the use of descriptive rather than statistical analysis techniques appropriate. This approach fits well with the combination of qualitative and quantitative questions. For this reason percentages of respondents are quoted as rounded approximations, such as about two thirds or about 40%, rather than the exact percentages of respondents being used to avoid giving a false impression of statistical precision and accuracy of the results.

5. First questionnaire on Interdisciplinary research in assistive technology

5.1 The respondents

Three quarters of the respondents are male, and only one quarter female. Two thirds of respondents are experienced, nearly 60% have a permanent job and just under 40% are on a short term contract, with approximately the same percentages (though not always the same respondents) not worried and worried to some extent about job security and no respondents very worried. The respondents are split 60:40 between academia and 'other', with none from industry. The majority of respondents are at the ends of the spectrum with regards to seniority. Disciplinary backgrounds are very varied and include both respondents with apparently single disciplinary backgrounds, such as electronic engineering and others with backgrounds in several related disciplines, such as physics and electrical engineering. However respondents with fairly similar backgrounds may describe themselves very differently, with some respondents only stating the major discipline studied and others providing information on all disciplines, including those to which there has been very minor exposure. The majority have a disciplinary background in engineering or the natural sciences. The disciplinary background of just over 45% of the respondents is very similar to that of their institution and of another nearly 45% moderately similar.

5.2 The Research: Type of Interdisciplinarity and Gender Aspects

Nearly 80% of respondents are currently or had previously been involved in interdisciplinary work in assistive technology or rehabilitation engineering and 60% have been or are currently involved in interdisciplinary work in other areas, including two of the respondents not involved in interdisciplinary work in assistive technology. In nearly 70% of cases interdisciplinary work in assistive technology involves respondents both personally working in a number of disciplines and collaborating with others from different disciplines, with the remaining 30% collaborating with colleagues from different disciplines. In other areas than assistive technology just under half the cases of interdisciplinarity involve collaboration with other disciplines, nearly 30% of cases personal interdisciplinary and only just under a quarter of cases both personal interdisciplinarity and collaboration. Unlike in assistive technology, work in other areas includes cases of personal interdisciplinarity without collaboration. About 30% and nearly 60% of respondents respectively found the interdisciplinary approach an important and a very important component of success in both assistive technology and other projects (with the remainder considering it moderately important). Clearly the overwhelming majority of respondents consider an interdisciplinary approach to have been important or very important to the success of projects where it has been used.

The percentage of women was higher in interdisciplinary than other projects in nearly half and the same in just over a quarter of the nearly two thirds of cases where specific answers were given to the question of the ratios of women to men in both interdisciplinary and other projects. This indicates that a higher proportion of female than male researchers may be involved in interdisciplinary research.

5.3 Experiences of Interdisciplinary Research: Benefits, Problems and Communication Issues

Nearly 90% of respondents had enjoyed the challenge of interdisciplinary research with the other 10% enjoying it sometimes. Nearly 80% of respondents consider they do work which 'sometimes' challenges the established paradigms of their disciplines and 20% that they do work which 'generally' challenges these paradigms. Unfortunately a category of 'often' challenging the paradigms was not included.

Benefits of interdisciplinary research suggested by respondents include providing a critical mass of skills; facilitating effective cross fertilisation of ideas; allowing both technical aspects and social impacts to be considered; providing a broader approach and obtaining better quality results; facilitating the development of strategies to obtain meaningful solutions in complex situations; as well as personal benefits in terms of obtaining insight into other disciplines and perspectives. The perceived disadvantages could be considered the flip side of this and relate to problems in managing teams with different academic and work cultures, research priorities and objectives; difficulties resulting from people unwilling to see other perspectives or shift their position even slightly; and competing interests between the different disciplines.

