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Mobile phone masts: protesting the scientific evidence

Frances Drake

In the UK mobile phone ownership is high, however, there are conspicuous local protests against mobile phone masts. Protesters' concerns often focus on the claimed ill health effects of mobile phone technology, which are frequently dismissed by industry and scientific experts. This paper provides an in-depth study into the attitudes and beliefs of one local protest. It considers to what extent health issues dominate the group's concerns and how the campaigners have engaged with scientific knowledge to form their opinion. Surprisingly, mobile phone ownership was high within the protest group. This apparent paradox could be rationalized, however, by considering the location of the group and the ways in which the protesters used their mobile phone. Few believed that the precautionary approach had been fully applied to mobile phones. The campaign can be interpreted as one that questions the presumption that science and technology lead to increased economic performance and quality of life.

1. Introduction

There appears to be increasing public concern about a number of aspects of modern life, in particular the assumed benefits of science and technology (Clarke and Short, 1993; Pardo and Calvo, 2002). Often these debates are characterized by opposing groups of scientists presenting conflicting interpretations of scientific data to the public. Whilst official sources often seek to reassure the public presenting the "rational facts," the media stand accused of acting as "agent provocateur" whipping up local action (Burgess, 2004; Clarke and Short, 1993; Kheifets et al., 2000). In cases such as bovine spongiform encephalopathy (BSE), the measles, mumps and rubella (MMR) vaccination and genetically modified (GM) food, significant numbers of the UK public have rejected the affected product (Burgess, 2004; Frewer et al., 2003). A curious exception to this pattern is the mobile phone. Despite various health concerns and numerous local campaigns against mobile phone masts highlighted in the media, phone sales remain buoyant (MOA, 2004). It is estimated that there are now over 50 million mobile phones in Britain with around 75 percent of the adult population having access to one (MOA, 2004). In a step to understand this apparent love-hate relationship with mobile phone technology, this study focuses on the opinions of members of a small protest group fighting the installation of a mobile phone mast in their village. It examines their

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attitudes to mobile phone technology and how they perceive the associated health risks. It also considers whether there is any evidence to suggest that the involvement of large corporations alters the perception of mobile phone technology.

In the past, the public was perceived to have a science knowledge deficit, which could be remedied by a greater understanding of the scientific expert (Bodmer, 1985; Pardo and Calvo, 2002). If the public appreciated science more they would hold it in greater esteem (Miller, 2001). Similarly, a greater public understanding of science would lead to a closing of the gap between the perceived and objective risks of new technologies (Frewer et al., 2003; Sturgis and Allum, 2004). This was seen as both necessary and desirable given a modern world built on social and economic progress achieved through increased scientific and technical know-how. Such a stance assumes that science provides an objective reality, which then enables rational policy decisions to be made. This normative view has been used to legitimate the role of science in policy making in the post-war years (Healy, 1997). Thus, initially a great deal of effort went into increasing the public's scientific understanding and encouraging scientists to be better communicators (Miller, 2001; Pardo and Calvo, 2002).

This "deficit model" has been widely criticized by social commentators who point out that the "public" are neither ignorant nor passive and that science is rarely pure or objective (Wynne, 1996; Healy, 1997). Philosophers of science have long dispensed with the idea of science as an accumulation of knowledge (Gieryn, 1995). The public, however, are often charged with requiring a level of scientific certainty inappropriate with current understandings of scientific endeavor (Frewer et al., 2003). The media are seen as exploiting the naturally discursive nature of science further fueling the public's disquiet regarding science and technology (Gutteling, 2005; Nisbet et al., 2002). At the same time, though, scientists are accused of hiding scientific disputes, seeing them as detrimental to the legitimacy of science (Miller, 2001; Jones, 2002). There also appears to be some reluctance on the part of experts to provide information on scientific uncertainty for fear that it will further undermine the credibility of science, as well as the continued belief that the public cannot cope with such information (Frewer et al., 2003; Frewer, 2004; Pardo and Calvo, 2002). For the public, the degree of trust they have in the expert agency may well be more important than any risk analysis (Clarke and Short, 1993; Wynne, 1995). Scientists may still ascribe to the Mertonian ideal of science but there is a growing awareness of the economic and political realities of funding scientific studies that erode trust in the scientific process (Wible, 1988). Furthermore, greater attention has to be paid to the impact of other knowledge spheres on factual scientific knowledge to contextualize the public's understanding of science (Sturgis and Allum, 2004). In response, a variety of institutions have promoted an engagement model of science in which "a two-way dialogue between specialists and non-specialists—is more appropriate" (OST, 2001: 315).

