

# Methodologies of research into gender and other social differences within a multi-faceted conception of social justice

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## Abstract

Our discussion of social justice begins by embracing both *distribution* and *recognition* aspects of social relations (Vincent, 2003). The first aspect considers the way that goods, knowledge, skills, rights, etc. are distributed among social groups; the second aspect focuses on aspects of society structuring social encounters and relations – modes of communication, 'treatment', respect. Our approach to social justice focuses not only on the dimension of gender, but also on social class and ethnicity: we consider that concern with these latter forms is crucial for a full appreciation of the structural and the interactional aspects conveyed by the concept (Arnot, 2002; Gillborn & Mirza, 2000). In methodological terms we argue that researching the questions posed by a social justice agenda, will require both 'quantitative' and 'qualitative' methods – within any substantial research programme, and even within individual studies. Our emphasis on the theoretical aspects of formulating a research problem points to the importance of a third facet of social justice, to do with *representation* and power. We discuss several examples of fruitfully combining different aspects of social justice and multiple methods of research. In particular, we argue that considerations of social justice, and a related 'hybrid' methodology, will play a crucial role in our ongoing study of the (re)production of images of mathematics in popular culture, and in particular advertising.

Key Words: social justice, equality, gender, social class, ethnicity, quantitative methods, qualitative methods, hybrid methodology.

## 1. Introduction

There is a range of concepts available for considering the fairness or otherwise of social arrangements in society, and their relationship to the education system and its effects on individuals and social groups. Here, we focus on *social justice*. Other work discussed below focuses on *equality*, or on *democracy*.

Indeed, *social justice* is a good concept to focus the discussion, because it is clearly related to the idea of equity or fairness, and because it is currently widely discussed in educational research (e.g. Vincent, 2003; Arnot, 2002; Burton, 2003; *Philosophy of Mathematics Education Journal*, 2007). It also appears to resonate with contemporary policy-makers' concerns, including the European Union's social agenda and the activities (or rhetoric) of many national governments around the world. The concept of social justice provides a way of grouping two distinct, but related, aspects: *distributive* justice and justice in terms of *recognition*.

This paper has several aims:

- To discuss a dual understanding of social justice in terms of distribution and recognition, in recent work in studies of educational policy and practice.
- To discuss several illustrations, from the sociology of education, and from adult mathematics education, which support our position of emphasising social class and ethnicity as key dimensions of social justice, as well as gender.
- To argue, drawing on these illustrations, that researching the questions posed by a social justice agenda requires both 'quantitative' and 'qualitative' methodologies.
- To show that addressing questions of social justice allows a broader investigation of issues in the teaching and learning of adult mathematics (formal and informal), drawing for illustration on our analysis of images of mathematics in advertising.

## 2. A dual understanding of social justice

The first, *distributive* facet of social justice focuses on the question of whether the individual (or social group) has (or has access to) material goods and services, and symbolic resources, such as knowledge or skills. Also important in our societies are the opportunities an individual (or a social group) has to gain access to, to participate in, or to succeed in, particular spheres of social activity, e.g. further and higher education, or certain occupations or grades of work.

The overriding concern of policy-makers in western societies from the 1960s onwards was equality, or more precisely, 'equality of opportunity' across social groups – meaning, at that time, across social classes. This made a distributive view of social justice dominant in social science analysis. However, in recent years, in mathematics education and educational research more generally, the tendency has been for social class not to be talked about directly (Secada, 1992; Skeggs, 1997; Vincent, 2003a), and sometimes in the educational research literature to be discussed in terms of 'ability differences'. The distributive facet of social justice, however, is especially important in situations where educational opportunities may be rationed and distributed according to 'ability', or 'ability to benefit'. Distributive concerns might suggest researching questions like:

- How are different forms of knowledge (e.g. mathematical, scientific), or certain educational credentials / qualifications distributed among the different social categories of class, gender, ethnic or language groups?
- How does provision of resources, or performance, differ between different social categories in school or college mathematics?

An interesting example is given by David Gillborn and Heidi Mirza, in *Educational Inequality: Mapping race, class and gender* (2000). This study, largely concerned with distributive issues, appears to use mostly quantitative methodology – based on a moderately large sample of official ethnic monitoring returns from local educational authorities, and a representative national youth survey. However, these researchers also draw on (their own and others') ethnographic research to focus on the experience of students in school. In particular they show that black pupils receive harsher *treatment* in discipline terms than others; and that teachers have *lower expectations* of Black students and *less positive assumptions about their motivation / ability* (p. 17). This suggests that there is also a need to study social justice and inequalities in *social interactions* in schools and classrooms.

Thus a second aspect of social justice concerns '*recognition* of difference', stemming from a concern with status-related inequalities, relating to manners of communication, 'treatment', respect for difference, and, in particular, avoidance of misrepresentation, stereotyping, and disrespect.

Since the 1980s, there has been increased interest in a 'politics of recognition' (Cribb & Gewirtz, 2003), understandable as a response to a range of 'New Social Movements' – concerning gender, ethnicity, disability, sexual preference – leading to assertions of / demands

for 'women's liberation', 'black is beautiful', 'gay pride', etc. These have had important implications for education and social policy, expressed as a concern with issues such as 'multiculturalism' and 'social inclusion' (Tett, 2003). Recognition concerns might prompt educational research questions like:

- How are different groups of students treated by teachers in educational institutions?
- What expectations and assumptions do teachers have about different groups in education? To what extent are these sometimes 'stereotypical'?

Examples of such concerns include, besides Gillborn & Mirza (2000), research programmes and individual studies in the sociology of education on issues of difference and identity, such as: Arnot (2002) on gender (see Section 3); Gillborn (1995) on ethnicity; Barton (1996) on disability.

We can use the discussion so far to suggest a number of provisional directions for further consideration. First, we might distinguish the bases of educational inequality / oppression for different groups. For some, inequality may be rooted *primarily* in an economic context, requiring redistribution: for example, social class, 'ability' differences, disability. For others, oppression may be generated *largely* in a cultural context, by lack of recognition/ mis-recognition, e.g., ethnicity, sexual orientation, religion, disability. In this connection, gender inequalities are central, since they can be seen as 'multiply generated' (Lynch & Lodge, 2002, p. 3), that is related both to redistributive and recognition issues. Nevertheless, there is a complex inter-relation between these two aspects of social justice.