Approximately 30%, 40% and a quarter of respondents respectively find it 'very easy', 'easy' and 'moderately easy' to communicate with colleagues in their own discipline, whereas there was an approximately equal split between finding it 'easy' and 'moderately easy' to communicate with colleagues using other paradigms, with only one respondent finding it very easy; and just under 30% and just under half of respondents finding it 'easy' and 'moderately easy' to communicate with colleagues from other disciplines. Only one and two respondents admitted to finding it hard to communicate with colleagues in the same discipline and using different paradigms, respectively, whereas three and two respondents find it 'hard' and 'very hard' respectively to communicate with colleagues from other disciplines. This may indicate a relationship between being able to solve the communication problems and successful interdisciplinary research. There also seems to be a definite trend of slightly decreasing ease of communication in going from one's own discipline to different paradigms to different disciplines. Suggested strategies for communicating across disciplines and paradigms include both practical means, such as email, seminars, workshops and conferences and a philosophical approach. Several respondents suggested (in different words) the need for open mindedness and respect and creating an environment in which all views are listened to and valued.

Few respondents generally experienced obstacles to interdisciplinary work or were undermined by colleagues, but just over a third had sometimes experienced obstacles and just under a third sometimes felt undermined by colleagues. Just over half the respondents to this question (nearly 90% of all respondents) felt isolated either regularly or sometimes. Problems in publication (for reasons other than the quality of the work), such as the paradigms used or being outside the remit of journals were generally not an issue and only concerned 10% of respondents. However approximately a third of respondents consider there are barriers to interdisciplinary work in both assistive technology and other areas and approximately half are unsure, with less than a fifth considering there are no barriers. Barriers considered to exist include problems in obtaining funding, difficulties in people assimilating different opinions or interests, little interest in research in assistive technology and a lack of substantive involvement of disabled end-users, though this has improved recently.

6. Second questionnaire on Interdisciplinary research

6.1 The Respondents

A total of 21 responses were received to this questionnaire. The balance of the genders is different in this survey from the first one, with two-thirds of respondents, this time, being female, and one third male. Half of the respondents are experienced with a permanent position and 30% are on short-term contracts, with similar percentages having some and no worries about job security.

The vast majority (about 80%) of respondents are from academia with none from industry or government. The majority of respondents are at the ends of the spectrum with regards to seniority, with about a quarter at the senior end, and 30% at the more junior end. Of the four Faculties represented (Arts, Sciences, Social Sciences, Law), 45% of respondents are from the Arts, 25% from the Social Sciences, and 25% from the Sciences and Law. Disciplinary backgrounds are very varied and include both respondents with apparently single disciplinary backgrounds (such as history) and others with backgrounds in several related disciplines, such as language, culture, gender and media studies. The interdisciplinary research itself embraces numerous combinations of disciplines. Some span the sciences, arts and social sciences (10%), some span just two of these Faculties (65%) and some interdisciplinary is concentrated in one Faculty area (25%).

Thus there are a number of differences in the characteristics of the respondents to the two questionnaires. In particular the majority of respondents to the first questionnaire are male and from engineering and the sciences, whereas the majority of the respondents to the second questionnaire are female and from the arts and humanities. This raises issues as to whether any differences found in responses are either gender or subject based, though there may be some correlation between the two due to the preponderance of men in engineering and the sciences and the relatively largely numbers of women in arts and humanities. In addition the overwhelming majority of respondents in the second survey come from universities or research institutes, whereas over 40% of respondents in the first survey came from other organisations.

One of the main reasons for involvement in interdisciplinary work reported by respondents is the inherent interdisciplinarity of certain areas or the requirement to consider them from an interdisciplinary perspective. Other reasons cited include the need to build bridges, whether for oneself or others and an interdisciplinary background from a joint honours degree.

Only just over and just under 20% of respondents consider themselves outsiders in their lives and work respectively. However respondents are divided more equally (11:10 and 4:3 in work and life respectively) between those who consider themselves insiders and those who either consider themselves outsiders or are unsure of their status. The combined figure indicates that a significant percentage of interdisciplinary researchers do not feel fully at home in the work environment, but comparative data on single disciplinary researchers would be required to more fully interpret this result.

There is a tendency to multi-tasking amongst respondents, with 80% involved in this at home and at work. Again a comparison with the practices of single disciplinary researchers would be useful to determine whether there is a link between multi-tasking and interdisciplinary work.

