"You must be very intelligent...?":

Gender and Science Subject Uptake

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ABSTRACT

The reasons that fewer girls than boys choose to study physics have, with few national exceptions, been an on-going academic and policy concern. This paper considers how 'common-sense' ideas about subject choice are gendered and are based on notions of 'natural' interest and 'natural' abilities of boys and girls. It identifies instances of such reasoning in sociological theories, most recently Catherine Hakim's preference theory. Drawing on ethnomethodology and Bourdieu's framework for the analysis of modes of knowledge production, the paper argues that 'common-sense' reasoning produces and reproduces gendered understandings about 'appropriate' and 'natural' male and female interests and abilities. Secondary qualitative analysis from a study on science uptake demonstates how girls who express interest in physics have to justify such preferences.

KEYWORDS

physics, preference theory, essentialism, gender, 'common-sense'

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INTRODUCTION

Rates of female participation in physics, as students at different educational levels and as scientists, and the reasons for these rates, have long been the concern of academic and policy analysis. Such concern is expressed in the context of the persistent horizontal segregation of the scientific and engineering labour market (Cahoon, 2011, p. 527; European Commission, 2010) and also in the context of enduring patterns of lower shares of female participation in tertiary education in science and engineering in the EU as compared to all fields (Eurobarometer, 2010, p. 52; Hughes, 2010; O'Rand, 2004). This concern is not limited to tertiary education – subject choice at secondary school largely determines further study and ultimately occupation, and the promotion of take up of physics has also been the focus of academic (Murphy and Whitelegg, 2006) and policy concern (Council of Europe, 2011). The trends in uptake of physics subjects in secondary school in Ireland show a consistent and enduring pattern of lower female than male participation (see Annex 1); a pattern that is evident in other countries (e. g., Murphy and Whitelegg, 2006; Moreau and Mendick, 2012).

Understanding the processes giving rise to such trends has 'real-world' implications because, at the very least, research findings inform policy and related activities. If the trends are the result of unconstrained choices, then the rationale for interventions to promote equal participation are weak. This paper rests on the fundamental proposition that the analysis of gender relations is central to understanding the differences between the differential take up of physics by boys and girls. 'Gender' refers to those social and cultural perceptions associated with biological 'sex' differences; these are socially constructed as 'masculine' and 'feminine'. A starting point is therefore to broadly locate the analysis of gender relations within a theoretical framework before moving to the intrepretive framework which draws selectively on ethnomethodology (Garfinkel, 1967; Lynch and Peyrot, 1992) and Bourdieu's framework (1990).

CONTEXT OF TRENDS: THEORETICAL FRAMEWORKS

The context of patriarchy, defined by Walby (1989) as 'a system of social structures and practices in which men dominate, oppress and exploit women' (p. 214) is the reference point in understanding the 'gender order' (Connell, 1987). Walby's elaboration of patriarchy situates gender relations in social institutions; it foregrounds power relations and sites of its operation (including the labour market and the education system). She identifies theoretically both a system and its structure:

> Patriarchy needs to be conceptualised at different levels of abstraction. At the most abstract level it exists as a system of social relations. In

contemporary Britain, this exists in articulation with capitalism and with racism. However, I do not wish to say that it is homologous in internal structure with capitalism. At the next level down, patriarchy is composed of six structures: the patriarchal mode of production, patriarchal relations in paid work, patriarchal relations in the state, male violence, patriarchal relations in sexuality, and patriarchal relations in cultural institutions, such as religion, the media and education. Any concrete instance will embody the effects, not only of patriarchal structures, but also of capitalism and racism (p. 214).

Patriarchy constitutes a backcloth or framework within which a particular gender order is established – the gender order refers to the gender arrangements in a particular society, as described by Connell (1987, see also Moreau and Mendick, 2012) and 'gender regime' – the organisation of gender relations in specific institutions. Gender is central to the experience of education; Ryan argues that people's experiences of 'being a boy' or 'being a girl' are shaped in many ways by the experience of schooling (in Tovey and Share, 2000, p.171). Walby similarly comments that 'the education system has been important in both differentiating men and women and providing men with more credentials. The forms of closure against women are usually more subtle because of the explicit discourse of "meritous achivement"' (1989, p. 227). A futher explicit discourse is that of 'preference' or 'interest', which can also function as a form of closure to women, as will be demonstrated in this paper.

Crompton and Sanderson point to the challenges of capturing the structuring role of gender in occupational preference in their comment that

> [g]ender is and has been significant in the structuring of individual occupations and thus of the occupational order as a whole. However 'gender' cannot be reduced to the status of a single variable...[It] is a multi-faceted phenomenon manifest though a net of social and institutional relationships linked across different areas of social life (1998, p. 171).

This signals the interacting nature of different 'gender regimes' within an overarching 'gender order' organised by patriarchy. The organisation of gender relations within different sites can reinforce or challenge these arrangements. Understanding the 'contextual web' is theoretically important and also relevant in terms of developing measures to increase female participation in physics, for example.