One recurrent criticism has been that social and sociological analyses of social justice or inequality have been too narrow, and have entailed, over the last forty years (in English-speaking countries at least), replacing concerns about social class, with those relating to gender, then with concerns about ethnicity, then disability and so on; furthermore that this has led to a proliferation of sub-fields, of research 'experts', and so on, thereby impoverishing the understanding of this most fundamental topic in educational research. However, we find it more appropriate to entertain the idea that, with each new form of inequality such as the currently held concerns with sexual orientation or disability, we do not simply have a replacement, but an *enriching* of the idea of social justice.

Therefore, as we shall show in the remainder of this paper, there are important reasons for us to embrace the notion of social justice in studying current educational arrangements, processes and outcomes. First, compared to the earlier conception of social and educational inequality, the notion of social justice points to a multi-faceted conception that considers questions about the structural determinants of social action, but does not limit the investigation to these. Second, it takes account of diverse forms of social difference, such as gender, social class, ethnicity, sexual orientation; while leaving open to consideration any other instance of social difference encountered, as to whether it might constitute the basis of a form of (in)justice. And, third, it expresses a commitment by those that use the concept to make efforts to combat the inequalities observed. This third reason, Cribb and Gewirtz (2003) refer to as the collapsing of the distinction between evaluation and action. They argue that a focus on evaluation alone carries the risk of representing social reproduction as inevitable. Furthermore, it is only by analysing examples of policies and practices aimed at promoting social justice that we can examine how tensions can be overcome in reality. This third reason for embracing the concept of social justice thus recommends that researchers focus on and scrutinise policies and practices prevailing in public life.

### **3. An enriched idea of social justice: An example**

Arnot (2002) provides an illustration of how the idea of social justice may be developed, in the course of her critique of social (class) reproduction theory (Bowles and Gintis, 1976). This is the idea that the social structure is perpetuated through ensuring broadly that – in Willis's (1977) now classic phrase – 'working class kids get working class jobs', and similarly for

middle class kids. Arnot's account allows us to see the importance of multiple aspects of social justice, based on multiple dimensions of social difference.

1. Arnot and others have criticised a notion of social class defined only in economic (or occupational) terms, and argued for inclusion of 'dynamic aspects of identity', and the role of patterns of consumption (spending), community and family values (Arnot, 2002, p. 205).
2. Thus the family, with its influence on gender relations, becomes crucial in processes of social class formation, through its role in forming identity, authority relations, perceptions of / resistance to schooling, mediation of differences in material circumstances. In this sense, she agrees with Bernstein (1977) that the 'long shadow of the family' also influences the 'expressive [affective] order of school'.
3. Youth cultures now soften and cross social class boundaries, and their class cultures are formed by young people acting during schooling as *mediators* between family class cultures and the cultures of employment; that is, they are not formed only by the latter.
4. Social class inequality may be affected by the differing opportunities of middle class professional and working class young women. The former now take responsibility for perpetuating their own class position (rather than aiming to do so via marriage), while also making different demands on family life (e.g. sharing of childcare), and different contributions to building up the family's capital (cultural and economic); working class women, in contrast, despite little if any improvement in the real opportunities available to them, paradoxically seem to appear to manage the contradictions by using the discourse of individualisation and choice (Arnot, 2002, pp. 212-14).
5. Black women have emphasised education and examination qualifications as a way of crossing class and breaking out of traditional gender and race classifications, and gaining an advantage in securing scarce local jobs (see also Mirza, 2005).
6. Nevertheless, in the national study of overall school attainment at age 16+, discussed in the previous section, Gillborn & Mirza (2000) found that social class differences had remained over the previous ten years, and, when social class differences were controlled for, there remained significant ethnic group differences. Gender differences were small overall.

The research discussed by Arnot illustrates the importance of theoretical development of social justice to encompass distributive and recognition (identity) aspects (illustrated here by point 1 above). Her overall account also shows how class, gender and ethnic differences inter-relate to have effects in subtle ways. And the findings she draws on are based at least partly on ethnographic (qualitative) work (points 2 to 5.) and partly on survey (quantitative) work (illustrated here by point 6).

Drawing on Arnot's account for illustration, we argue that researching the questions posed by a social justice agenda, and developing theorisations to begin to address them, will require both 'quantitative' and 'qualitative' methods – within any substantial research programme. Below we give further illustrations from our own ongoing work.

#### **4. Quantitative and qualitative methods**

There is not space here to discuss in depth the difference(s) between 'Quantitative' and 'Qualitative' methodologies, as that distinction is currently deployed in social and educational research (see for example, Bryman, 1992). Here we simply refer to some of the distinctions most evidently in use by a substantial proportion of practising social and educational researchers; see Table 1.

The simplest way to try to distinguish the two types of method is to look at the form of the data, and the methods of data analysis used: numerical data, analysed statistically, indicates quantitative methods, and textual data, analysed 'semiotically' indicates qualitative methods. These distinctions are highly overt or 'visible'. Less visible, but still often acknowledged, is the degree of structuring by the researcher of the verbal social interaction with the participants during the data production and coding stages. These are the sorts of distinctions used by many

to categorise differences between their work and that of others, and these are the basis of the working characterisation of the differences that we will use in this paper<sup>1</sup>.

*Table 1. Possible Bases of a Quantitative/Qualitative Distinction*

	<b>Quantitative</b>	<b>Qualitative</b>	<b>'Visibility' of distinction</b>
Form of data	numerical	textual	very high
Methods of analysis of the data	statistical	'semiotic'	very high
Degree of structuring (by the researcher) of interaction in the field	substantial (in standardised, and coded, tests, interviews or questionnaires)	relatively little (in semi-structured interviews and participant observation)	moderately high

In fact very often researchers, in justifying their choices of method, refer the issue back to questions of epistemology and ontology in order to argue that the two methods study completely different worlds: one to do with an objective world 'out-there' and independent of the observer, and the other a world of individuals as intentional beings making sense of their interactions with others. However, our approach is to focus on an adequate theorisation of the problem at hand, in this case that of social justice so as to guide, using such theorisations, the methodological decisions to be made, at each crucial point in the research.

## **5. Types of method in practice: A consideration of further examples**

To explore the use of, and the fruitful combination of, 'quantitative' and 'qualitative' methods in practice, and using our developing notion of social justice, we draw on an earlier study by the first author, Evans's (2000) study of adult numeracy and emotion; and a joint ongoing study of images of mathematics in popular culture; see Evans, Tsatsaroni & Staub (2007).<sup>2</sup> In both studies issues of inequality have been crucial in conceptualising the research object, but the use of additional theoretical resources in the second study has allowed us to put the issue of learning and social justice at the centre of our problematic.

