

# Images of Mathematics in Popular Culture / Adults' Lives: a Study of Advertisements in the UK Press

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## **Abstract**

The success of policies to attract adults back to the learning of mathematics, at various levels, is often linked to questions of motivation. However, motivations depend on relevant beliefs, attitudes and emotions about mathematics - which themselves reflect, together with experiences with maths in school and in the home, wider cultural discourses on mathematics. The work presented here is part of a larger study examining the complex relations between popular cultural products such as advertisements and films, the way that knowledge is portrayed by them, and possible consequences for people's affective responses. The initial phase of the project (Evans, 2003, 2004) analysed small 'opportunistic' samples of advertisements and films. The advertisements portrayed mathematics as generally negative, whereas the films were more ambivalent. In the next phase, we produced larger samples of both advertisements and films. In this paper, we report on our search through a systematic sample of issues of UK daily newspapers for 'mathematical' advertisements. A notable finding was the very small number of advertisements containing images of mathematics. Those few advertisements we found were most frequently for cars, or for services to businesses. Using a discourse theoretical perspective and a hybrid methodology, we categorise advertisements according to features such as their 'appeal' to potential consumers - and we also produce semiotic readings of a sub-sample of advertisements, as to their 'message', in particular their images of mathematics, and of people doing, using, or teaching mathematics. Here we find these images to be much more varied and subtle than in the initial phase. We end by discussing some of the consequences of our analysis for perceptions, teaching and use of mathematics in today's market economy societies.

Keywords: images of mathematics; popular culture; advertisements; discourse analysis; emotion; motivation.

## Introduction

Despite long-term neglect of emotional issues in education, they are today firmly on the educational policy agenda. This is evident from the way that resources are drawn from diverse cultural fields to please and to educate learners in formal educational settings. The “emotional turn” (Hartley, 2004) has shifted the emphasis in the polarity *rational vs. emotional*, within the educational discourse. But terms such as *emotional intelligence* and *emotional literacy* theorise emotions as something to be taught, learned and evaluated. They function to regulate and to manage learners - especially adults, a newly significant target group, since, for instance, the inception of the UK government’s *Skills for Life* strategy, launched in 2001.

The emotional and attitudinal issues are especially important in mathematics education, since mathematics functions as a gatekeeper, both as a qualification for further study and desirable jobs, and as a prerequisite for certain types of cultural participation. Thus, recent policies on lifelong learning, in the United Kingdom (UK), in the European Union (EU), and around the world, argue for a substantial return to learning by adults, notably in mathematics and numeracy, to help eliminate inequalities (e.g. Parsons & Bynner, 2002; Hughes, Blaxter, Brine, & Jackson, 2006) Yet there is concern over the persistence of low levels of motivation and high levels of avoidance of mathematics and resistance towards it (e.g. Wedege & Evans, 2006), both among schoolchildren and adults. These ‘negative’ attitudes have been linked in the research literature to emotions experienced during school activity, in “numerate everyday contexts” (Evans, 2000) - and as a result of exposure to various kinds of media representations.

As Paul Ernest (1995) notes

A widespread public image of mathematics is that it is difficult, cold, abstract, theoretical, ultra-rational, but important and largely masculine. It also has the image of being remote and inaccessible to all but a few super-intelligent beings with ‘mathematical minds’.  
(Ernest, 1995, p. 1)

He argues that negative attitudes to mathematics are likely to be associated with the traditional *absolutist* image of mathematics (as described in the quotation), rather than a more *humanised* image of the subject.

Gail FitzSimons (2002) sees the *public images* of mathematics as “created and reflected both in the cognitive and affective domain and concern[ing], *inter alia*, knowledge, values, beliefs, attitudes, and emotions”. She argues that

a very strong influence on the public image of mathematics comes from the experience of formal mathematics education ... [and] other influences such as stereotypes reinforced by popular media, or personal expectations conveyed explicitly and implicitly by significant others such as peers and close relatives. (2002, pp. 43-45)

For these reasons, the public images of *mathematics* and the images of *mathematics education* are exceedingly difficult to disentangle.

The work-in-progress presented in this paper explores representations of mathematics as articulated in a variety of ways - and not only as ‘stereotypes’ - through powerful media forms. From the beginning of this project, we have decided to focus on advertisements (largely in the press) and films as our two media forms. This is because of our belief that these are two from among the most socially potent media in present times, and because the relevant research

materials are relatively convenient to manage. Further, presentations and discussions based on them tend to be accessible to a wide range of audiences (including international ones): many films (at least mainstream ones) tend to be well known globally, and advertisements can be portrayed on one side of paper (or on one projector slide).

The initial phase of the project analysed small and 'opportunistic' samples of each (amassed with help from friends, and colleagues, and mostly from before 2001). Our initial thinking and analysis of these advertisements and films focussed on issues such as:

- the extent to which dominant discourse(s) on mathematics could be identified in such samples of materials;
- the extent to which there appeared to be systematic differences in the representation of mathematic(ian)s between films and advertisements (especially the most recent ones); and
- the extent to which there appeared to have been changes in these discourses over time.

In connection with the latter issue, we asked whether we might find a more 'positive' tone (in terms of the image of mathematics and mathematicians) in advertisements and films after 1995<sup>1</sup>, than before.

Our initial results were as follows. The advertisements we found generally portrayed mathematics as something to be disliked, feared and mistrusted. On the other hand, the films (e.g. *Good Will Hunting* (Bender & Van Sant, 1997), *A Beautiful Mind* (Grazer & Howard, 2001), *Enigma* (Michaels, Jagger & Apted, 2001)) produced ambivalent messages. Mathematics was there portrayed as perhaps the most powerful form of thought - and as therefore supporting a quest for truth and beauty. But too much mathematics can be dangerous: it can be an expression of - or perhaps a trigger for - 'madness' (see also Evans, 2003, 2004).

In the second phase of the project, we aimed to produce larger samples of both advertisements and films. A larger number of films were thus identified as relevant, and systematic sampling of UK national daily newspapers from 1994-2003, supplemented by our earlier 'opportunistic' sample, resulted in a small corpus of print advertisements to analyse.

In this paper, we focus on our sample of print advertisements. Drawing on several conceptual approaches, we first discuss our discourse theoretical perspective, followed by an outline of our methodology. We then present an analysis of our sample of advertisements, as well illustrating our semiotic readings of several of them. We conclude by pointing to some of the implications of our analysis for images, teaching and use of mathematics in the current conjuncture.

### **Theoretical Considerations**

Our starting point is that films, advertisements and other such cultural productions are representations which both reflect, and contribute to the construction and maintenance of, dominant social discourses. Such discourses, formed partly by appropriations of popular cultural ideas or images, might be reappropriated by official educational discourses and reinterpreted by individual agents, be they policy makers, teachers, pupils, or adult learners. This means that we are interested in cultural productions because they play a significant role in constructing and

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<sup>1</sup> We chose this point in time partly in response to features of the early data, and partly on the basis of the initially positive reporting around that time of Andrew Wiles's efforts at proving Fermat's Last Theorem. As will become evident, we no longer propose such a simple factor for such a substantial ideological change, nor are we sure that such a change has occurred! And, even if it has occurred, there may have been a time-lag (see also Conclusions).

reproducing dominant and dominated positions of power affecting individuals in many contexts of social and educational activity.