6.2 The Research: Type of Interdisciplinarity and Gender Aspects

The overwhelming majority of respondents are involved in interdisciplinary work which involves personal interdisciplinarity either on its own (nearly 40%) or in combination with working with colleagues from other disciplines (nearly 50%). Only about 15% of respondents' interdisciplinary work solely involves collaboration with colleagues from other disciplines. This supports the finding of the first survey that personal interdisciplinary work, particularly in collaboration with colleagues, is an important component of interdisciplinary

research. However the role of purely personal interdisciplinary work was found to be much stronger and of purely collaborative interdisciplinary work much weaker than in the first survey.

In two thirds of the 40% of cases where specific answers were given to the question of the ratios of women to men in both interdisciplinary and other projects, a higher ratio of women to men was reported in interdisciplinary compared to other projects. In just under a third of cases equal numbers of women were reported to be working in interdisciplinary and other research. Although different project groups have different numbers of members, the higher proportion of women in interdisciplinary than other research groups in both surveys gives an indication that a higher percentage of female than male researchers are currently involved in interdisciplinary research.

6.3 Experiences of Interdisciplinary Research: Benefits, Problems and Communication Issues

Respondents to the second survey reported more problems, barriers to interdisciplinary work and greater communication difficulties than in the first survey – just under 70% of respondents speak of barriers to IDR work - but they universally enjoyed the challenges and with only two exceptions (who considered it important or moderately important) considered interdisciplinarity very important for the success of their research. This may be a case of the second group of respondents being more realistic about the problems and consequently working harder to overcome them and experiencing increased satisfaction and success. However there could also be other explanations.

With only one exception, respondents reported that their interdisciplinary work challenges established paradigms 'generally', 'often' or 'sometimes'. Two thirds of respondents cite this as happening 'generally' or 'often'. All but two of the respondents considered that the interdisciplinary nature of the research was critical to the research's success, with slightly under half linking interdisciplinary with a new understanding of issues, and a fifth linking it with the formulation of new ideas. One respondent expressed the advantages as 'seeing things as a web rather than a line'.

45% of respondents find it 'moderately easy' and another 45% easy or very easy to communicate with other researchers from the same or related disciplines. These percentages reduce to 40% for communication with researchers using different paradigms and the percentage of respondents finding communication hard or very hard doubles from a tenth to a fifth. In the case of communication with researchers from different disciplines there were slightly more respondents who reported finding this hard or very hard (about 40%) than moderately easy (35%) and the percentage of respondents finding this type of communication easy or very easy dropped to just over 15%. As with the first questionnaire, there is trend of increasing difficulty of communication in going from one's own discipline to different paradigms to different disciplines, but much greater communication problems were experienced (or admitted to), particularly across disciplines.

Just under 70% of respondents consider that there are barriers to interdisciplinary work. Those cited include: research funding programmes being geared towards highly specific topic areas; human ignorance; tradition and careerism; fixed university structures; obstacles or obstruction from colleagues, problems with journals, and too many researchers unprepared to think 'outside the box'. The problems experienced led one respondent to conclude that 'the fundamental platform of academia is geared in many instances away from interdisciplinary work'. However another respondent considered that interdisciplinary work is now being stimulated. Over half of the respondents have experienced problems in publishing due to each of the following on at least one occasion: the nature of the topic, using paradigms which have not yet been accepted, paradigms which challenge disciplinary

orthodoxy and work being outside the remit of established journals. About 40% have experienced problems in each of these areas sometimes or frequently and another approximately 15-20% have experienced problems in each area on one occasion. This shows a significant difference from the first survey in which problems in publishing work (for reasons other than its quality) were experienced by a only small minority. Part of the difference is probably due to the different response options encouraging a higher response rate, but the remainder could be a consequence of the higher proportion of women in the second survey, the different mixture of subjects or specific factors associated with assistive technology research which do not hold for other types of research.

Isolation and obstacles or obstruction from colleagues are problems for the majority of respondents, with nearly 30% feeling isolated, another third sometimes feeling isolated and the same percentages experiencing obstacles and obstruction from colleagues generally or sometimes. Being undermined as a researcher is a problem for a significant minority of respondents, with nearly 30% undermined and nearly 15% sometimes undermined. The greater experience of problems in all these areas than in the first survey could be a consequence of the higher proportion of women in the second survey, the different mixture of subjects or specific factors associated with assistive technology research which do not hold for other types of research.