### **5.1 Adults' mathematical thinking and emotions**

Evans (2000) studied adults' mathematical thinking and performance in a higher education institution. He produced survey and interview data on three cohorts of students studying mathematics, as part of their main study of a social science subject.

Evans studied *distributional* issues in mathematics education – by asking students to complete a questionnaire including some performance items, and by analysing the results through building a statistical model. He found that the size of gender differences in the performance items was initially quite substantial. But they decreased (and were no longer statistically significant for school leavers in the 18-20 age range), after controlling for a range of

<sup>1</sup> There is not space here to continue this discussion, by bringing in 'low visibility', but important, differences, such as the difference in aims of quantitative and qualitative approaches, or the (related) commitment to different types of explanation – namely, explanation by causes and explanation by reasons / intentions, respectively; for further on these issues, see Bryman (1992) and Creswell (2003).

<sup>2</sup> For another illustration using Boaler (1997), who also uses multiple methods, see Evans (2007).

competing explanations such as social class, age, level of qualification in school maths, and affective variables, especially confidence and mathematics anxiety.

Besides these quantitative methods, the research also used semi-structured interviews (life history/clinical) to observe student problem solving and affective reactions. This allowed the problematising of categories and scales from the questionnaire, and more flexible and rich description of several concepts:

- *performance*, in a context-specific – more precisely, a practice-specific – way, as in how to understand a student's calculation of a restaurant tip as '37.2p', when the UK's smallest unit of currency is 1p (Evans, 2000, p. 162ff)
- *social class*, elaborated to include not only an economic, work-based aspect, but also cultural and identity-based aspects (for example, pp. 230-1, and also the discussion of Arnot's elaborations above)
- *anxiety expressed*, distinguished from *anxiety 'exhibited'*, using insights from psychoanalysis (pp. 171-2).

These elaborated categorisations were used to examine the main relationships in a richer way (though for a smaller sample), in what Evans called 'qualitative cross-sectional' (or might have called 'quantitative semiotic') analyses. These 'hybrid' analyses combine an interpretive reading of textual material with a basic statistical analysis; see Table 2 below, where the categorisation of an interviewee as having '*expressed anxiety*' or as 'likely to have *exhibited anxiety*, but not to have expressed it' depends on a careful reading of the entire interview transcript, drawing on psychoanalytic insights about the way that anxiety can be 'exhibited', even if it is not expressed (Evans, 2000, pp. 144-5).

When the results of the categorisation on the latter anxiety variable are cross-tabulated with gender, the resulting 'qualitative cross-sectional' analysis in principle allows a comparison across gender groups (Table 2).

Table 2. Expressing and exhibiting anxiety in semi-structured interviews: cross-tabulation of numbers with gender (n = 25).

<i>Coding</i>	<i>Males</i>	<i>Females</i>	<i>Total</i>
<i>Anxiety expressed</i>	9	13	22
Likely to have <i>exhibited anxiety</i> , but not to have expressed it	3	--	3
Total	12	13	25

Source: Evans (2000), Table 9.7

Thus, 100% of the women expressed anxiety during the interview, as compared with 75% of the men. This suggests a 25% difference in the percentage of students expressing anxiety in the interview setting. However, virtually all students (22 of 25) took the opportunity to express anxiety during the interview, so any gender differences must be seen as small and not very reliable (because of the small sample size).

Another way that Evans (2000) brought together quantitative and qualitative methods was in indicating which students might be 'over-achievers' or 'under-achievers'. This was done by calculating the *residual*, or the difference between the student's observed performance score and his/her performance score that would be expected, given their gender, social class, age, level of mathematics anxiety, etc., and using statistical modelling (see Evans, 2000, note 8, chapter 10, pp. 270-1, and also Boaler, 1997, pp. 138-9). Such 'over-achieving' and 'under-achieving' individuals could then be selected to be invited for semi-structured interviews, on the grounds that they might possibly be informative 'critical cases' for the analysis. Thus both quantitative and qualitative methods are here used for distributive analyses of social difference / social justice in the context of education.

The semi-structured life history interviews provided material on subjectivity/identity, and therefore, allowed for the *recognition* of students from various social groups. In these

interviews, the student related earlier experiences where they were 'recognised', or not, as a learner of mathematics. The interviews gave students space to express anxiety and other feelings about mathematics to the interviewer, as illustrated above. The interview also allowed several students to describe, but also to celebrate, their 'recovery' of confidence and competence in mathematics during the first year of their college course (Evans, 2000, p. 239), an issue which relates to the agenda of social justice research.

These two aspects of the study together show the use both of quantitative and qualitative methods to investigate distributional and recognition aspects of social justice in mathematics education. In particular, the 'qualitative cross-sectional' method (Table 2) can be seen as a *hybrid*, having *both* quantitative and qualitative features. However, it is also important here to stress that revisiting the study with a more clearly formulated concept of social justice, rather than a narrower focus on structural inequalities, has helped to draw out more clearly the methodological features of the study and their implications.

## 5.2 Images of mathematics in popular culture

Evans, Tsatsaroni & Staub (2007) investigate the images of mathematics / mathematicians portrayed in a small sample of advertisements in the UK national daily press. The main aim of the part of our overall project focusing on advertisements is to describe the images portrayed, the discourses on mathematics drawn on, and various characteristics of the advertisements, e.g. their differing 'appeals' (Leiss, Kline & Jhally, 1990). Here we extend our earlier analysis to examine two related issues:

- the extent to which dominant discourses on gender can be identified
- whether these are likely to reinforce or to challenge long-term discourses and established gender stereotypes.

Several key methodological issues are discussed in Evans et al. (2007), including the definition of a 'mathematical advertisement', how the fieldwork was organised, and the sampling design. UK newspapers are divided into 'quality' papers, 'mid-market', and 'tabloids', on the basis of their traditional styles of presentation and level of reporting and commentary; we chose three 'qualities' (*Times*, *Daily Telegraph*, *Financial Times*), one 'mid-market' (*Daily Mail*), and two 'tabloids' (*Sun*, *Daily Mirror*) on the basis of their readership, including breakdowns as to gender and age. Then, randomly selected two-week periods of back issues (from 1994 to 2003) of the selected papers were searched for appropriate advertisements in the National Newspaper Library.