Our theoretical approach uses discursive perspectives (see Evans, Morgan & Tsatsaroni, 2006; Evans, 2006), based on Critical Discourse Analysis (Fairclough, 2003) in socio-linguistics, work on pedagogic discourse in the sociology of education (Bernstein, 2000), and post-structuralist analyses, drawing on psychoanalytic concepts (e.g. Walkerdine, 1988, 1997; Evans 2000; Mendick, 2006).

Discursive perspectives focus on specific societal/institutional practices as recurrent forms of behaviour/action. A discourse here is seen as a system of ideas/signs organising and regulating the related practices, crucially, with respect to social relations of *power*. Discourse has several functions:

- defining “how certain things are represented, thought about, practised and studied”;
- providing resources for constructing meanings, and accounting for actions; and
- “construct(ing) identities and subjectivities”, which include affective characteristics and processes (Hall, 1997, p. 6).

Power is exerted in micro social interactions, in ‘meso’ institutional contexts, and in the wider culture, including by policy-makers and by the media within popular culture (Appelbaum, 1995).

A key concept is that of *positioning*, a process whereby an individual subject takes up and/or is put into one of the *positions* which are *made available* by the discourse(s) at play in the setting. In this approach, a person’s *identity*, which includes more durable aspects of affect such as attitudes and beliefs, comes from repetitions of positionings, and the related emotional experiences, in a context of a personal history of positionings in practices.

Bernstein’s sociological theory is also a main theoretical source (Bernstein, 1990, 2000). First, his concept of recontextualisation is a key concept in understanding the construction of discourse. This was developed by Bernstein to describe (initially) how pedagogic discourse is created through social processes which involve selection, simplification, repositioning and refocusing of elements drawn from knowledge producing discourses (Bernstein, 1990). These processes entail transformations of these elements and changes in social relations. Therefore, like official pedagogic discourses, media discourses are regulatory, having consequences for the construction and reconstruction of identities and subjectivities.

Of particular relevance for developing our problematic are two key assumptions forming the basis of Bernstein’s theory. The first is that education today, more than ever before, serves symbolic control functions rather than functions related to material production (i.e. transmitting knowledge and skills). The second assumption is that education, while belonging as an institution to the general cultural field, is nonetheless distinguished from it - since historically it has become the state’s official site for social and cultural reproduction. This means that in the context of Bernstein’s theory the pedagogic discourse assumes priority over and against other (‘unofficial’ or non-state, e.g., media) institutions and their discourses in the cultural field. However, a post-structuralist reflection on Bernstein’s notion of discourse (Tyler, 2004; Lemert, 2006) would recommend greater consideration of the interconnections between the wider field of symbolic control and the field of education; or, more precisely, of the perpetual constitution and reconstitution of their respective boundaries and relations through the influence of internal (to each), as well as external, political, social and cultural forces.

Nevertheless, Bernstein's later emphasis on media discourses (2000, Ch. 11) provides important theoretical insights into our research object. The first insight comes from his view that *cultural productions*, whether oral communications in the classroom, textbooks, syllabuses, advertisements or films, are the means by which power relations translate into discourse and discourse into power (Bernstein, 1990). Of importance here is to describe what Bernstein calls the *code modality* regulating communication processes; his concepts of classification and framing are indispensable in such activity. *Classification* helps to conceptualise power relations between different categories of agents (e.g., transmitter and acquirer), discourses (scientific and everyday), forms of knowledge (mathematics and history). *Framing* helps to ask questions regarding who has control over what in the process of communication/interaction. Furthermore, both concepts utilise the idea of boundary pointing to the importance of describing changes in its strength in the processes of recontextualisation through which (pedagogic) discourse is constructed, taught and learned.

The second theoretical insight stems from his view that contrary to pedagogic discourses that form more durable pedagogical relations and communications, media representations contain a range of discourses that are segmentally organised. These segments may have a variety of discursive realisations, and may result in different motivations - aiming as they do to maintain, develop or change an audience niche (Bernstein, 2000, Ch. 11). We can assume therefore that due to their segmental organisation, media discourses are multi-layered, *creating a variety of modes of communication*, and are therefore complex as to their reception. That is, we cannot expect a strong, or even indirect, control over the context, social relations and motivations of the receivers/consumers. On the contrary, what is acquired, at what level and for what purpose is open to investigation and debate. Nevertheless, Bernstein calls this form of media discourse a *quasi-pedagogic discourse*, thus indicating that media discourses entail some form of pedagogic (i.e. social) regulation, irrespective of the ways in which messages are acquired.

This basic analysis of media discourses as quasi-pedagogical justifies at this theoretical level of discussion the focus of our current study of mathematics representations in the media. In particular, it allows us to argue that the modalities of communication created by the organisation of media discourses attempt to distribute forms of consciousness, identity and desire<sup>2</sup>. At the same time, these theoretical insights point to the difficulties of such a project; especially with regard to the implications, for individual receivers of messages, of any analysis of the modes of communication embedded in a given discourse.

Thus far we have argued for the importance of approaching our topic with the view that the production of cultural objects simultaneously inscribes ways of producing identities and subjectivities. Our second key starting point is the idea that central to the constitution of subjectivity in sites of cultural production are the links forged between the cognitive and the affective, here understood as the question of the place of emotion in cognitive-affective *chains of signification*. By this, we mean chains of developing meanings produced by chains of signifiers in the relevant text.

On emotion, the following points are important for us. First, just like thinking, learning, or working with mathematics, emotional expression and experience are embedded in social contexts, and thus can be seen as *socially organised* (see Evans, Morgan & Tsatsaroni, 2006).

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<sup>2</sup> Leiss, Kline & Jhally (1990) point to the possibility of a given culture of 'consumers' of advertising being 'educated' over time through changing forms and strategies of advertising.

Second, we see *emotion* as related to *desire*, which is considered to permeate the workings of language. Thus emotion can be visualised as a charge attached to ideas and the terms in which they are expressed. This charge has a physiological, behavioural (including verbal) expression, and a subjective ‘feeling’ aspect. This allows emotion to be seen as ‘attached’ to ideas (cognition), but in ways that are fluid, not fixed. Some of this fluidity can be seen as related to psychic processes of *displacement*, where meanings and feelings flow along a chain of ideas (or signifiers) and *condensation*, where meanings and feelings ‘pile up’ on a single signifier (Evans, 2000). This is how the psychic/‘individual’ and the linguistic/social interconnections could be conceptualised.