Understanding choice: encounters with preference theory
This paper was prompted by two 'encounters' with preference theory; firstly, Gash's (2008) study of whether women in different European countries freely choose part-time work or were constrained in their choices concluded that, albeit varying by national systems, women's preferences for part time work were constrained by childcare availability. Freedom of choice was not evident. Secondly, and more directly, it was prompted by Hakim's recent efforts to extend the scope of

preference theory from the labour market to the education system. Hakim asserts that

> [i]n all countries, the most enduring segregation of men and women is in the educational system, long before people enter the labour market, as women continue to prefer courses in arts, humanities and social sciences, while men are more likely to choose courses in maths, science and engineering. Sex differences in tastes emerge early and are resistant to attempts to impose politically correct choices because sexism is no longer the dominant factor in young people's lives (2008, p. 215, emphasis added).

Occupational segregation, both vertically and horizontally, has been 'at the heart of debates about gender inequality' (Blackburn and Jaman, 1997, p. 2). This segregation is the focus of Hakim's preference theory which is recognised as being extremely influential. James claims that 'since the early 1990s, research on women's work orientiations has been dominated by debate over Hakim's influential preference theory'(2008, p. 394). The fundamental assertion of preference theory is that social structural constraints of social life are secondary to individual choices and that these choices are made freely, that is, without constraint.

Such reasoning would also apply to the STEM employment field – occupational segregation, in this framework, can be explained by reference to women's 'free choice' of career. The extent to which this claimed influence of Hakim's preference theory is evident in analyses of women's participation in STEM is not known. However, the existence of academic disciplinary silos may mean that those in the STEM research field are unaware of the debate to which James (2008) refers. Further, the adoption of preference theory may result in essentialism (i.e., the analyses of social action which assume that men and women have innate characteristics which account for difference) being incorporated into future analyses. Critics have argued that such essentialism pervades Hakim's work, a charge she rejects (2007) but it is noted that her rejection is based on the premise that 'gender' is a 'redundant concept' (p.125) and that individual preferences are replacing such factors. Sayer (1997) remarks that critiques of essentialism are concerned to '[c]ounter characteristations of people, practices, institutions and other social phenomenon as having fixed identities which deterministically produced fixed uniform outcomes' (p. 454).

Preference theory foregrounds the ways in which 'commonsense' ideas about social behaviour are expressed. This paper contests the idea that 'choice' or 'preference' is freely made; it asserts that social structural constraints operate and further, that 'traces' of constraint can be discerned in accounts of 'choices'. Exploring the social bases of choice is important in understanding the trend data of student participation rates in different subjects; if these and labour market participation patterns are taken as simply reflecting individual choices outside of social context then it means that efforts to promote higher levels of participation of women in both education systems and in the labour market are set to fail. This is the logical conclusion of Hakim's preference theory.

The structure of the paper is as follows: the basic features of preference theory are outlined and the move to extend the reach of this theory to account for subject choice evidenced. Countering the argument that choices are 'freely' made, secondary data from a study which, inter alia, explored science subject uptake, are presented to illustrate the ways in which gendered understandings inform, firstly, ideas about which jobs 'suit' females and secondly, ideas about male and female approaches to learning. Data from focus group and in-depth interviews with secondary school students and teachers suggest that girls' selection of physics continues to be be constructed as 'unusual'. Categorising girls in this way may account for lower levels of participation and points to the the need for ongoing programmes to counter this gendered categorisation.

In the concluding sections of the paper the limitations of using secondary data to explore this topic are considered and further areas for research are suggested. Such research needs to move beyond description that simply reproduces 'commonsense' understandings of social life to more sociological understandings which seek to uncover the complex dynamics operating. This paper thus touches on, but only references, a wider debate centred on reflexivity, embodiment, and the 'detraditionalisation' of gender:

> ..the claim that gender…and other inter-related axes of difference, power and inequality are being detraditionalised and replaced by processes of individualisation where-in people (agents) increasingly make reflexive decisions about their biographical projects (self-reflexivity) and indeed reflect on the conditions of their existence (structural reflexivity) and so invent their own certainties (Kenway and McLeod, 2004, pp. 525ff).

While noting the existence of this debate, the more limited aim of this paper is to counter analyses based on 'commonsense' understandings of why girls and boys choose different subjects by illustrating how notions of 'appropriate' subjects for boy and girls inform staff's and students' accounts of subject selection. The 'appropriateness' of subjects are attributed to gendered notions of ability, future job possibilities and 'happiness'.

The starting point of my engagement with Hakim, the backcloth to my argument, is the wider literature on gender and physics. My intention is to signal to the reader some of the key themes in this ever growing literature. Murphy and Whitelegg (2006) present a review of 177 sources on the participation of girls in physics covering a period of 15 years (1990-2005), considering the factors that influence their choice and the impact of various strategies to enhance girls' achievement in, and recruitment to, the subject. They note that there are three key determinants which are seen to account for students' attitudes to physics:

1. how students see themselves in relation to the subject, both now and in the future: their 'physics self-concept';
2. their experience of school physics;
3. a personally supportive physics teacher (2006, p. iii).