Thus the sampling over the ten-year period was rather 'light'<sup>3</sup>, because of resource constraints and the pilot nature of the study. Yet, despite the fact that over 500 editions of daily newspapers were examined, only nine advertisements judged to contain an 'image of mathematics (or mathematicians)' were produced by this systematic sampling process. They were supplemented by a further four gathered in an 'opportunity' sample over the same time period (1994-2004), to make up the sample of 13 advertisements to be studied here. Evans et al. (2007) analysed this corpus, with a focus on the images of mathematics and mathematicians that were portrayed. Here we re-analyse these advertisements, with a focus on the images of gender (and other social differences), and on issues of social justice.

Because of the very small sample available in the pilot study, it is not really possible to do a 'quantitative' analysis with this set of data. However, we are currently replicating the study with a larger sample, where the sorts of analyses that we point to here can be used with much greater effect. Thus, the sort of 'quantitative' analyses that we present here are intended to be suggestive only. First we might do a simple categorisation of the characteristics of the advertisements, beginning with the product being advertised (Table 3).

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<sup>3</sup> Only four weeks in each of five years were selected for examination for each newspaper.

Table 3. Product category of the advertisements.

Product category	Number in overall sample (number in random sample)
Automobiles	4 (3)
Business Services	3 (3)
Food	2 (2) [1 campaign]
Consumer Telephone Services	1 (--)
Bank (job advertisement)	1 (1)
Rail Transport	1 (--)
Men's Cosmetics	1 (--)
Total	13 (9)

In both our systematic random and the overall sample, 'mathematical' (or 'scientific') portrayals appear more frequently in advertisements for cars and for business services. Evans et al. (2007) observed that, when we combine this with the information that a substantial percentage of buyers (for many models) of cars are male, as are a high proportion of the senior managers who are commissioning the purchase of business services, we should expect that appeals in advertising, including appeals to mathematics, in the UK will be 'gendered' in particular ways (cf. Williamson, 1978). Our aim here is to study this gendering. We might begin by studying the *context* of the different advertisements, that is the newspaper in which the advertisement appeared and the characteristics of the readership (Table 4).

Here we can see some variation among the newspapers as to the percentage of their readership that is male. On the basis of an assumed masculine gendering of mathematics, we might hypothesise a *positive* correlation of the percentage of male readers for a newspaper with the number of advertisements found that contained an image of mathematics<sup>4</sup>. However, of the newspapers that showed more than one mathematical advertisement, the *Guardian* and the *Times* had over 55% male readership, whereas the *Daily Mail* has a majority of female readers. And of those that had no mathematical advertisements, the *Financial Times* had the highest percentage of male readers, while the *Sun* and the *Daily Mirror* had 'average' levels of male readership<sup>5</sup>. Thus, on the evidence so far, always keeping in mind the small numbers, we might conjecture that the incidence of mathematical advertisements does not seem to relate to the proportion of male (or female) readers.

<sup>4</sup> Or more precisely, with the newspaper's 'success rate' (percentage of issues which included a 'mathematical advertisement').

<sup>5</sup> We could produce a formal measure of the correlation, through producing a scatter plot, or calculating the correlation coefficient, but here we have a very small set of newspapers that were systematically sampled for the study – six, excluding the *Guardian*, since the latter was sampled only in an 'opportunistic' way in this phase of the research.



Table 4. Advertisements found in editions of daily newspapers in overall sample.

Newspaper	No. of advertisements found	% of readers who are male	% of readers who are middle class ("ABC1")
<i>Times</i>	4 (Concert Communication Services, BMW, Abbey National Bank, Sun Microsystems)	56.8	<b>89.2</b>
<i>Guardian</i>	3 * (Mercury Telephone Services, Peugeot, South West Trains)	58.6	<b>90.1</b>
<i>Financial Times</i>	0	77.1	<b>94.0</b>
<i>Daily Telegraph</i>	1 (Thales IT & Services)	52.9	<b>87.4</b>
<i>Daily Mail</i>	4 (Quorn Foods (2), Jaguar, Daihatsu)	47.7	<b>64.7</b>
<i>Sun</i>	0	58.8	<b>36.8</b>
<i>Daily Mirror</i>	0	51.8	<b>39.7</b>
<b>All Papers</b>	<b>12 **</b>		

Source: calculated from results of National Readership Survey (2005)

Notes: \* The Guardian advertisements came from the 'opportunity sample'.

\*\* One advertisement (Givenchy) was found by our study only on the company website, and therefore is excluded from this table.

However, if we take into account the social class mix of the newspapers, we can start formulating one or two working hypotheses for the next phase of research.

First, mathematics advertisements seem to appear only in papers where there is a high percentage of middle class readers (the 'qualities'), or at least a more 'middling' level of middle class readership (the mid-market papers): we might go on to formulate an explanation in terms of levels of education and some (presumed) familiarity with and knowledge of mathematics. This would explain the absence of advertisements in the *Sun* and the *Daily Mirror* – but not that in the *Financial Times*! We might conjecture that the latter anomaly might be due to the readership being composed of financially highly specialised – and numerate – groups of (largely) middle class males, but the investigation of this idea would require further information or data.

Second, we might conjecture that there might be some difference between the types of 'mathematical' advertisements appearing in the *Guardian* and the *Times*, as compared with those in the *Daily Mail*. What our (limited) data show is that 'mathematical' advertisements for cars appear in three of the newspapers (*Daily Mail*, *Times* and *Guardian*); whereas 'mathematical' advertisements for business systems appear only in the *Times* and the *Daily Telegraph*. That might suggest a provisional hypothesis – that advertisements for business systems are more highly gendered than those for cars. It is important to try to assess whether there is any gendering of the individual advertisements, and, if so, in what ways. To do so, we can ask:

- whether the advertisement includes any recognisable or stereotypical masculine or feminine character
- whether there is any appeal to masculine or feminine discourses
- whether the advertisement addresses the reader as likely to be male / in a masculine role, or alternatively female / in a feminine role.

We shall classify each advertisement as gendered, ambiguous, or apparently gender-neutral (Table 5)

Table 5. Degree of gendering in advertisements.