One new important policy approach that acknowledges the limit of scientific information is the precautionary principle, which is particularly relevant to the environment and health issues (Sand, 2000). The most commonly quoted definition of the precautionary principle is from the 1992 Rio declaration: "Where there are threats of serious irreversible damage, the lack of full scientific certainty should not be used as a reason for postponing cost effective measures to prevent environmental degradation" (UNCED, 1992). Adopted from early German studies of the environment, the precautionary principle would appear to be a common sense tool. In practice, however, the interpretation of the precautionary principle is widely contested and it is unclear whether it can be used with analytical tools of risk assessment (Graham, 2000; Rogers, 2001; Sandin, 1999; Sandin et al., 2002). For some, the precautionary principle challenges the very notion of risk analysis and the legitimacy of science (Charnley, 2000; Kheifets et al., 2000).

The current debate in the UK into the health risks of mobile phone technology reveals the tension between the old style "deficit" model and the newer "engagement" model. The mobile phone debate emerged in the aftermath of the BSE crisis in the mid-1990s. The announcement that there might be a link between BSE and Creutzfeldt–Jakob disease (CJD), after frequent UK government denials that there was any risk, has generally been acknowledged as seriously damaging the credibility of government health pronouncements (Balzano and Sheppard, 2002; Frewer, 2004; Jacob and Hellström, 2000; Miles and Frewer, 2003; Pardo and Calvo, 2002). Understandably, the government's response to the potential health risks surrounding mobile phones has been more proactive. The government initiated Independent Expert Group on Mobile Phones (IEGMP) or the Stewart Inquiry took evidence from over 170 interests, showing an extraordinary willingness to engage with a wide variety of opinions (IEGMP, 2000; Walton, 2002). In contrast, however, the mobile phone operators and government scientists have dismissed protesters' health fears as "irrational" (Walton, 2002: 695 quoting Orange; Henderson, 2004). Both protesters and the IEGMP have been accused of failing to understand key scientific knowledge (Balzano and Sheppard, 2002; Henderson, 2004). Thus, a precautionary approach to mobile phone technology is seen as endorsing the protesters' health fears and potentially leading to the abandonment of science-based policy decisions (Burgess, 2004; Kheifets et al., 2000).

By only listening to the protest groups, it may be that only small sections of the public are represented. This has led to a questioning of the effectiveness of public participation in science-based policies (Burgess, 2004; Pardo and Calvo, 2002; Miller, 2001). The protest group is one of any number of individuals or groups termed stakeholders that are affected by the actions, decisions, policies, practices, or goals of an organization (Carroll, 1996). Typically, an organization is a company whose primary stakeholders are usually shareholders, without which a corporation would not survive. In contrast, secondary stakeholders are not essential to a business's survival (Clarkson, 1995). Thus, protest groups are usually considered secondary stakeholders. Nonetheless, they can wield significant influence over the successful implementation of innovative technologies by companies. It is claimed that the failure of Monsanto to engage with key secondary stakeholders led to the rejection in Europe of GM foods (Hall and Vredenburg, 2003). Mitchell et al. (1997) argue that whether managers listen to stakeholders depends on a combination of three attributes: power, legitimacy and urgency. Power is the ability of one social actor to force another to do something they do not wish to do. Legitimacy is the perception that an action is desirable, even morally right. Urgency is the need for an issue to be addressed quickly. Latent stakeholders possessing only one attribute are likely to be ignored by managers. The definitive stakeholder possessing all three attributes is assured of attention, as is the dominant stakeholder with power and legitimacy. Stakeholder attributes, however, are dynamic. This means that less powerful groups, lacking legitimacy or power, can move into a definitive stakeholder position. Attributes are also socially constructed definitions with perceptions of them varying from stakeholder to stakeholder and over time. Therefore, even weak protest movements can become potent forces should their attributes change.

Why certain issues emerge at particular times to become the focus of contested claims is unclear and the study of such phenomena is commonly approached from a social constructionist perspective. This acknowledges that conditions may exist which are never identified or considered problematical, while others may emerge with claims that do not reflect the severity of the problem (Burningham, 1998). What is important is not the reality of the problem, but the way in which the claims are made and how they are organized and maintained (Burningham, 1998). Thus, the social constructivist perspective can reveal how claims of "objective truth" can be used to empower certain groups while oppressing others

(Foucault, 1980; Pedynowski, 2003). A number of studies have concentrated on this aspect, emphasizing the conflict between authoritative scientific knowledge and local knowledge (Feyerabend, 1987; Pedynowski, 2003; Wynne, 1996). Pedynowski's critique points out, however, that this ignores the socially constructed nature of these alternative knowledge bases, which have also been associated with endorsing powerful "truths" about the world (Pedynowski, 2003).

An advantage of the social constructionist perspective is that in areas of contested science it does not privilege one particular knowledge base above another. This has led, however, to the accusation that such an approach can lead to inaction and political quietism (Burningham and Cooper, 1999; Jones, 2002). In particular, there is a danger that environmental problems can be dismissed if scientific knowledge is devalued (Soulé, 1995; Soper, 1995). Much of the debate about the merit of social constructionism revolves around whether it rejects the notion of "a single external reality" (Jones, 2002: 248). Such debates are beyond the scope of this paper other than to acknowledge that this study does not deny the existence of a physical reality. It does not, however, seek to establish the validity of the claims made by members of the protest group; rather it tries to understand the beliefs of the individuals which lead them to take action under these circumstances. This is to acknowledge that for effective management of such issues to occur there is a pressing need for an integration of constructionist and realist approaches (Healy, 1997).