Others have also identified the operation of tripartite structures which can be mapped to those presented by Murphy and Whitelegg, for example Hannan et al.'s work on schooling and 'sex roles' in Ireland (1983) posits (i) provision; (ii) allocation (subject groupings), and (iii) student choice. The wider literature on girls, femininity and schooling which informed the development of the original research, but also informed the reanalysis of the dataset in response to Hakim's statement about girls' choices, includes work on patriarchy (Walby, 1989, 2000), Sue Lees' seminal work on sexuality and adolescent schoolgirls and the negotiation of gender identity (1986), and on gender in schools and the responsibility of schools to promote gender equality, elaborated in Kenway and Willis (1998).

Preference theory: an overview
Preference theory is an explicit example of work referred to by Kenway and McLeod (2004) which claims that 'social structures are declining in social significance and that this has been accompanied by increasing agency with regard to the rules and norms of social life' (p. 534). Choices are freely made by individuals with little constraint. The dominance of Catherine Hakim has been remarked upon (James, 2008) and so for this reason I consider her work. Comprehensive critical reviews of Hakim's preference theory are available (see Crompton and Sanderson, 1998; Gash, 2008; Ginn et al., 1996; James, 2008; Walters, 2005) and an in-depth examination is not required for current purposes. Suffice to note the following: the basic tenet of preference theory holds that women's labour market position is explained by reference to their personal choice ('preference') which is freely made by women's prioritisation of home life or paid work (James, 2008, p.395). Hakim suggests that there is an empirical basis for her tripartite distinction of women's preferences in relation to their labour market participation: 'home –centred', 'adaptive' and 'work-centred/careerists'.   Table 1 reproduces selected features of preference theory (Hakim, 1998, p. 138).

Table 1: Preference Theory: Lifestyle preferences and women's work

Home-centred (20% of women) varies 10-30%	Adaptive (60% of women) varies 40-80%	Work-centred (20% of women) varies 10-30%
Children and family are the main priorities throughout life	This group is most diverse and includes women who want to combine work and family, plus drifters and unplanned careers	Childless women are concentrated here. Main priority in life is employment or equivalent activities such as politics, sports, art, etc.
Prefer not to work	Want to work but not totally committted to work career	Committed to work or equivalent actvities

Source: Extracted from Hakim, 1998, p. 138

These categorisations are derived by Hakim from data gathered in UK and international surveys and constitute the empirical basis of Hakim's preference theory (2000). Finally, Hakim's own synopsis of preference theory claims that it

> is an evidence based theory, developed over a decade from extensive reviews of research results on women's choices and lifestyle preferences in modern societies in the decades after the contraceptive revolution of the 1960s and the equal opportunities revolution of the 1970s started to give women genuine choice as to how to live their lives...Preference theory has no underlying assumptions (2007, p. 123, emphasis added).

Within preference theory, child-rearing responsibilities are not identified as relevant to women's lifestyle preferences, yet the availability of childcare has been identified as predictive of part-time work (Gash, 2008). In addition, lack of attention to the articulation of class and ethnicity with gendered patterns of occupational segregation has been highlighted as a particular issue (Anxo et al., 2010; James, 2008). In sum, the critics of preference theory charge that Hakim does not sufficiently account for social structural constraints (Arber and Ginn, 1995; Crompton and Harris, 1998; Crompton and Sanderson, 1998; Gash, 2008, Ginn et al., 1996; James, 2008, McRae, 2003; Walters, 2005). Hakim retorts these critics are incorrect in retaining the classic sociological argument that choices are socially constructed and that social structures remain the dominant primary determinant of behaviour; she reasserts that 'sex and gender are redundant concepts', no longer determining social activities and social roles and that lifestyle preferences are causal factors (2007, p. 128).

What constitutes 'common-sense'?: a critique of Hakim's philosophy

While the aforementioned debate about women's lifestyle preferences has been ongoing between Hakim and her critics, the relevance of the debate is foregrounded by a recent report in which Hakim (2011) argues that government sponsored measures to promote and achieve gender equality are predicated on a misunderstanding of women's choices. In particular she states that:

> most studies focus on horizontal occupational segregation which most people would regard as inevitable...Few women aspire to be engineers or soldiers and few men choose to be nurses, teachers or beauticians. Insisting on 50/50 quotas of men/women in all occupations makes no allowance for variations in tastes, talents, interests, personal chocies and cultural diversity (Hakim, 2011, p. 12).

Efforts to 'coerce' women denies recognition of women's 'tastes' et cetera, and the message is therefore emphasised that it is a waste of resources to attempt to do so. This statement is an example of 'common-sense'.

Hakim's reference to how choices are seen by 'most people' as 'inevitable' can be productively addressed by reference to Garfinkel's (1967) work in which 'interrogating common-sense', as one of the 'injunctions of ethnomethodogy', is advanced. The selective use of some of the key tenets of ethnomethodology in this

context is justified on the basis that it highlights the ongoing production and reproduction of gender in different sites. Ethnomethodology seeks to explore the resources people ('members' of society) use to make sense of everyday life as topics of investigation in their own right, i.e. to treat resource as topic.   This approach requires the analyst, rather than simply accepting accounts of preferences as being 'freely chosen' in making sense of female choices, whether of subjects or of jobs, to study how people make their experiences recognisable and understandable; that is, 'common-sense knowledge' can be explored via the accounts that people give of their activities (see Garfinkel, 1967; Arminen (2008) for a more elaborate overview).