	Clearly Gendered	Ambiguous	Gender-neutral	Total
Number of advertisements	4 (Mercury, Peugeot, Givenchy, Thales)	3 (Jaguar, R4Quorn R5Quorn)	6 (Abbey National job advertisement, Concert, Daihatsu, BMW, Sun Microsystems, South West Trains)	13

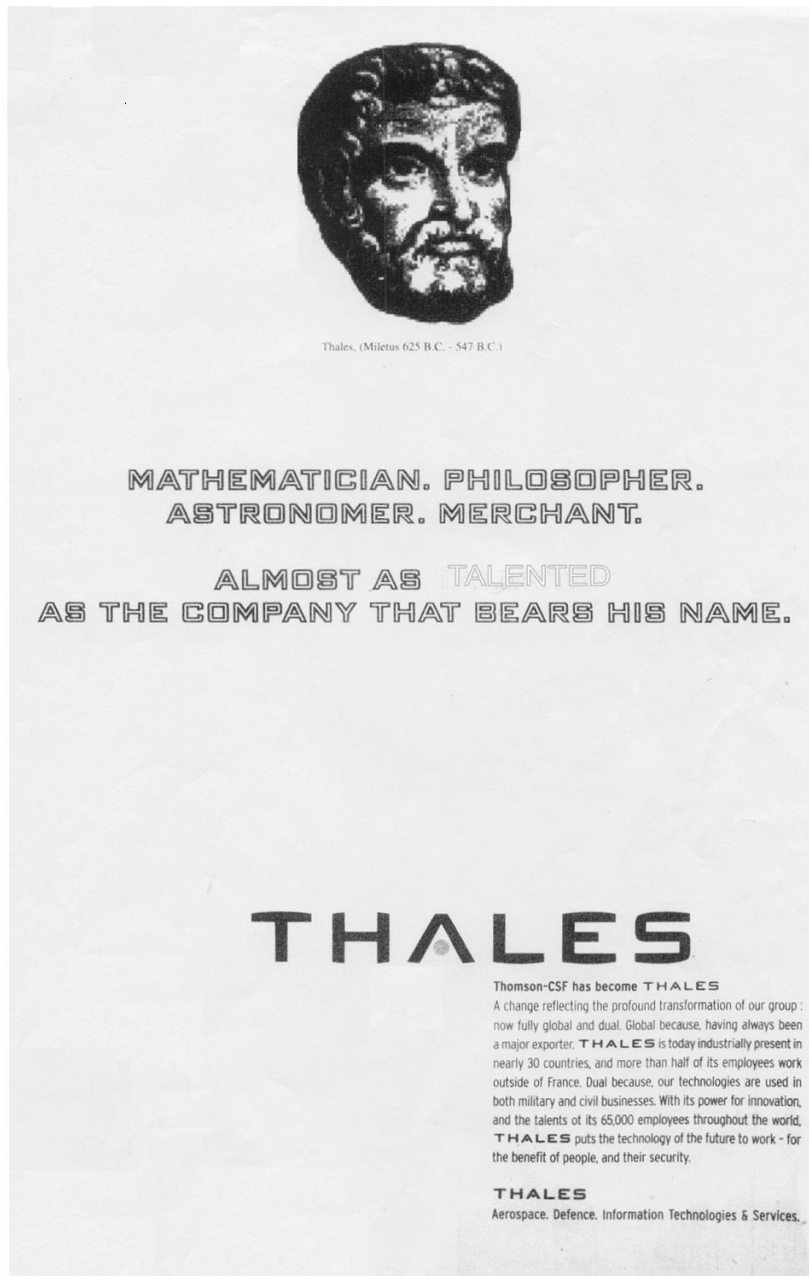


Figure 1. Thales advertisement (*Daily Telegraph*, 8 December 2000)

Within the ‘clearly gendered’ category, the Thales advertisement (in the *Daily Telegraph*, in 2000) contains a picture of (a sculpted head of) the eponymous Greek ‘Mathematician. Philosopher. Astronomer. Merchant.’, and the Mercury (see Evans, 2003) and Peugeot advertisements (in the *Guardian*, in 1994 *circa* and 1999, respectively) contain stereotypical male characters. The Givenchy advertisement (2002 *circa*) juxtaposes discourses on mathematics with those on masculinity.

The two advertisements for Quorn (a vegetable-based meat substitute) are categorised within the ‘ambiguous’ category, because, as a pair, they were clearly conceived to produce a ‘gender balance’. Thus, the R4 Quorn advertisement shows a ‘stick-figure’ woman dressed in a cooking apron in an advertisement advising readers what to eat on Wednesdays; however, at the same time she is pointing to a graph, purporting to indicate the “time spent smiling on Wednesdays”. The R5 Quorn (published four days later in 2003, also in the *Daily Mail*) is similar, except that the person in the cooking apron is now a man! However, a closer examination suggests that the man’s apron is smaller, also revealing a shirt and tie, and he is pointing to an apparently more complex graph<sup>6</sup>. These somewhat subtle differences may nevertheless be read to suggest that the man has a less ‘hands-on’ relationship with cooking than the woman, and that he may be able to handle basic statistical graphs more easily.

The Jaguar advertisement (Evans et al., 2007) has been classified as ‘ambiguous’, since the imagery generally, and the ‘soaring’ Jaguar in particular, may function to suggest a striving and competitive masculinity.

We categorised under half of the advertisements (6 of 13) as ‘gender-neutral’. First, the Abbey National bank’s job advertisement (*Times*, 2001): despite any gendered stereotypes of statisticians that may exist, our reading of this advertisement for a financial statistician is that it appears to be addressed to a (young) reader of non-specified gender; it also emphasises the company’s intention ‘to meet our disability symbol commitments’. The two car advertisements, for BMW and Daihatsu, make no reference to men or women, nor to discourses on gender. The same is true for the two advertisements for business systems, for Concert and Sun Microsystems (though we hypothesised above that advertisements for business systems might be more gendered than for those for cars).

In the South West Trains advertisement (*Guardian*, 2004) the narrative expresses concern for people who might be ‘worried about your safety’ and announces that £17 million has been spent on devices and staff to assure passenger safety. The reader is not addressed as gendered, nor as a member of any other vulnerable group of rail travellers.

Following these ‘quantitative’ analyses of the data – involving categorisation, frequencies, and the suggestions as to how we might use associations/cross-tabulations or correlations – we examine three of the advertisements categorised as ‘clearly gendered’ with more attention to their possible meanings in terms of the gender discourses underlying the text. The Peugeot and Givenchy advertisements have also been discussed in Evans et al. (2007), but it was the mathematical qualities of the images, rather than gender and social justice issues, that were foregrounded in that discussion. Let us first consider the Thales advertisement (Figure 1, published in the *Daily Telegraph*, Dec. 2000).

This advertisement is dominated by Thales’s sculpted face and his name, which has also become that of the renamed company. We are assured that he was a real person, by the added detail of his dates of birth and death: he certainly belongs to the Classical Era. Next follows his list of his achievements in a ‘mini-CV’: ‘Mathematician. Philosopher. Astronomer. Merchant’, each separated by full stops to give added emphasis. What is clearly considered his key attribute, ‘Talented’, is emphasised with a different typeface.