7. Suggestions for Good Practice

Suggestions for good practice include encouraging research projects on the theme of interdisciplinary work; all participants to be equal and valued stakeholders and project 'owners', regardless of their disciplines; ensuring all participants are aware of all objectives and progress in parts of the projects involving other disciplines, for instance by regular walkthrough sessions; having a good coordinator; well qualified partners who are open to interdisciplinary work and other perspectives; regular communication and project review; being open, listening and insisting that other participants do; involvement of disabled people; setting aside time to understand the perspectives of other disciplines; developing communication strategies to be understood by all participants and being sensitive to other people's feeling. It should be noted that many of these suggestions are equally important for the success of single disciplinary research and that there are no significant differences in the types of suggestions made by the two groups of respondents.

8. Conclusions

Initial conclusions from this survey corroborate many of the findings of other surveys, for instance on the status of interdisciplinary researchers, the problems encountered and the benefits of interdisciplinarity, but seem to contradict others, such as the earlier indication that more male than female researchers are involved in interdisciplinary research: both questionnaires reported on here suggest the very opposite, or at least that a higher percentage of female than male researchers may be involved in interdisciplinary research. The second survey, unlike the first, had a majority of female respondents, and it is noteworthy that this second survey reported higher levels of problems and obstacles, as well as greater difficulties in communication particularly across disciplines than the first questionnaire. Other noteworthy indications from the two survey are the importance of the combination of personal interdisciplinarity and collaboration with colleagues across disciplines in carrying out interdisciplinary research. This goes against the reporting of collaboration with colleagues across the disciplines as the main approach to interdisciplinary work in much of the literature. Differences in the proportions of respondents exhibiting personal interdisciplinarity and collaborating across disciplines in the two surveys may be gender based.

Responses to the questions on challenging disciplinary boundaries, considering oneself an insider or outsider in work and life and experiencing isolation and obstruction from colleagues particularly in the second survey, give an indication of possible links between interdisciplinary work and heresy. However more in-depth investigation, for instance through focus groups and interviews would be required to draw firm conclusions. In some cases the differences in responses on these questions was solely to differences in the two questionnaires, with, for instance, the questions on being an insider or outsider only present on the second questionnaire. However there is also a possibility of gender differences, due to the greater percentages of men and women answering the first and second questionnaires respectively.

The relatively small numbers of respondents means that conclusions are only tentative. The authors hope to carry out further research, initially using the two existing surveys at http://www.elec.gla.ac.uk/projects/Leonardo/leonardo/ques_interd.html and http://www.iftr.org.uk, to investigate the following questions:

- Differences in the numbers of women and men involved in interdisciplinary research.
- Gender differences in experiences of interdisciplinary research, including the extent and types of problems, barriers and other difficulties as well as levels of satisfaction.
- Gender differences in approaches and methods used, including to overcoming problems.
- The balance between personal interdisciplinarity, interdisciplinarity through collaboration and a mixture of the two and any gender differences in this balance.
- The consequences of interdisciplinary work on career progression, access to grant funding and ability to publish and gender differences in these consequences.
- The influence of other identity factors on gender differences.
- Perceptions of interdisciplinary work or researchers as heresy or heretics either by themselves or others.
- The ways in which perceptions of and attitudes to heresy affect the conduct of interdisciplinary work and the experiences of interdisciplinary researchers.
- Gender differences in attitudes to heresy and the use of new paradigms, particularly if they challenge established orthodoxies.

References

Allen, Judith and Kitch, Sally (1998), 'Disciplines by disciplines? The need for an interdisciplinary research mission in women's studies', *Feminist Studies*, 24:2, 275-299.

Baron-Cohe, Simon n (2003), *The Essential Difference: Men, Women and the Extreme Male Brain*, London: Allen Lane.

Bird,Elizabeth (2001), 'Disciplining the interdisciplinary: radicalism and the academic curriculum', *British Journal of Sociology of Education*, 22:4, 463-478.