Third, emotions may be *unconscious* in the psychoanalytic sense of being pushed into the unconscious, via the operation of *repression*, one of the defence mechanisms. In psychoanalytic approaches, ideas which have strong emotional charges, such as anxiety, or which mobilise intrapsychic conflict, have a tendency to meet defences, and thus to be repressed. Therefore, much thought and activity takes place outside of conscious awareness: everyday life is mediated by unconscious images, thoughts and fantasies (Hunt, 1989). This unconscious material is linked to complex webs of meaning (Evans, 2000, Chs.7-10).

Thus, emotions must be understood in connection with *desires* and *fantasies*. Many desires are unconscious, since they may be felt to be ‘unacceptable’ or in conflict with the person’s desired social image; fantasies are specifically ‘unrealistic’ or ‘irrational’ images and narratives that express the desire for some object on the part of the person entertaining them. Both have ‘social’ aspects, in that desires are connected with social imagery, as is the case with advertising and films, and fantasies can manifestly be shared at the group, professional, or national cultural level (Walkerdine, 1988, Chs. 9 & 10).

An excerpt from *Enigma* (Michaels, Jagger & Apted., 2001), a film which portrays mathematicians at work and at play, allows us to illustrate the role of fantasy in the effectivity of films and their articulation of powerful elements of social imagery. In this excerpt, the themes of desire and fantasy are illustrated in a story of the code-breaking headquarters at Bletchley Park in Britain in World War 2. In this scene, the hero, a mathematician, goes to the home of a woman with whom he had earlier fallen in love. He does not find her there, but he cannot resist entering her room; there, he recollects her image, as he smells her perfumes, and, in particular, one earlier meeting with her:

*Theme song in the background, they are sitting on a sofa.*

She: Why are you a mathematician? Do you like sums?

He, holding a rose: Because I like numbers - because, with numbers, truth and beauty are the same thing ... you know you’re getting somewhere, when the equations start looking ... beautiful. (He looks at her slightly appraisingly/appreciatively.)

Then you know the numbers are taking you closer to the secret of how things are. A rose is just plain text...

He hands her the rose; she takes it, but, as he passes it over, a thorn pierces his thumb and makes it bleed. She kisses his thumb; they embrace.

Illustration from *Enigma* (Michaels, Jagger & Apted., 2001)

In this scene, the beauty of mathematics is intertwined with that of the rose and that of the classically attractive woman. He exhibits his desire for these beautiful ‘objects’, and further, in aligning beauty with truth in mathematics, he suggests a ‘higher’ form of beauty. His desire to follow “the numbers [...] closer to the secret of how things are” suggests a heroic goal shared by many mathematicians, and also perhaps attractive to some young mathematics students at

school or university. Others have considered the extent to which this version of 'Reason's dream' can be usefully understood as *fantasy* (e.g. Walkerdine, 1988).

In the illustration above, the beginning of the scene can be interpreted to show that the male mathematician is experiencing pleasure through entering the room, and smelling the perfume of the woman he loved as these are associated with her. He is also experiencing pleasure through remembering the encounter with her. These re-experienced pleasures derive from the original experience with her, which was imbued with feeling - but they also reformulate that experience, as they reverberate with pleasures experienced in practising mathematics. Such instances of emotion are experienced by individuals who already have beliefs and attitudes that are to a great extent *culturally transmitted* by the person's 'significant others', such as parents, siblings, teachers. But there is also a role for the media and other means of communication, which transmit images of mathematics and mathematicians in popular culture (Appelbaum, 1995; Evans, 2003, 2004; Mendick, 2006).

Emotion can also arise through an association with objects or ideas different from those to which it was originally linked. Psychoanalytic approaches see this as happening through the capacity of an affective charge to move from one idea to another along a chain of associations by *displacement*. A number of examples are given by Evans (2000, pp. 116-9). The following excerpt from another film featuring a mathematician illustrates the meaning of displacement, and how it works.

In *Smilla's Feeling for Snow* (Eichinger, Moskowitz, & August, 1997), the heroine, who investigates the mysterious death of a young boy in a block of flats in Copenhagen, is also a mathematician. In one scene, where she is having a meal with a man who clearly has strong feelings for her (apparently unreciprocated), she is describing how difficult it was for her to be relocated from Greenland to Denmark, as a young girl:

*He:* And you were never happy here?

*She:* The only thing that makes me truly happy is mathematics ... snow ... ice ... numbers [*She smiles.*] To me the number system is like human life. First you have the natural numbers, the ones that are whole and positive, like the numbers of a small child. But human consciousness expands and the child discovers longing. Do you know the mathematical expression for longing? [*He shakes his head.*] Negative numbers, the formalisation of the feeling that you're missing something. Then the child discovers the in-between spaces, between stones, between people, between numbers - and that produces fractions. But, it's, it's like a kind of madness, because it doesn't even stop there.... There are numbers that we can't even begin to comprehend. Mathematics is a vast open landscape: you head towards the horizon, it's always receding ... like Greenland. And that's what I can't live without, that's why I can't be locked up....

*He:* Smilla, can I kiss you? [*She moves away.*]

Illustration from *Smilla's Feeling for Snow* (Eichinger, Moskowitz, & August, 1997)

This scene again associates mathematics with beauty and seduction: here we have a beautiful female mathematician herself talking about mathematics. As we listen to her talk, what comes across most strongly is her longing ... for numbers, mathematics, Greenland, and the sense of loss as she sees them "always receding": the linking of these signifiers forms a *chain of signification*. The original (in this excerpt) feeling of loss and longing appears to relate to Greenland, which itself may stand for another object, such as her dead mother; that feeling is *displaced* onto mathematics, and in turn onto the negative numbers - that part of mathematics which for her "formalises" the feeling of loss, and which she contrasts with the "whole and positive" natural numbers of the young child.

Thus we see that objects of popular culture such as films are sites for the articulation of discourses within which meanings are defined, images are built up, and hence power is invested. This illustrates another way in which emotions are socially organised. These different objects of popular culture may relate to each other as texts via *intertextuality* (the insertion in one text of ideas, terms, or images from another - see examples below). Further, discourses operating in one field may allow an influx of terms, symbols and ideas from other fields, that is, *interdiscursivity* (Fairclough, 2003). From our discourse theoretical perspective this points to the importance of *key signifiers*, which ‘arrest meaning’, in the sense of re-articulating and stabilising meaningful contexts for action - though always precariously, with no guarantee of permanence or fixity.

### Research Questions

Following on from the theoretical premises above, and from the general issues indicated in the introduction, we can assume that popular representations may play a major role in reinforcing (or challenging) long-term public images of mathematics, thereby reproducing dominant social and educational discourses. Furthermore, we assume that the way that mathematics is recontextualised in such representations may become a significant influence on subjectivity. This in turn indicates that it would be crucial to examine mathematics in popular representations by exploring questions such as:

- From what discourses do advertisements or films draw resources in order to construct the public/reader/viewer/consumer as a person?
- How do they construct him/her as knowledgeable in mathematics?
- What branch and level of mathematics does an advertisement draw on to convey the intended message and consequently what level and depth of knowledge is a citizen of average educational experience assumed to have?