However, Thales, for all his talents, is displaced by the (superior) talents of the company in the line which asserts that he was ‘Almost as Talented as the Company that Bears His Name’. This ‘humorous’ line is followed, by some space, perhaps to let its double-edged meaning sink in. The smaller text at the bottom then emphasises the transformation of the company to a

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<sup>6</sup> However, both graphs are clearly based on fabricated, indeed ‘silly’, data (see Evans et al., 2007).

‘global’ and ‘dual’ one – concerned with ‘both military and civil businesses’ – guaranteed by the ‘talents of its 65,000 employees throughout the world’.

The humorous strapline may function to allay possible ‘worries’ created elsewhere in the advertisement. The reader may feel anxious in the face of the long list of talents possessed by the ancient Thales, or concerned that one of the services provided by the modern Thales relates to the military and ‘security’. Thus the appeal of the advertisement is a mixture – a ‘rational’ announcement of the change of name of the company, and its substantial capacities, and ‘relief’ from these sorts of anxieties. As for the ancient Thales, there is no doubt as to his masculinity, his talent or his achievements – and these qualities are meant to be associated with the company in this advertisement. His powerful and unambiguous masculinity is clearly established by the ‘Greek god’ image that heads the advertisement.

We next consider the Peugeot advertisement (Figure 2, published in the *Guardian*, August 1999). Evans et al. (2007) argue that this advertisement functions by creating a ‘lack’ (Williamson, 1978).

The advert thereby establishes a ‘need’ for in-car air conditioning, by sketching a worrying fantasy of a vindictive public road service, staffed by aggressive, nasty workers, who want to make the reader’s life a misery, even (or especially) on a holiday weekend. The relief is provided by the advertiser’s cars, which have [...] ‘personal air-conditioning’. (p. 46)

We can see the basis of this argument, in the domination of the picture by the large masculine figure – complete with huge traffic cone – and the ‘calculating’ tone of his words: “If I’ve got my sums right, these should cause a nice long tailback...”.

The man with the cone is an apparently powerful and anxiety-inducing figure, but, on reflection, the advertisement subverts him in several ways. He is the scapegoat for the disruption, although rationally we know he isn’t to blame: it is his employers and the road engineers who decide on where to put the cones. Further, the visual treatment is rather comical – he is almost caressing the cone and could be partnering the cone in a dance, but on the other hand, he is almost dwarfed by its size. Although the words attributed to him suggest that he thinks he can get one over on us (the readers), the resolution is that we get one over on him because we know that he is not really in control of the cones. We may indeed be tempted to laugh at him, because of the comic visual aspects (Bayley, personal communication, 2006).

Evans et al. (2007) suggest that the advertisement may point to class antagonism – of the road worker towards middle class car drivers. However, Bayley’s comment in the preceding paragraph suggests that the other aspect of class antagonism is built into the very narrative of the advertisement, in that the middle class reader/car driver has the ‘last laugh’. Thus, a consideration of the figure’s masculinity is incomplete without an appreciation of his social class position. This confirms the arguments above that the gender aspects of social difference must be understood in connection with other aspects of identity.

The advertisement in our corpus with the most overt links with gender is the Givenchy ‘Pi’ advertisement – unsurprisingly, since it is for a men’s perfume, and perfume is one commodity that plays a large role in expressing, and creating, gender difference (Figure 3).

This version of the advertisement was picked up on the company’s website in 2002, part of a campaign that has attracted much attention from serious newspapers (e.g. MIT’s campus newspaper) and from bloggers on the internet; since that time, the product has been re-launched with different colours and packaging, but with the same name.

Evans et al. (2007) note the ‘sensuality’ and sexiness of the pictures and the text, which aim to reinforce the association of positive (masculine) qualities with the perfume, for example by the references in the text to ‘man...’, ‘men...’. The mathematical object,  $\pi$ , we are told, ‘evokes infinity’; this is associated with the product’s ‘pioneering spirit’ and ‘adventurous imagination’. As for mathematicians, ‘men’ are claimed to be ‘still in pursuit of the end of its innumerable string of decimals’: this allows the text to assert the product’s qualities of ‘internal force’, ‘unruffled calm’, strength and energy.