Drawing on this approach, the critical assessment of Hakim's approach is that preference theory rests on essentialist tenets – women choose certain jobs (and subjects) because they are female and that such tenets are reproduced in 'common-sense' ideas about women's preferences. Such ideas are accepted as natural, as something that every competent member of society knows[1]. It is contended that how the preferences of women and men are formed is the central research question, and in particular how, in accounting for preferences expressed in subject choice, 'common-sense' understandings of which students do what subject(s) can be explored.

The value of ethnomethodology's phenomeological bases was recognised by Bourdieu in his efforts to engage with the ongoing sociological issue of the question of agency and structure. In The Logic of Practice he contends that the artificial divide set up between subjectivism and objectivism is artificial and 'runious', suggesting that

> to move beyond the antagonism between these two modes of knowledge, while preserving the gains of each of them…it is necessary to make explicit the presuppositons they have in common as theoretical modes of knowledge, both equally opposed to the practical mode of knowledge which is the basis of ordinary experience of the social world (1990, p.25).

The ordinary experience of the social world does not consider structural contraints. Bourdieu suggests that this approach 'presupposes a critical objictification of the epistemological and social conditions that make possible both a reflexive return to the subjective experience of the world and also the objectification of the objective conditions of that experience' (1990, p. 25).

Bourdieu goes on to contend that phenomenological modes of knowledge (as per ethnomethodological and phenomenological approaches to lived experience) cannot go beyond a description of what specifically characterises 'lived' experience of the social world, that is, apprehension of the world as self-evident, taken for granted; this is because

> it excludes the question of the conditions of possibility of this experience, namely the coincidence of the objective structures and the internalised structures which provides the illusion of immediate understanding,

characteristic of practical experience of the familiar universe and which at the same time excludes from that experience any enquiry as to its own conditions of possibility (1990, p. 25-26).

That is, 'common-sense' understandings of the nature of the social world present experience as 'simply there'. The value of objectivism, as a mode of knowledge production, is that it

raises, objectively at least, the forgotten question of the particular conditions which make doxic experience of the social world possible (1990, p. 26).

This, he says, does not

strictly speaking contradict phenomonological analysis of the primary experience of the social world as immediate understanding, but it defines the scope of its validity by establishing the particular conditions in which it is possible…which phenomenology ignores (1990, p. 26).

Bourdieu's approach to the study of social life and to the sociological enterprise enables an engagment with the accounts, provided by respondents (see below), that illustrates the ways in which 'common-sense' knowledge reproduces essentialist notions of the bases of male and female preferences.

Recognising the ways in which 'seen but unnoticed background features' of the social world (in Garfinkel's,1967, terms) can be explored by reference to the conditions of their production and reproduction, Bourdieu allows a 'way into' examining how 'common-sense' understandings of action draw on essentialist ideas about girls and boys and how objective social structures – in this case gender – structures understandings of male and female behaviour. Garfinkel's (1967) programme of exploring the 'background, seen but unnoticed features' of everyday scenes, and in particular of paying attention to how members of society use background expectancies as a scheme for interpretation is of interest. Culture is understood as a 'system of shared understanding' (Sachs and Moerman in Silverman, 1985, p. 116). Hence the analyst's task is to explore this 'architecture of inter-subjectivity' (Heritage in Arminen, 2008). Analysts should strive to be 'anthropologically strange', in Garfinkel's words, 'to attempt to detect some expectancies that lend commonsense scenes their familiar, life-as-usual character' (1967, p. 37). The analyst therefore attempts to explicate 'common-sense'.

EXPLORING 'COMMON-SENSE' – A SECONDARY ANALYSIS OF DATA ON SUBJECT CHOICE
Gash's (2008) critique of Hakim's preference theory prompted a reconsideration of data on science subject uptake which were collected by the author as part of a wider study on the implementation of gender equality measures in schools (Ryan, 2006). The representation of the data as secondary data analysis is justified as it involves the utilisation of existing data, collected for the purposes of a prior study,

in order to pursue a research interest which is distinct from that of the original work (Heaton, 1998). The original research was not concerned to engage with the methodological challenges posed by preference theory.

The issues relating to secondary qualitative data analysis are not reviewed here – there is an ever expanding literature on this topic to which the reader is referred (see Fielding 2004; Heaton, 1998; Long-Sutehall et al., 2010). It is generally accepted that, at a minimum, the use of secondary analysis requires the original study to be outlined. This is presented as succinctly as possible : The study from which data are presented was undertaken in 2004-5; it employed different methods of data collection – documentary, qualitative and quantitative methods – appropriate to the research question (whether or not a national policy on mainstreaming gender equality had any effect on science subject uptake in schools). A national, representative, postal survey of post-primary schools in Ireland was carried out, achieving a 58% response rate. This survey assessed the prevalence of gender equality policies and schools' identification of barriers to equal participation in the science subjects.