In this second phase of our work these issues led us to produce the following set of specific research questions with which to systematically approach the advertisements data:

- RQ0 To what extent do advertisements use mathematics as a resource to construct their messages?
- RQ1 What kind of discourse(s) on mathematics, people doing mathematics, school mathematics, and/or teachers of mathematics can be identified in the images portrayed in our sample of advertisements?
- RQ2 Are there changes in these discourses/images over time?
- RQ3 On what discourses do advertisements draw to construct the public/reader as a person, who is knowledgeable (or otherwise) in mathematics?

### Methodology

Initially, we needed to decide on several methodological issues:

- Criteria/Indicators: how to determine whether an advertisement was an instance of a ‘representation’ of mathematics or mathematicians
- Fieldwork method: how to gain access to a set of newspapers that could be scanned for advertisements satisfying the definition
- Sampling: how to select the sample of newspaper issues for scanning.

As criteria for an advertisement to qualify as containing a representation of mathematics (or mathematicians), we looked for one or more of the following keywords in the text:

- mathematics; mathematician; math/s; geometry/geometrician; algebra; equation(s); number(s); science/scientist; calculation(s), sum(s) (or related terms);
- the name of a prominent mathematician (such as Einstein, Stephen Hawking).

Alternatively, we looked for one or more of the following graphics:

- a graph, a formula or equation;
- the picture of a prominent mathematician (such as Einstein, Hawking).

As a fieldwork method, we decided that we would look for advertisements in a sample of newspapers in the Colindale Newspaper Library in London, rather than using an agency. The reason for this was that we were uncertain as to whether the 'proxy researchers' available from an agency would have sufficient understanding of our requirements, and sufficient flexibility for dealing with borderline cases.

For sampling, we designed the sample on the basis of readership profiles (available from British Rates and Advertising Data - BRAD). We decided to focus on national daily newspapers, as providing the most generally representative indication of advertisements placed in the British press. We selected three 'quality' newspapers (*Times*, *Daily Telegraph*, *Financial Times*), one mid-market paper (*Daily Mail*), and two 'popular' papers (*Sun*, *Daily Mirror*) - and systematically selected two periods (each 10 to 15 days long) for each of the four years 1994 (i.e. before 1995 - see footnote 1), 1997, 2000, and 2003. This systematic sampling method resulted in almost 550 editions being examined from cover to cover for 'mathematical' advertisements (as characterised above). However, this work yielded fewer advertisements than we had expected. So we added further sampling periods from 2001 (before September). At the same time, we decided to stop before completing the *Sun* sample, since no appropriate advertisements were found in it or the *Daily Mirror*.

Once we had amassed our sample of advertisements, they were analysed on three levels:

- basic characteristics: e.g. newspaper, timing, overt aim of the advert;
- content analysis indicators, based on those used by Leiss, Kline & Jhally (1990); and
- 'semiotic' readings of the images of mathematics, school mathematics and people doing mathematics portrayed by the advertisement.

(See Appendix A for further details on the coding categories used.)

The first level relied on relatively straightforward categorisations, whereas the next two required interpretations of the possible meanings of the advertisements. This had the potential to fruitfully combine 'quantitative' and 'qualitative' analyses, as in the hybrid 'qualitative cross-sectional' analyses by Evans (2000), using a sample of semi-structured interviews.

## Results

In this section, we produce a selection of initial results from the data analysis. The results of the trawl for advertisements are indicated in Table 1. The first notable finding is how few advertisements were found in which 'mathematics', 'mathematician', or similar terms (see above) figured. Of the almost 550 editions of daily newspapers examined from cover to cover, only 9 advertisements were found. Furthermore, they were concentrated in the quality and mid-market papers, with none being found in the popular newspapers; see Table 1.

Table 1. Advertisements found in editions of daily newspapers in the systematic sample.

Newspaper	No. editions examined	No. of Ads	“Success rate”
<b>Times</b>	105	4	<b>4/105 = 4%</b>
<b>Financial Times</b>	124	0	<b>0</b>
<b>Daily Telegraph</b>	76	1	<b>1/76 = 1.3%</b>
<b>All Qualities</b>	305	5	<b>5/305 = 1.64%</b>
<b>Daily Mail</b>	97	4	<b>4/97 = 4%</b>
<b>Sun</b>	53	0	<b>0</b>
<b>Daily Mirror</b>	88	0	<b>0</b>
<b>All Papers</b>	<b>543</b>	<b>9</b>	<b>9/543 = 1.66%</b>

That is, only 1.66% of the daily editions examined included an advertisement that made reference to mathematics, and all of these were in either the quality papers represented by *The Times*, the *Financial Times*, and the *Daily Telegraph* (various success rates ranging from 0 to 4%), or in the *Daily Mail* (‘success rate’ a little over 4%), the sampled representative of the mid-market newspapers. No advertisements making reference to mathematics were found in the ‘popular’ newspapers, represented by *The Sun* and the *Daily Mirror*. As far as advertisements in the daily press are concerned, mathematics appears to be marked by its absence as being outside the range of attention of most ordinary people.

### Basic characteristics of the advertisements

In considering basic characteristics of the advertisements, the whole sample of 15 was analysed; nine from the systematic sampling over the period 1994-2003, and six from the ‘opportunistic’ sample from 1986 to 2004<sup>3</sup>. The product category of the advertisements are detailed in Table 2. We compared the results from the systematic sample with those of the overall merged samples.

Table 2. Product category of the advertisements

Product category	Number in systematic sample (number in overall sample)	Advertisements in systematic sample {Advertisements in opportunistic sample}
Automobiles	3 (4)	Jaguar (2003), Daihatsu (2003), BMW (2003) {Peugeot (1999)}
Business Services	3 (3)	Concert (2000), Thales (2000), Sun Microsystems (2001)
Study Aids	-- (2)	{Letts (1986), Sharp home computers (1987 ca.)}
Food	2 (2) [1 campaign]	Quorn (2003)
Consumer Telephone Services	-- (1)	{Mercury (1994 ca.)}
Bank	1 (1)	Abbey National (2001)
Rail Transport	-- (1)	{South West Trains (2004)}
Men’s Cosmetics	-- (1)	{Givenchy (2002)}
Total	9 (15)	

<sup>3</sup> Of the latter, three were from *The Guardian*, a ‘Quality’ daily not included in the systematic sampling procedure, two were from the Sunday newspapers (*The Observer*), and one (the Givenchy advert discussed below) from a company’s website (though it may well have featured in print also).

In both our systematic and the overall merged samples, 'mathematical' (or 'scientific') portrayals seem more likely to appear in advertisements for cars and business services. Combining this with the information that a large percentage of 'primary car buyers' and senior managers consuming business services are male, suggests that an appeal to mathematics in advertising in the UK is somehow gendered (cf. Williamson, 1978)<sup>4</sup>.

It is noted that all of the advertisements found in our systematic sampling procedure were in the period 2000-2003, and only three of those in the opportunistic sample were published before 1995. Thus, despite research question RQ2 above, we are unable in this paper to make any conclusions about changes in advertising images over time.