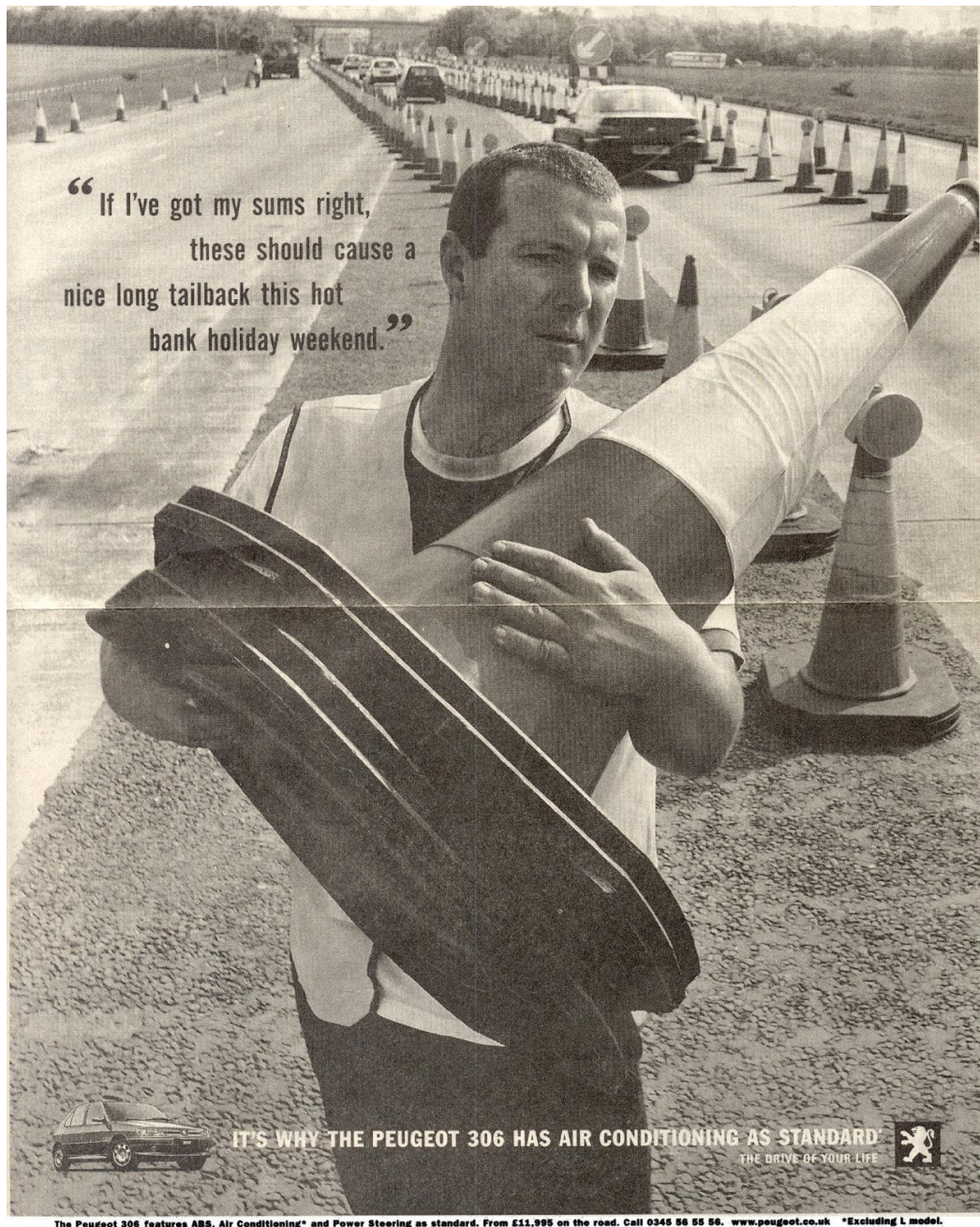


Figure 2. Peugeot advertisement (*Guardian*, August 1999)

Thus this advertisement not only picks up on gender stereotypes in the wider society, but it also *reinforces* and *extends* the association of masculinity with mathematics (see also Mendick, 2006), and with all sorts of other supposedly ‘desirable’ qualities.

We have thus sketched how the analysis of gender and (reproduction of) social differences using the corpus of advertisements can benefit from both ‘quantitative’ and ‘qualitative’ methods. In terms of social justice, this analysis appears to relate mainly to the *recognition* aspects, since what seems to be most at stake are the images of gender, and other social differences. However, we might ask how the portrayal of mathematics, and of the social divisions in relation to mathematics, affects the attraction to, or avoidance of, mathematics for individuals and diverse social groups – and hence the unequal *distribution* of types of mathematical knowledge, and satisfactory performance in school and college mathematics. Our discussion above gives an indication of ways to do further research into relations between different types of newspapers, notably those with different readerships, mathematics

advertisements, and gender and other social differences – based on a larger sample that would allow one to extend quantitatively the picture shown in Tables 3, 4, and 5.



π: BEYOND INFINITY

Deep in the nature of man is the will to go further than any man has ever been before. The quest is symbolised by the Greek letter  $\pi$ , which evokes infinity. Men are still in pursuit of the end of its innumerable string of decimals....A perfume which is synonymous with the pioneering spirit,  $\pi$  celebrates internal force and an adventurous imagination: energy and sensuality, unruffled calm and strength.

Figure 3. Givenchy advertisement (Givenchy, 2002)

More specifically, greater attention has to be paid to the apparent absence of advertisements in which mathematics figures in the popular press. For it might be that mathematics as a body of knowledge is being 'silenced' in this popular cultural domain, rather than being considered as a resource for public discussion for the average person. This in turn would have clear implications for the learning of mathematics and would raise the question of who can be recognised as a learner of mathematics. Positioning the subject outside the field of mathematical knowledge in discourses of the public domain, in this case advertising, constitutes an exclusion that might reverberate in some way in the positioning within formal educational discourses. And, for example, we can see here that drawing on such discourses, as the current pedagogy and policies recommend and encourage teachers to do, is not something that automatically benefits all students. At the same time, this would raise questions as to whether companies should be allowed to use the cultural heritage of mathematics in ways that are likely to clash with the work of teachers aiming to make comprehensible the ideas and methods of mathematicians or other scientists.

## 6. Extending the analysis of social justice to further aspects

So far we have developed a dual aspect of social justice or equality. Writers within the field of sociology of education have considered, in addition to 'distribution' and 'recognition', a third facet of social justice. Lynch & Lodge (2002) focusing on 'equality' in schools, use the term 'representation' to refer to (equal or unequal) relations of power in decision making processes. Cribb and Gewirtz (2003) in discussing different facets of social justice from a sociological perspective on policy, call this third facet 'associational justice'. It 'calls for a consideration of the social and political context within which schooling takes place and of the possibilities of building higher levels of participation within these contexts' (p. 26). Bernstein (2000) proposing a model for examining and evaluating democracy in schools, suggests that 'there is likely to be an unequal distribution of images, knowledges, possibilities and resources which will affect the rights of participation, inclusion and individual enhancement of groups of students (p. xxii). In particular 'participation' which operates at the level of the political, is defined by Bernstein as 'the right to participate in the construction, maintenance and transformation of order' (p. xx).

The references above suggest that there is a lively and renewed interest within the various strands of theory and research in the discipline of sociology of education on social justice. Indeed, this discipline has also a long tradition of raising and elaborating on social justice concerns. As an indication, it is worth reproducing here four sets of questions which, according to Roger Dale, have been formative to the sociology of education in the course of its development. These questions are:

- Who gets taught what, how, by whom, and under what circumstances, conditions, contexts and resources?
- How, by whom and through what structures, institutions and processes are these matters defined, governed, organised and managed?
- What is the relationship of education as a social institution to other social institutions of the state, economy and civil society?<sup>7</sup>
- In whose interests are these things determined and what are their social and individual consequences? (Dale, 2001, p. 27)

It can be seen that, while the first point relates immediately to distributional issues, the last three raise issues concerning politics and power. These are not completely covered by the distributional and recognition aspects of social justice, so to be adequately conceptualised they require a third dimension of analysis.

Thus the third aspect of social justice or equality, in its most general formulation, concerns power as the 'representation of interests':

- power relations at macro-levels of state and related institutions
- micro-level power relations between teachers and students (or 'age-related status')
- Meso-level power relations.

This last refers to the way pedagogical discourses (including quasi-pedagogical ones such as media 'texts' and advertisements) are constructed, and the way institutional practices are organised so as to include or to exclude individuals (and social groups) from legitimately and effectively participating within the terms of the discourse.

Overall, 'representation' is less developed as a concern within educational research than redistribution and recognition. And, within this facet of social justice, the macro- and micro-levels are better researched.