For the qualitative phase of the study, eight school sites were selected. The selection criteria related to the inclusion of single-sex and mixed-sex schools in Ireland, and included the different school types in Ireland - secondary schools, community, and comprehensive and vocational schools. Schools were selected from the two administrative regions; and equal numbers of schools were selected from the two EU Structural Funds regions in Ireland. In addition, geographical spread (East, West, South, South-West and North) was also a selection criterion. Such criteria were largely relevant for the quantitative data selected; for example there were fewer pupils taking physics at final examination in the vocational schools which are more technically orientated; they were largely irrelevant for aims of the qualitative data collection which sought to capture the processes associated with the implementation of policy in local sites and aimed to explore whether students experienced any effect(s) of such policy (see McCracken, 1990).

In-depth interviews were held with key school personnel: school principals (n=8, plus one deputy principal), science teachers (n=17, including physics, chemistry and biology teachers), and career guidance staff (n=10). The eight schools also completed a School Profile Form that provided descriptive information about the school provision and allocation practices (i.e., what science subjects it provided and how it aligned these subjects with other subject choices). In addition, detailed information about laboratories and global student numbers enrolled in science for junior and senior academic cycles was collected. Eighteen focus group interviews with students were held, involving 85 students from the eight school sites. Between 4 and 7 students participated in each group, and 52% (44) of interviewees were female and 48% (41) male. These focus group interviews were tape-recorded, transcribed verbatim, and analysed according to themes identified. In addition to participation in the focus group interview, all students completed a Student Profile Form that recorded science subject choices and future career options, including identification of key 'influencers' – family, school, et cetera. The

information collected included the following: age (interviewees were between 15 and 18 years old, with the majority – 59%, aged 16); subject enrolment (all, bar one student, were enrolled in higher level physics, chemistry and biology courses; 54% were taking physics; 64% were taking chemistry and 58% were taking biology).

A final set of in-depth (individual) interviews was held with four female students in one of the school sites. These interviews functioned as 'member checks' (Erlandson et al., 1993, p. 142), a process which involves efforts by the researcher to verify interpretations gathered in earlier interviews. Further information about the methodology is detailed in Ryan (2006, p. 44-56).

The data which this paper reconsidered ('reanalysed') included all of the qualitative interview data. The interpretation of these data was informed by my wider knowledge of the entire dataset, described above. Heaton (1998) suggests the need to engage with ethical issues in secondary data analysis, and I follow Grinyer (2009) in considering the reanalysis as a legitimate extension of the original consent given by research participants. Most of the data presented are in the public domain (Ryan, 2006) and respondents were informed of the aim to disseminate the work as widely as possible. No identifying information about the students or school staff was retained on documents or on interview data transcripts. Most compellingly, the overarching aim of the original study was retained in the secondary analysis, namely the need to address gender equality issues.

'Common-sense' reasoning about jobs women prefer
Hakim (2000) suggests that home-centred and adaptive women consider lifestyle preferences in their labour market aspirations. In returning to the qualitative data (focus groups and in-depth interviews), I was initially interested to see whether the respondents had discussed 'science jobs' and more specifically whether the issue of childcare responsibilities had been a feature of accounts in the qualitative interviews with students. If preferences are freely formed, and if the different categories of women's preferences are empirically identifiable (i.e., the categories of women's life style preference presented by Hakim - home centred, work centred and adaptive), then, at least as a starting point, there should have been some evidence of such preferences in the interviews with, in particular, the female students.

A review of the 18 focus group transcripts indicated that only 3 of the 89 students who participated in the focus group and in-depth interviews had identified a future career in the science field; one boy wanted to be a theoretical physicist and two girls identified forensic science as a possible future career. No student referred to children or related childcare responsibilities. Nor had students clear, definite ideas about science jobs; discussions focused on their most immediate concern which was securing the best marks ('points') which would allow access to a university course. However, they did have some idea of what 'scientific work' entailed: laboratory work was assessed by students as 'boring'; one female student referred

to how 'I just think you would be on your own all day'. Teachers also spoke about the lack of sociability or excitement in science-based jobs:

> There's no excitement in it, there is no variety of work (career guidance teacher, comprehensive school)
> There is a sensation of science jobs being really, that is, [for] the girls, they think it's boring. They think they will be in a lab.
> A friend of mine, her daughter did applied physics and she was working in [a multinational company]. Big money all right but it was shift work [so] she gave it up…The shift work [was] very demanding…They pay but people want a life as well. It's no life, particularly for a girl, for a family like….

The 'common-sense' understandings of women's responsibilities for childcare are reproduced in the last of these quotes. Another guidance teacher referred to how girls want 'regular jobs'.

The earlier quotes resonate with students' assessments about 'excitement'. One theme raised by the career guidance staff in the following excerpt was that girls have to be 'happy' in their jobs:

> I'm talking about two girls I know, and a boy, who have given up….the work is not interesting enough, it is not conducive to happiness or self-fulfillment or something.

In another interview with two teachers, the following exchange occurred:

> Career guidance teacher 1: I think that boys are more motivated by money and by careers… Money would be a motivating factor more so than with girls. Girls do what they like… [men] are prepared to sacrifice their family lives in the interest of their careers whereas a woman wouldn't bother doing that.
> Career guidance teacher 2: The wife can give up work if she has to
> Career guidance teacher 1: I don't think the fella ever [thinks like] that….