In interpreting these results and considering the extent to which they might generalise to a description of advertising practices in the UK, we must express two types of caution. First, despite the reasonably large number of editions examined, the sampling was still 'light', in that it covered only a small percentage of the editions of daily papers published during the period: the presence of a further three 'mathematical' advertisements in *The Guardian* during the sampling period suggests that our sampling may have missed a substantial number of relevant advertisements. Second, with only 60% of our merged sample chosen by our systematic methods - and 40% resulting from the research team's reading habits or from referrals from colleagues, the results from the merged sample may fall short of the claims of representativeness that the systematic sampling sought to justify. Nevertheless, we think it is worthwhile to present our results for our merged sample (n = 15), since this allows us to give a slightly more broadly-based account.

### Content analysis and semiotic readings of the mathematical images presented

Here we present a discussion of our readings of five of the advertisements, as to the content analysis of a key indicator, and the images they present of mathematics, mathematicians and school mathematics (Table 3).

Table 3. Sub-sample of advertisements considered

Advert	Product	Newspaper	Year
XJ(CO2xOTR)=low B1K	Automobiles (Jaguar)	Daily Mail	2003
"If I've got my sums right, ..."	Automobiles (Peugeot)	The Guardian	1999
"Wednesdays are lousy. Certified"	Food (Quorn)	Daily Mail	2003
"I hereby scientifically declare; Wednesdays stink"	Food (Quorn)	Daily Mail	2003
$\pi$ : BEYOND INFINITY	Men's Cosmetics (Givenchy)	Corporate website	2002 ca.

Two of the five advertisements were chosen to illustrate the range of advertisements for cars, one of the two markets that referred most to mathematics in our sample. The two food advertisements were chosen as they were paired in one campaign. The men's cosmetic advertisement for the perfume,  $\pi$ , was chosen for several reasons: it apparently appeals to more interesting realms of mathematics; by its nature, it might suggest insights concerning gender;

<sup>4</sup> It is worth noting that there is an appeal to science (and to mathematics, at least implicitly) in advertisements for skin creams and other cosmetic products for women, too (Heather Mendick, personal communication).

and it is perhaps the most long-lived advertisement in the sample and is the focus of much ongoing comment on the internet (as a web search on ‘Givenchy Pi’ shows).

We consider each of these advertisements in relation to several selected indicators from those indicated for the content analysis and the semiotic readings (see Appendix A). From among the content analysis indicators listed, we focused on those related to the ‘appeal’ of the advertisement (Leiss et al., 1990), and investigated in a more ‘semiotic’ fashion the images of mathematics and people doing mathematics.

The Jaguar advertisement (Figure 1) was visually one of the most sumptuous of the advertisements we found: light shines onto the car from all sides, and, besides the car, the biggest object in the frame is the jaguar, which seems to leap off the car and to soar above everything else. The overt aim of the advertisement is to inform the reader and potential customer of the low BiK (environmental) tax payable at purchase, because of the low CO<sub>2</sub> emissions of the car, due to the ‘unmatchable’ construction. The largest element in print is the equation:

$$XJ (CO_2 \times OTR) = \text{low BIK.}$$



Figure 1. Advertisement for Jaguar

Though apparently mathematical, the equation turns out on closer inspection to be somewhat different. Without the material in brackets, it may be a way of expressing something like ‘The XJ has the lowest BIK tax bill (in its class of car)’ - which is what the text says further down. The material in brackets (which could not in any case be multiplied by the non-quantitative XJ) also appears to represent the ‘product’ of CO<sub>2</sub> by something undefined (which may turn out to

mean something like 'On the Road'). Not really the stuff of which mathematics is made<sup>5</sup>, this equation appears to be inserted to attract attention, or perhaps to allude to the high-quality engineering that lies behind the construction of this car.

The image of mathematics presented here is that of simplicity, succinctness, precision, and an association with high-quality engineering, science, and consciousness of the environment. The implicit image of a mathematician, or of the engineer or scientist using mathematics, is of someone who expresses or confirms simple, straightforward statements, in this case about the car. The advertisement's appeal is thus 'rational' (Leiss et al., 1990), as well as 'sensual'.