In our own research project on mathematics in advertising we are seeking to approach the representation facet of social justice by asking questions about the construction / recontextualisation (Bernstein, 2000) of discourse and the space it allows for individuals to participate and actively engage with it. In particular we explore how substantial mathematical

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<sup>7</sup> Here we would add: relations of the educational institutions to the media and popular culture.

topics such as ‘equations’ are recontextualised in advertising practices; attending in particular to the way the design of such texts position the ‘pedagogical’ subject.

An example comes from our new sample of advertisements, from the Jordans ‘3 in one’ breakfast cereal advertisement (April, 2007). The Jordan’s ‘3 in one’ breakfast cereal advertisement contains large, colourful pictures of three ‘natural ingredients’, and a picture of the cereal box. The main part of the layout is arranged in the form of an equation, which ‘adds’ (the pictures of) the three ingredients to ‘equal’ the cereal box.



Figure 4. Advertisement for Jordan’s ‘3 in one’ (*Observer*, 1 April 2007)

The three ingredients are not named in the pictures, but the claimed effect (e.g. ‘Taste’, for the apples and raisins) is shown above the picture (and ingredient and effect are linked in the text). The natural quality of the ‘wholesome’ ingredients is emphasised in the largest prints of the verbal text, with ‘nothing artificial added’ in the main text, and with a ‘Back to nature’ slogan, placed next to the brand’s name.

The main equation covering the space of the advertisement looks simplistic and childish, perhaps evoking the experience with arithmetic as remembered from early learning classrooms. In the picture of the cereal box, the equation is repeated, this time equated to a bowl full of cereal, the content of which is summed up in a curious (mixed genre) statement made up by the combination of a number (3) circling the words ‘in one’. The pattern created by the repetition of the equation, each time with a little more information added on, gives the advertisement a rhythm which totally directs its reading: everything adds up (with a little help from other signifiers in the verbal text, such as ‘plus’ and ‘sums up’) to a full breakfast, and everything leads you to Jordan’s new ‘3 in One’ cereal product.

In terms of its mathematical content, then, this equation pretty much dispenses with mathematical symbols altogether. The three little piles of ingredients cannot really be added mathematically, though measurable qualities of them (e.g. weight) might be. Thus they could not ‘equal’ the product in the box. The ingredients might be mixed together physically, but, in order to ‘equal’ the product in the box, (industrial or other) transformation of some of the ingredients would be required (the oats and other grains of course have already been transformed for the pictures). This shows something of the operation of the Referent System ‘Nature/Natural’, which is ideologically related to the Referent Systems of ‘Science’ and ‘Mathematics’: Culture, through Science, transforms Nature – and we are left only with ‘the Natural’ (Williamson, 1978).

If we scrutinise the advertisements presented above with the systematic tools of analysis presented by Bernstein (1990), we can see how the Jordans ‘3 in one’ advertisement has been designed. In terms of its *classification*, we note that boundaries between the mathematical ideas expressed in the idea of the equation and the everyday knowledges about eating healthy breakfasts are blurred; similarly, the language is a mixture of words and mathematical symbols; therefore, there is a weak classification of specialised and everyday language. Turning to



*framing*, the degree of control that an implied author and a reader – as constructed in the text – have over the communicative process, we could argue that very little control is left to the addressee: the options left to the implied reader are reduced by repeated equations all leading to the box enclosing the product.

We are suggesting that mathematics topics as recontextualised in advertising practices may constitute crucial texts for exploring the third facet of social justice. In particular they invite us to examine the power and control relationships in (quasi-)pedagogical communication settings; therefore to analyse the potential for individual's participation and engagement in spheres of knowledge; that is to say in a symbolic world through which social order is maintained, reproduced or challenged.

From a methodological point of view, the research we have carried out thus far on the advertisements is mainly qualitative, semiotic analysis of text. However there is no necessary reason why such work cannot be conducted using a quantitative methodology. Indeed the work of Koulaidis and colleagues in science education is a case in point (Dimopoulos, Koulaidis, Sklaveniti, 2003). They have studied both textbooks and unofficial pedagogical sites such as science reports in the press and artefacts in museums; and they were able to assess quantitatively the extent to which such texts construct students as active participants in science learning. Such findings in quantitative form clearly can contribute to a wide-ranging analysis of the meanings and effectivity of such texts, including the advertisements that we study.

Indeed, in the case of our mathematics advertisement project, it was in terms of quantification of number of advertisements, location, and kind of readership that absences were identified. And it is this observation that has provided certain methodological insights concerning further sampling strategies. Thus we argue here that, just as it is difficult to separate in practice each of the three analytical aspects of social justice, so it is difficult to separate strictly in practice between 'quantitative' from 'qualitative' work. As shown in this article, a crucial basis for deciding the methodological strategy of a research project is the theoretical conceptualisation of the problem.

## 7. Conclusions

In this paper we have argued that a perspective on social justice and equality is fundamental for many important research topics in educational research today. It is also central to many policy concerns. Our approach includes not only gender, but also social class and ethnicity, as crucial dimensions of social justice.

We have argued that research into social justice and equality requires the use *both* of quantitative and qualitative methods, as illustrated here. These may sometimes be used together in one particular study (e.g. Evans, 2000 and our 'mathematical advertisements' project, discussed above), or sometimes woven together in a developing research programme (see discussions above of Gillborn & Mirza (2000), or Arnot (2002)).

On a theoretical level, there is a complex inter-relation between the three facets of social justice/equality which should be understood as interpenetrating. As Fraser (2000) shows, the different aspects are inseparable for many groups. And in this paper we have shown the importance of working with a multi-faceted notion of social justice in researching mathematics education<sup>8</sup> – a conception which can guide researchers as to which methodologies are appropriate to use.

Thus we want to emphasise again that theoretical analysis is crucial in underpinning empirical work of a qualitative or a quantitative kind, or their combination and that sociological research programmes provide an essential basis for this research. Although there are different

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<sup>8</sup> Following Lynch & Lodge (2002), we might also explore whether the emotional biography of an individual is a further facet of the notion of social justice, and we should explore its implications for the current research agenda of mathematics education.

theoretical perspectives within the former, a theory that would combine some of the criteria underlined in the extract below is a necessary guide to research.

Theory [ ... ] offers a language for challenge, and modes of thought other than those articulated for us by dominant others. It provides a language of rigour and irony rather than contingency. The purpose of such theory is to de-familiarize present practices and categories, to make them seem less self-evident and necessary, and to open up spaces for the invention of new forms of experience... (Ball, 1998)

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