These comments point to some of Hakim's arguments, specifically, her arguments about women's weak attachment to the labour market and strong attachment to 'family life'. The issue of normative social control is raised in such comments – Fox, for example, has considered how women are 'channelled into jobs that contribute to the establishment and maintenance of the status of 'nice girl'; such jobs include those 'that call forth nurturant, service or socio-emotional behaviour' are examples (1977, p. 815). Noting the ways in which normative restriction limits a woman's personal freedom, she states

> Normative restriction, through the nice girl construct may underlie and contribute to the enormous loss of female talent produced by channelling women into jobs that fail to use or use at all the full range of skills and capacities that women possess (1977, p. 817).

The data suggest that 'nice' jobs for girls have to include sociability so that they will be 'happy'. The interview data from both the interviews with students and staff referred to the perceived need of girls for company in the workplace and for the need for a job to be 'exciting'; these features of employment were not reproduced when talking about boys' needs[2]. [2] Choice of job is more than 'individual choice'; the data suggest that a range of issues are drawn upon in identifying 'appropriate jobs'. This partial re-analysis of the data points to the complexity of labour market preferences and career aspirations and suggests areas for further research.

Explaining subject choice: preferences
Moving from the traditional focus of preference theory, i.e. labour market participation, the following sections consider Hakim's extension of preference theory to education (see above). She (2008, p. 215) simply states that girls 'prefer' subjects other than sciences; how choice is exercised is unproblematic within her framework; girls simply exercise a preference without significant constraint. However, how 'choice' is exercised has long been recognised by social scientists as a complex process (see Hannan et al., 1983; Hannan and Boyle, 1987; Murphy and Whitelegg, 2006); such work suggests that 'preferences' may not be uni-dimensional.

Structural issues such as school provision of a subject (not all schools offer physics at honours/advanced level) and whether there are timetabling clashes between science subjects and other subjects form the context within which individual students make subject choices (Hannan et al., 1983).

Evidence from the qualitative interview data suggests that subject choice can be determined by at least the following:

- assessment of likelihood of securing sufficient grades for 'points' (for university access);
- assessment of teachers (local assessments of 'good' and 'bad' teachers);
- previous experience of the subject (and possibly the teacher);
- assessments of relevance of a subject to a later career and relatedly, knowledge of which jobs require what subjects;
- interest in /enjoyment of science subjects;
- assessment of self-ability to achieve grades and complete a programme of study.

These issues were routinely raised by the students and teachers alike to account for subject selection. They were seen to affect all students and gender was largely identified as extraneous. School staff routinely spoke in the following way:

This is the thing about here [this school], we don't notice. The kids themselves don't notice, boys are friendly with girls and it's just, it's just not an issue (Principal).

However, even when gender was not seen as relevant to explaining differences in subject take-up, the notion of 'preferences' also entered into accounts of gender differences:

> I see it the whole way along, that girls perceive that they are not good [enough], but a lot of it, I think it all stems back that the girls are not geared. The sort of job that they want to do might not necessarily involve Physics yet they will take a subject that they perceive might be easier for them to get points in and they are just doing the subjects to get points, as opposed they might like Physics but they just don't do it because they don't need it….It seems to be the boys are a lot more geared towards engineering, even electrician, anything like that (physics teacher, emphasis added)

This teacher identifies 'being geared', that is being oriented or interested, job aspirations and the points system as key reference points in considering take up of physics. Use of the concept of ' being geared' is an example of 'common-sense' in action – girls are as able as boys to do the subject – a point made continuously by both students and teachers. One girl's response illustrates this: responding to a newpaper article which referred to genetic differences ("Fewer women engineers due to genetics", Irish Times, 21 October 2004):

> There is a difference, men get it a lot easier. In intelligence they are both the same…

This position may be relevant in explaining the silence of respondents, experienced in the interviews, when asked about about 'gender' and gender differences. The routine response was that there is no difference between boys and girls, girls and boys 'just prefer' different subjects – as one physics teacher commented

> It comes down really to what they are interested in following at the end of the day.

In such accounts, boys and girls differential 'gearing' is 'natural', it is not imposed but is the 'way things are'.

The excerpts above may be seen as an example of Hakim's 'preferences'. Girls and boys are understood to have freely chosen their subject, albeit within contraints imposed by the school timetable. The theme of 'not being geared' was picked up by teachers across the participating schools: ability to learn physics was identified as an innate characteristic, as something that male students 'just have':

> 'being good at maths' Well, the honours Maths would be the ones that would be going for Physics and Chemistry and would apparently have, for example, you would imagine they would be into Electronics or something, that they have a natural interest in [it] but I find they don't, they are just good at maths (science teacher, emphasis in original speech)

'Natural' Characteristics
Boys were identified as natural 'knowers' and this was seen as something that 'everyone knew'

>   Interviewer (LR): Why did you decide to do a science subject?
> Boy: because I liked science in Junior Cert [lower level secondary school examination]. I have always liked science; I have always been good at it
> Girl: He is just really bright, he just picks it up, no problem (focus group students).