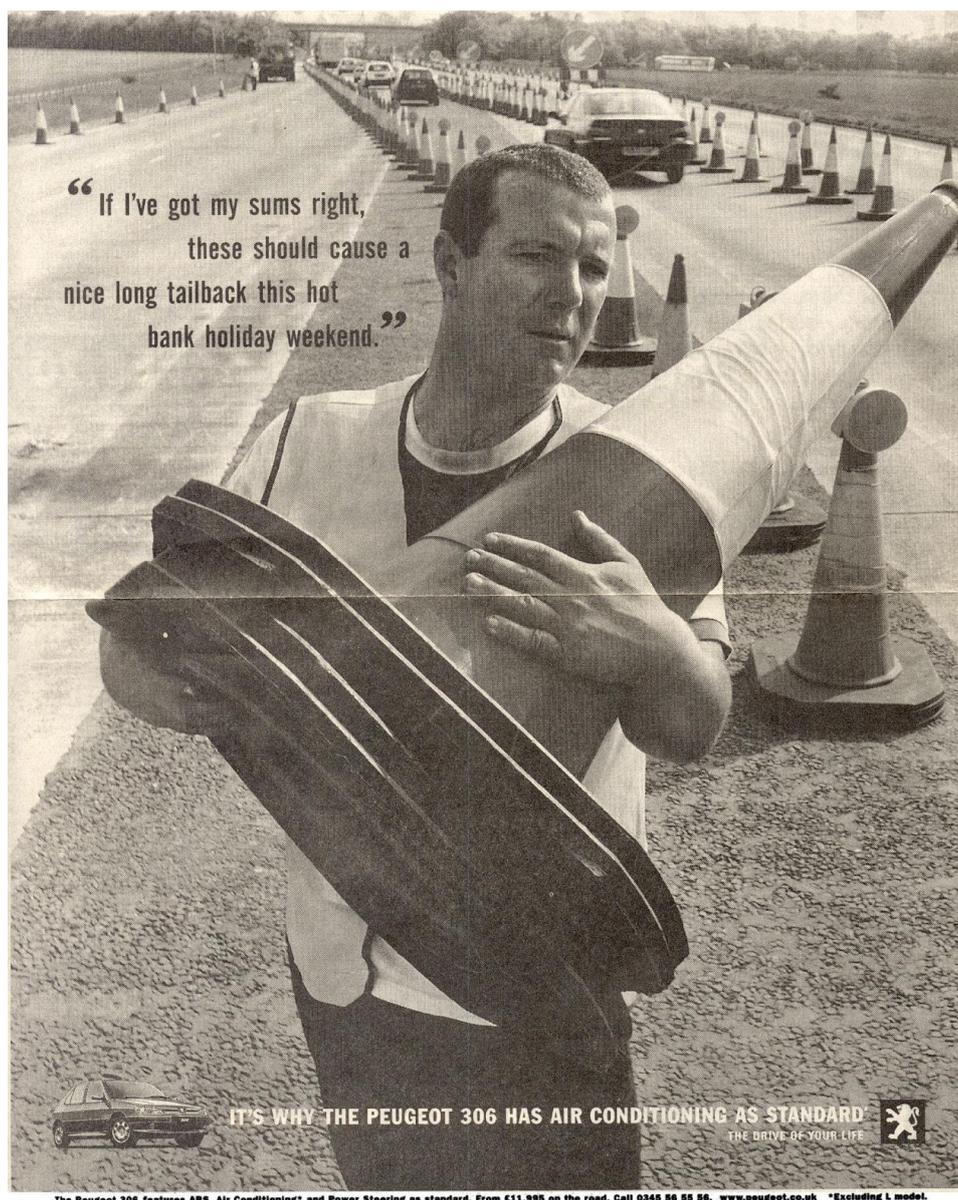


Figure 2. Advertisement for Peugeot

<sup>5</sup> Glendinning (1998) presents an even more striking picture (a still image from a television advert for VW Golf), which shows a baby holding a placard, which purports to show the evaluation of an integral: he argues that the first two lines have been cropped (presumably to save space in the frame), and several errors in the reasoning have been inadvertently introduced, presumably by someone who does not understand mathematics.

The Peugeot advertisement (Figure 2) was published in *The Guardian* in August/September 1999. On the overt level, it aims to inform the reader of the availability of in-car air conditioning “as standard” in the advertiser's models. However, this advertisement functions by creating a ‘lack’ (Williamson, 1978); we might say that its appeal is based on ‘worry’, followed by ‘relief’ (Leiss et al., 1990). It aims to establish 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 a built-in ‘private’ solution - personal air-conditioning. Volume 2(2) – September 2007

Mathematics here is portrayed as “sums” - which can be used in a clever, ‘calculating’ way, to gain advantage, to ‘put one over’ on people who, perhaps do not have to work on this “hot bank holiday weekend”; see the discussions of the reverberations of ‘calculating’ in Walkerdine (1997) and Evans (2000, Ch10). Here, we note that what might be an interesting mathematical problem – whatever its social merits – of modelling the relationship between the pattern of deployment of traffic cones and the resulting restriction of traffic flow, is trivialised.

Anxieties around school mathematics are perhaps invoked by the mention of “sums”, and whether they have been “got right”. And the portrayal of the particular person who is ‘doing maths’ is nasty and aggressive.

Other plausible themes are social class antagonism, and suspicion of public services and their employees. This 1999 advertisement also provides an example of *intertextuality*, in recalling the UK public’s irritation with traffic cones earlier in the 1990s, culminating in the then Prime Minister, John Major’s call for a “Motorway Cone Hot-line”, aiming to allow road users to use their mobile phones to report any unnecessary traffic cones on a particular stretch of road.

We now turn to the pair of advertisements for Quorn (a protein substitute), published in the *Daily Mail* over 4 days in March 2003 (Figure 3). The overt aim of these is to relate ‘sympathetically’ with readers that on Wednesdays they feel the “mid-week blues” and are short of ideas, and to suggest that Quorn “lifts the spirits” and inspires on Wednesdays. Here the advertisements function by creating a worry, about under-performing or feeling low on Wednesdays. Allegedly this is brought on by the day itself, rather than the readers themselves. The advertisers then offer their product as a “solution” or ‘relief’.

We classified these advertisements as mathematical, since they used graphs of frequency distributions. On the most straightforward level, mathematics is portrayed as simple (frequency counts) data analysis. These statistics are used to “certify” that Wednesdays are “lousy” (due to “mid-week blues”), or that Wednesdays “stink” (allegedly “nobody has good ideas” that day). On reflection, however, we are struck by several unusual aspects of these ‘data’. The headline language is most unscientific – “lousy” and “stinks”. The person asking for our attention is dressed, not as a scientist, but as a cook, complete with cooking utensil. The graphics are not ‘professional’, but suggest an inexperienced schoolchild. And these ‘data’ – problematical on their own terms, regarding validity of indicators, and the likelihood of reliable data production – could be recognised further (by some readers, at least) as fabricated.

Thus we have an image of mathematics as simple frequency count analysis - and possibly as wrong-headed on several accounts. But the original ‘conclusions’ do not matter anyway, as Quorn will make it all right - and, apparently, none of the maths (or “science”) was necessary, since it was all ‘rubbish’ anyway. This is an example of a particular sub-category of advertisements figuring mathematics and science, which suggests that it is not necessary to be

concerned with mathematics, science, evidence, or argument - as you will 'know' what to think anyway, with the help of the advertisements<sup>6</sup>.

One might respond that part of the appeal of these advertisements – or part of their defence – is that they are 'humorous'. However, this pair of advertisements creates different subject-positions for different readers, as do many advertisements post-1970. This differential positioning of readers corresponds to general processes of *market-segmentation*, and of customising of consumer goods by companies in an age of accelerated consumerism.