Birnbaum, Philip (1981), 'Academic interdisciplinary research', *Sociological Research Association Journal*, 5-16

Birnbaum, Philip (1982) 'The organization & management of interdisciplinary research', *Sociological Research Association Journal*, 11-23

Boxer, Marilyn (2000), 'Unruly Knowledge: Women's Studies and the Problem of Disciplinarity', Indiana University Press: Indiana.

Brecht, Bertolt (1930, 1972) *Die Maßnahme*, Suhrkamp Verlag

Bruhn, John (2000) 'Interdisciplinary research', *Integrative Physiology. and Behavioural Sciience*, 35(1), 58-66

Editorial (1997) 'Avoid financial ' correctness'', *Nature*, 385: 469.

Evans, Rob; Butler, Nicola and Gonçalves Eddie (1991). *The Campus Connection, Military Research on Campus*, Student CND.
Girard, Rene (1987). 'Generative scapegoating', in *Violent Origins, Ritual Killing and Cultural Formation*, Burkett, Walter, Girard Rene and Smith, Jonathan, Stanford University Press, pp. 73-105.
Gürsoy, Akile (1996) 'Beyond the orthodox: heresy in medicine and the social sciences from a cross-cultural perspective', *Social Science Medical,* 43(5), 577-599.
Hersh, Marion (2002) 'Whistleblowers – heroes or traitors?: individual and collective responsibility for ethical behaviour', *Annual Reviews in Control*, 26, 243-262.
Ilkkaracan, Ipek and Appleton,Helen (1995) *Women's Roles in Technical Innovation*, Intermediate Technology Publication.
Jeffreys, Toni (1998) *Your Health at Risk*, London: Harper Collins.
Johnson, Gerry (1988), *Processing of Managing Strategic Change*, Management Research News 11, 4/5, 43-6.
Krimsky, Sheldon and Rothenberg, Leslie Steven (2001) 'Conflict of interest policies in science and medical journals: editorial practices and author disclosures', *Science and Engineering Ethics*, 7, 205-218.
Kuhn, Thomas (1962), *The Structure of Scientific Revolutions*, Chicago: University of Chicago Press.
Nelson, Neil (1980) 'Issues in funding & evaluating interdisciplinary research', *Journal of Canadian Stuies*, 15(3), 25–9
O'Day, Rory (1972) 'Intimidation rituals: reactions to reform' *Journal of Applied Behavioural Science*, 10, 373-386.
Porter, Alan and Rossini, Frederick (1985) 'Peer review of interdisciplinary research proposals', *Science, Technology and Human Values*, 10(3), 33–38.
Pryse, Marjorie (2000), 'Trans/Feminist methodology: bridges to interdisciplinary thinking', *NWSA Journal*, Summer, 12:12, 105 et seq.
Pugh, Derek (1993) 'Understanding and managing organisational change', in: *Managing Change*, Mabey, C and Mayon-White, B (eds,), London: Paul Chapman.
Qin, Jian, Lancaster, Frederick and Allen, Bryce (1997), 'Types and levels of collaboration in interdisciplinary research in the sciences', *Journal of the American Society for Information Science*, 48(10), 893-916
Robertson, Ivan (1998), 'Some factors associated with successful interdisciplinary research', *Sociological Research Association Journal* 13(2)
Rossini, Frederick and Porter, Alan (1981) 'Interdisciplinary research,' *Journal of Sociological Research Administration* 13(2), 8–24
Salter, Liora and Hearn, Alison (1996) *Outside the Lines*, McGill Queen's University Press
Wilson, Patrick (1996) 'Interdisciplinary research and information overload', *Library Trends*, 45(2) 192-203
Younglove-Webb Julie (1999) 'The dynamics of multidisciplinary research teams in academia', *The Review of Higher Education*, 22(4), 425-440

[i] Marion Hersh is a Lecturer in the Department of Electronics & Electrical Engineering, University of Glasgow and can be contacted at m.hersh@elec.gla.ac.uk
Gloria Moss is a Research Fellow in the Business School at the University of Glamorgan and can be contacted