This theme was continued in the girls' comments about 'one line' answers: A female student, responding to a question about whether girls and boys learn differently, said:

> I went to an all-girl Primary School as well so I've never really kind of seen boys at work in school. But I think that the majority of guys, obviously there is exceptions and stuff, but they always seem to look so much more laid back when it comes to school and learning than the girls would. In some ways they seem to know a lot more, just exactly the limit of what you need and that's it. Even looking at my brothers and stuff, they always have it sussed out as to the minimum amount of work they can do to get it done properly.

While girls' lack of confidence has been identified in the literature as particularly important (see the review by Murphy and Whitelegg, 2006) and while teachers and students also identified this feature as a factor relevant to understanding participation rates, this excerpt points to a more complex situation that is beyond 'confidence' – this account presents what is generally known about boy and girls. It is a 'common-sense' understanding of the social world.

In line with the literature (Murphy and Whitelegg, 2006), confidence was explicitly related to gender in staff and students accounts – one instance of this confidence, which was explicitly related to either gender, was knowledge about the limits of what to write. This was an issue routinely raised by science teachers – this knowledge was assumed to be 'natural', not the result of social processes; boys 'just know'. As one teacher said

> you ask them a question, you know? In physics it's just short answers, and some of the girls will write essays...There is a boy in my class and he just writes one line and everything is there. I have just noticed it. I have never seen a girl do that.

The reason why relates to different approaches of boys and girls; as one girl explained while noting that 'you need certain words' in your answer 'to get the marks',

> The girls give an overview of it, to understand it. My friend she was saying that she found it hard, she studied for her Physics exams and she, she,

she…knew what was going on in class but she didn't know, when she went into the exam, the points to write down. She wrote everything in and around the points, but didn't have the points so she didn't get the marks.

Another girl considered how

Looking at physics there are definitely less girls doing physics than boys, I don't know why. There is no one that actually said to us blatantly "you can't do science because you're girls, you don't have intelligence for it", I think its something in yourself that you kind of lack. Girls are more unsure about themselves, guys are so, my own brothers are so like, "of course I can do that", they can do that, they know everything. Even coming out of exams, Maths, if anyone asks how you do, you would be afraid to say it went well…You would be afraid to say it went well; boys "get A1 down, got it, sorted, that's it". Sometimes you've done better than them (emphasis added).

The 'common sense' knowledge expressed in this quote is that the 'something in yourself' which girls lack is an individual issue and furthermore it is 'usual'- it is generally accepted that girls are more unsure of themselves and their abilities. Her closing comment indicates that this 'lack' may be misplaced - girls can sometimes do better than boys which means that the boys' confidence in themselves may be questioned.

It has been noted in the literature that often academically weaker boys take up physics more than their female counterparts (Kenway and Willis, 1998). One career guidance teacher spoke of how

there is a difference between the way the girls and the boys choose their subjects. When you have a young boy [coming] in [for a career guidance class], he says 'oh yeah, I'm going to do physics' basically because 'I'm a boy', as far as I can figure out, and anyway 'I want to become an electrician'. So he would be an ordinary level student but he considers physics because it is useful to his future and because it is about how things work. An Ordinary Level [pass grade] girl in this school will not be doing science for the [final state examination] …I was really shocked at how strong the lines were but definitely the girls…only cross the gender barrier in big groups once they get above a certain ability level.

Different subjects were seen by students as aligned with the different, innate, abilities of boys and girls. One boy spoke of how:

Biology you just have to learn everything whereas chemistry and physics you have to understand it. The way [biology] is kind of structured in secondary school is that it suits girls.

This alignment between subjects and what was identified as biological or 'natural' ability to learn was expressed throughout the interviews. That ability is constructed

in such a gendered way means that in cases where either gender 'deviates' from what are seen as 'natural' and innate capabilities, accounting for this 'deviation' has to occur.

"You must be very intelligent…?": Accounts of subject choices
Following a comment from a career guidance counsellor that boys expect to be doing physics, the interviews explored how the girls taking physics and higher mathematics experienced reaction from others. Thomas comments that

> A woman who chooses to study physics is stating (not necessarily intentionally) her difference from other women. She is making what is conventionally a masculine choice (1990, p. 22).

While this statement was made over two decades ago, and while the numbers of girls and women studying physics and progressing through scientific careers are increasing (European Commission, 2012), there is evidence to suggest that women in physics are still relatively 'unusual'. The following comment raises issues of how student choices/preferences are accounted for by female students (again, an obvious limitation is that boys were not invited to participate in in-depth interviews in the original study).

One female student recounted that

> People ask what subjects you're doing and I say 'oh, three sciences' and they go 'oh my god, you must be very intelligent, are you?' and I'm like 'No, I just have an interest in them' (emphasis in original speech).

Her awareness of 'deviation' from typical femininity was pervasive amongst the female students. Goffman (1961, p. 77) defines role distance as 'the attempt of the individual to isolate oneself from the contamination of the situation. The student has to 'disavow' extra intelligence ('very intelligent'); 'just' having an interest, demonstrates that she is aware that what she is doing is unusual. Another female student talked about how girls doing physics may not

> be seen as unusual, but people always seem surprised when you say you're doing Physics , they always kind of say 'Oh god, why are you doing that? You know? People seem to think that because its dealing with, I don't know, even like electricity, so they seem to maybe think , isn't that more of a guy's subject, so why would girls be interested in it.
>   Interviewer (LR): Do you think that that would put some girls off?
> I think in some ways, most of them have the sense of the fact that people would be kind of looking at them strangely for doing Physics, but I think that a lot of girls maybe seem to think 'oh it's more of a guy's subject, you know, they just kind of stereotype it and put it back into a category.