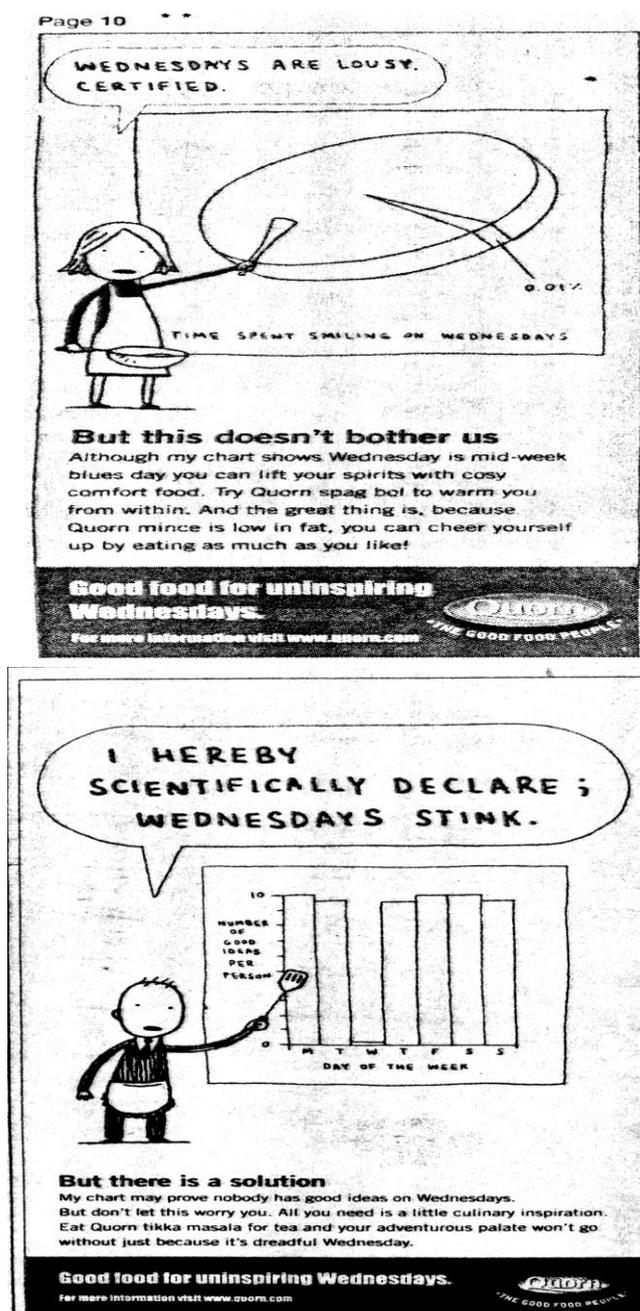
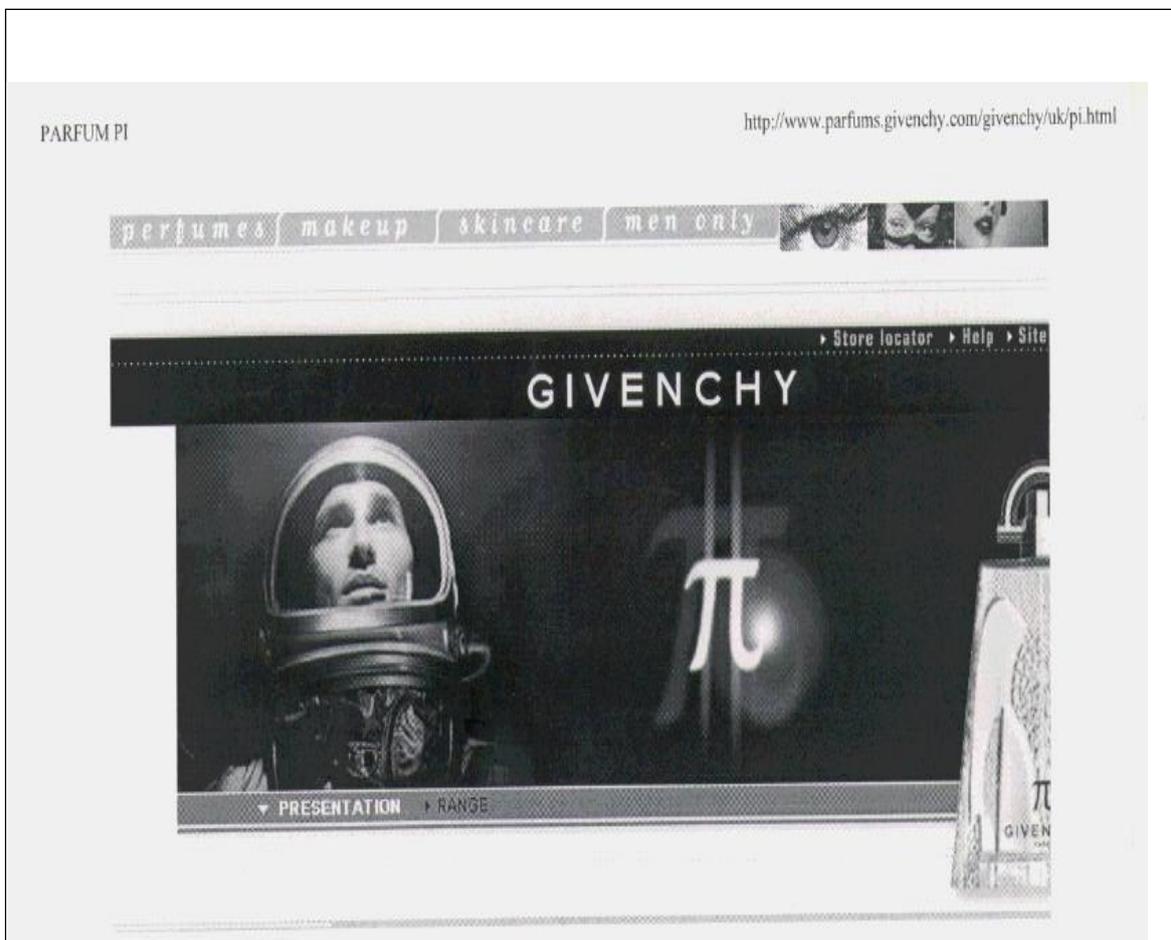


Figure 3. Advertisements for Quorn

<sup>6</sup> Other examples of advertisements promoting this message in the sample, but not discussed here include the Mercury telephone services advert (1994 ca., *The Guardian*), and the BMW car advertisement (2003, *The Times*).

The last advertisement is for a men's perfume called  $\pi$  (Pi), produced by Givenchy in 2002 (Figure 4). The picture at the top shows a man in a spacesuit looking upwards towards the light; to the right are two symbols of  $\pi$  superimposed, and to the far right, partially hidden is a bottle of the fragrance.



### $\pi$ : 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 this pioneering spirit,  $\pi$  celebrates internal force and an adventurous imagination: energy and sensuality, unruffled calm and strength.

Figure 4. Advertisement for Givenchy's Pi<sup>7</sup>.

The overt aim of the advertisement is to announce a new men's perfume, with an appeal to a distinctive segment of the market - and to associate positive (masculine) qualities with it. Its appeal is neither 'rational', nor related to worry/relief, as with the previous two, but might be characterised as 'sensual', as was the Jaguar advert. We can note the 'sensuality' and sexiness

<sup>7</sup> The version shown here is taken from the company's webpage.

of the pictures and the text. Of course fragrances (as commodities), in most Western societies at least, are heavily gendered. This is reinforced by the pictures and the text in this advertisement (with its references to “man...”, “men...”).

On the face of it, mathematics is portrayed in a much more open-ended way here than in the previous advertisements. In terms of the portrayal of mathematics, 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 claims of “internal force”, “unruffled calm”, strength and energy to be asserted. This advertisement reinforces the association of masculinity and mathematics (see also Mendick, 2006). It does indeed appear to be designed to appeal to men, and especially those who are knowledgeable about mathematics, or for whom it has an allure.

However, there is a problem about the portrayal of mathematics, and especially  $\pi$ , here. For people who know a little about mathematics,  $\pi$  does *not* mainly “evoke infinity” in mathematics: despite its infinite, non-repeating decimal expansion<sup>8</sup>, it is itself a finite number! And not many “men” are “still in pursuit of the end of its innumerable string of decimals” (!). This claim again seems to bring mathematics back to being basically mere calculation, despite the key reference to infinity. The heroic aspect of the doer of mathematics thus appears severely limited – to the quest for “the end of its innumerable string of decimals”. In this advertisement, mathematics is considered as something which can be selectively drawn on, and moulded (by the text), so as to produce the desired associations for the product.

### **Conclusions and Suggestions for Further Research**

A striking result from our fieldwork, in response to research question RQ0, is that there appear to be relatively few advertisements where ‘mathematics’ (broadly defined) is used as a resource in the UK daily press recently. Caution is in order because of the relatively ‘light’ sampling used here. However, within our two samples, any advertisements portraying ‘mathematics’ appear to be concentrated in the quality and mid-market press. Their apparent absence in the popular press suggests a question, as to whether mathematics, science, are being ‘silenced’, especially in this domain, rather than being considered as a resource for public discussion for the average person.

‘Mathematical’ and ‘scientific’ portrayals appeared more frequently in advertisements for cars and for business services – domains traditionally identified with men (see below). The discussion of the Givenchy men’s perfume advert, and that of the Jaguar car, suggests that these advertisements not only pick up on gender stereotypes in the wider society, but also *reinforce* and *extend* such stereotypes. For example, the Pi advertisement appears to promote an image of numbers of men engaged in a quest for “the end of its [ $\pi$ ’s] innumerable string of decimals” – which is of course misleading as to the actual activities of mathematicians or indeed of other men (see also the discussion of the advertisement in the previous section). Thus, in relation to research question RQ1, we can see that some of the advertisements we examined do allow the identification in their images of gendered discourses on the type of people who do mathematics; see also Mendick (2006).

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<sup>8</sup> Therefore, a so-called ‘irrational number’.

In relation to research question RQ2, about changes in the images of mathematics over time, the Peugeot advertisement (1999), like the other three pre-2000 advertisements in the sample (Letts study aids, 1986; Sharp home computers and study aids, 1987 ca.; Mercury telephone services, 1994 ca.) drew on 'negative' aspects of mathematics, such as its supposedly "hateful", scary, or "too clever" character (see Evans, 2003), as part of their message. This tendency has not been apparent in the 11 advertisements produced post-2000, four of which have been discussed here. This may suggest a gradual change trend towards focussing on the 'positive' aspects of mathematics, even if in a limited way, since around 2000. But it is difficult to be certain, with so few advertisements from before 2000.

The portrayal of mathematics in the advertisements examined here is very often as basic calculation (Peugeot), or as single equations. Moreover, the equations may be meaningless (Jaguar), trite ("A + B = C" to indicate cooperation or "Concert" between AT & T and British Telecom), or erroneous (see footnote 5). Some of this result from the constraints on advertisements – the need to attract attention, and to project a message in an instant - but these messages circulate nonetheless.

With respect to RQ3, on how the advertisements construct the reader as knowledgeable (or otherwise) in mathematics, the Quorn advertisements (and others in the sample, but not discussed here) illustrate a particular category of advertisements in which mathematics and science figure, but which suggest that it is not necessary to be concerned with the content of mathematics, science, or with (real) evidence or argument – as you will 'know' what to think anyway, with the help of the advert. On this reading, there is a danger that the advertisements will help to reinforce social relations where large corporations speak to the consumer, whose critical faculties are 'dumbed down' by the process – and that intellectual tools like mathematics that are useful for critique might be trivialised by the process. Other readers might respond more positively to aspects of the advertisements, such as the 'knowing' parody of mathematical/scientific data in the Quorn advertisements, and find it a challenge to their mathematical identity to figure out the advertisement.

The discussion of these advertisements, in particular those relating to Quorn, shows that the deceptive complexity of the processes needed to decode them 'fully' may lead to different categories of readers being differently positioned vis-à-vis the advertisements. This differentiation parallels a process of market-segmentation, so that the same advertisement is not expected to 'speak' to all readers, in the same way. This suggests that different categories of readers, and indeed different cultures at different times, may be expected to be (and perhaps are) more or less 'literate' in reading the messages of advertisements (see Leiss et al., 1990).

Nevertheless, any effects in terms of trivialisation of evidence, data, science, and mathematics are not without danger for the company commissioning such advertising. It may want to market some of its products on the basis of scientific production processes, and it implicitly appeals to research on physics and engineering in the case of automobile producers, nutrition for food producers like Quorn, or to skin care for cosmetic producers (see also Glendinning, 1998).

The consequences for citizens/consumers of assumed limitations on their 'mathematical literacy' are not restricted in their consequences to their general appreciation of the role of mathematics and science in the surrounding culture. Many medical treatments involving medication, for example, include written instructions which require the reader to make choices in the use of the medication, based on information and conditions that often have a numerate aspect (see Eagle, Reid, Hawkins & Styles, 2005).

The analysis so far suggests several lines of further research. There are links to be made with the analysis of films, in this project. Television, cinema, internet, and further print advertising might be investigated, including that in 'niche' publications, such as educational journals for advertisements on teaching aids, and trade or professional journals for job advertisements. It would also be useful to investigate the aims and images of mathematics of those working in advertising agencies, who were responsible for some of the campaigns discussed here. Comparative work would be useful, especially between the UK and cultures with possibly different levels of numeracy<sup>9</sup>.

There is also a need to look comparatively at discourses in fields of activity such as educational policy making, by examining official documents promoting mathematics learning in the EU or in the UK, on the one hand, and discourses constructed in recent films and advertising, on the other, to see whether intersections or cross-fertilisations among them can be located.

Leiss et al. (1990) point to the possibility of a given culture of 'consumers' of advertising being 'educated' over time through changing forms and strategies of advertising. This could relate to current UK government policies on advertising and discussions on Corporate Social Responsibility (CSR).

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<sup>9</sup> Cf. Lida Arnellou's ongoing study at the University of the Peloponnese, Dept. of Social and Educational Policy, of advertisements portraying science, in UK, France, and Greece.

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## **Appendix A. Coding Frame for Advertisements**

### **Basic Characteristics**

Advertisement No. :  $RS_j$  – from systematic sample;  $A_i$  – from opportunistic sample

Advertisement Description: 'strapline' (quotation of key text)

Product Category

Brand

Publication Name, Year, Date

Overt Aim of Advert

### **Content Analysis Indicators (drawn from Leiss et al., 1990)**

Appeal: motivational/persuasive technique: rational, worry/relief, sensual, testimonial  
[categories apparently not exhaustive – Leiss et al., 1990, Fig. 9.27, p268]

Display Area Allocation: % devoted to text, as compared with % for visuals

Pattern of Combination of Elemental Codes (Product, People, Setting): product-information, product-image, personalised, life-style

Values: quality, leisure/work ethic, progress/tradition, individualism/family.

### **Semiotic Indicators (see also Mendick, Moreau & Epstein, 2007)**

Public Images/Discourses of mathematics:

Complex language, meaningless/"beyond understanding" to most

Powerful language of nature/science, technology/human behaviour

Satisfying activity for own sake: puzzles, intellectually stimulating/beauty, patterns to be appreciated aesthetically

Useful: positive - individual's everyday affairs, business, 'save the world'; negative - militaristic, destroys environment [NB links with science, technology]; useless

### **Public Images/Discourses of school mathematics**

Elite subject/accessible to all

Scary, humiliating experience

Boring

### **Public Images/Discourses of people doing mathematics**

Not like ordinary people: unusual intelligence, brilliance

Madness/eccentricity/obsession

Nerds, Geeks

Rational, cool, lack of emotion

Lack of social skills, ability to communicate, to relate: a compensation

### **Public Images/Discourses of people teaching mathematics**

Clear-headed, "calculating"/Absent-minded

Impatient, cruel

Lack of social skills, ability to communicate