One girl, asked if, given this reaction, she thought 'you nearly have to be more girly?' she said

> Yeah, to compensate for it…I am quite outgoing anway, so you know, I would be a social person, but people, like the Physics class or whatever [are] kind of nerdy, yeah (emphasis added)

Boys are not seen as subject to similar reactions:

> These are the kind of things, they wouldn't pass much notice that boys are doing, you know, they might be really hard subjects, [including] Chemistry but then, the girls, 'you just kind of think, how do you keep that up?' (female student).

This girl considers that boys' take up of 'really hard subjects' is expected and in contrast, girls have to account for their choice of study ('how do you keep that up?'), girls have to justify why they study 'really hard' subjects. Her comment illustrates one way in which 'commonsense' understandings of which pupils (male or female) do what subjects can result in boys and girls being treated differently and in the scenario above, the girls' ability is questioned -'how do you keep that up?' is a question not asked of boys.

Limitations
The data presented were gathered as part of a wider study on the implementation of national policy on gender mainstreaming in local schools sites. The research data reported were collected in 2004-5 and were revisited in the light of Catherine Hakim's statements (2008) regarding men's and women's educational preferences. Undoubtedly the analysis presented above could be further elaborated in line with other research findings; for example the concept of 'physics self-concept' (i.e., students' sense of themselves in relation to the subject, both currently and in the future) as presented in Murphy and Whitelegg (2006, p. 9-10) is especially apt in considering students' preferences for different jobs. This concept could profitably be used to chart the young people's current and future engagement with physics, and other subjects, allowing a comprehensive understanding of how science is incorporated into young people's lives at current and future points (an important issue for the learning society required to support the knowledge based economy, see Rooney et al, 2003). The essential point of this paper, however, was to signal how the presentation of 'commonsense' knowledge, using Bourdieu's (1990) critique of lived experience, covers over and makes invisible social structure.   More importantly, the paper contends that sociological theory can incorporate and reproduce 'common-sense'.

CONCLUSION
The complexity of subject choice as it relates to science subject selection by young people has been explored in this paper. In particular, the paper has critiqued Hakim's (2000, 2008) preference theory, charging that the theory rests on 'commonsense' notions of male and female characteristics as shaping preferences and these characteristics are the basis of a commonsense knowledge about 'freely chosen' subjects. The data presented suggest that understandings of which subjects (and later jobs) are 'appropriate' for girls inform the accounts of subject

choice offered in the interviews with students and staff. These understandings include an ability to learn, being 'geared' (interested) and having knowledge about requirements of writing. The presence or absence of such characteristics is presented as 'natural' in relation to boys and girls. When girls demonstrate these characteristics, they are required, culturally, to account for them.

The findings lend support to the argument that gender, the socially constructed perceptions of masculinity and femininity, structure the educational experience. The perceived ability of boys and girls as 'natural' was routinely drawn upon in accounts of subject uptake (in particular boys' natural ability to study physics). Female students were reflexive in recognising that their interest in physics was perceived as 'unusual' and their accounts pointed to efforts to demonstrate their 'normality' (not being 'very intelligent').

The data presented illustrate the way in which gendered understandings inform staff's and students' accounts of choice of physics. The data also illustrate the complex nature of choice-making and how socially constructed 'common-sense' assumptions concerning gender ability are implicated in this process. Finally, they provide further confirmation of how perceptions of competence alone are not sufficient to influence girls' choices; Murphy and Whitelegg concluded that their extensive review of literature pointed to the significance for girls, in particular, being able to perceive a future in physics (2006, p. 53). The data presented in this paper suggest that such careers have to be identified as desirable and as fitting with 'normal' femininity.

The challenge for 21st century sociology may not, after all, be the adoption of Hakim's preference theory, as she claims (2000, p.20; 2008, p. 215), but of continuing the enterprise of illuminating the complex ways in which gender relations and associated social inequalities are produced and reproduced. A critical understanding of gender identity remains a central organising principle for this project.

Annex 1
Trends in Physics Subject Uptake - Students sitting physics final year school examination by gender (Ireland, 2005- 2011)

Examination Year	Male	Female
2005	3,817	1,670
2006	3,633	1,567
2007	3,657	1,566
2008	3,495	1,434
2009	3,398	1,296
2010	3,497	1,380
2011	3,462	1,320

Source: Higher Level Physics, Leaving Certificate Examinations, Ireland Central Statistics Office, www.cso.ie

ENDNOTES

[1] One example provided by Garber (1993, p. 2) is how, in the period before World War II, the convention was that baby boys wore pink and baby girls wore blue, a complete reversal to what, in Western European countries, is accepted as unchanging and natural, not culturally constructed, i.e. that boy boys wear blue and baby girls pink.
[2] The limitations of secondary data analysis are evident here – probing interviewees about boys' employment did not take place in the original interviews

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