In summary, it is now widely accepted that economic growth requires science, technology and scientifically literate citizens. In the past, public resistance to innovative technologies was interpreted as a lack of public understanding of science. The deficit model assumed that increasing the public's scientific knowledge would lead to a greater acceptance of these new technologies. This simple relationship has attracted much criticism. In addition, confidence in the deficit model has been weakened by high profile failures in science public policy. Consequently, the UK government has placed greater emphasis on consulting with various stakeholders in relation to scientific policy, promoting an engagement model of science. This approach has also been criticized on the grounds that current government initiatives on public debate are merely the deficit model in disguise. There are, however, more salient questions. These include, how much weight should be placed upon lay as opposed to scientific knowledge? Can a consensus always be reached? Which stakeholders should be included? In addition, there is increasing recognition that scientists are not neutral. They are also stakeholders that both influence and are influenced by wider society. Social constructionism provides a relativist approach within which competing knowledge bases can be considered.

2. Mobile phone technology and the health issue

A mobile phone works by sending and receiving radio waves to and from the nearest base station. A base station comprises a mast tower together with transmitters and antennae, although often the whole set-up is referred to as a mast (MOA, 2003). Each base station deals with all the calls within a cell, which is frequently described as a hexagon. So, the complete cellular structure looks like a honeycomb with a mast at the center of each hexagon. The cells, however, are rarely regular in shape because of various constraints (NRPB, 2004a). These include the availability of sites, the number of cell phone users in the area, how difficult the terrain is, as well as technological limitations on how far the signal can travel. Typically in rural neighborhoods base stations cover areas 10 km in diameter. This decreases to a few hundred meters in urban areas (Hyland, 2000; NRPB, 2004a). Base

stations communicate with each other by means of dish antennae and sometimes by a land line (ODPM, 2002). The radio signals used by mobile telecommunications are in the ultra high frequency band, commonly called microwaves, although they are below those used for microwave communications links (NRPB, 2004a). Therefore, both the base stations and the handsets radiate microwaves. A mobile phone emits radiation equally in all directions, however it does so in short bursts, which means it only transmits for an eighth of the time. This reduces the power output by handsets to eight times less than their peak output (Hyland, 2000; NRPB, 2004b). A base station radiates "in conical fan-shaped beams, which are essentially directed towards the horizon with a slight downward tilt" (NRPB, 2004c). There are also sidelobes, which are weaker than the main beam, but can intersect with the ground much closer to the mast (Hyland, 2000; NRPB, 2004c). Mast sharing by operators is encouraged by government guidelines. There are, however, several constraints upon this including technical limitations, as the antennae need to be vertically separated by a certain amount in order to avoid radio interference (ODPM, 2002).

Radio waves at these frequencies can penetrate the human body by a few centimeters. The water in the body then absorbs the energy and this causes a heating. The amount of heating that takes place is dependent on the intensity (or power density) of the radiation (Hyland, 2000; NRPB, 2004b). The body can cope with a certain amount of heating but above 1°C detrimental health effects can occur (Hyland, 2000). The specific absorption rate (SAR) of energy is a measure of the absorption of radio waves. In the case of mobile phones, the SAR is relevant to the head. All mobile phones in the UK conform to the International Commission on Non-Ionizing Radiation Protection (ICNIRP) standard that the SAR should not exceed 2 W kg^{-1} (watts per kilogram) (NRPB, 2004b). In the case of base stations exposure is to the entire body rather than concentrated at the head. ICNIRP guidelines state that the total exposure from radio waves should not be more than 0.4 W kg^{-1}. Under current planning regulations in England all mobile phone mast applications should be accompanied by an ICNIRP certificate that guarantees the mast will comply with National Radiological Protection Board (NRPB) guidelines (PPG8, 2001). Many health concerns focus on the possibility of malignant tumors, which may be a result of the known effects of ionizing radiation rather than radio frequency exposure (Rothman, 2000; Burgess, 2004). The balance of scientific evidence is that such thermal effects of radiation pose no health risk to the general public (IEGMP, 2000; NRPB, 2003; Rothman, 2000). There are claims, however, that adverse health effects may result from the interaction between microwave radio frequencies and the electrical oscillations to be found within living beings rather than through the heating of body tissue (De Pomerai et al., 2002; Hyland, 2000, 2003). The typical analogy used is that of epileptic seizures induced by flashing lights. Thus, a variety of possible health problems including headaches, sleep disturbance, epileptic fits and tumors have been linked to mobile phone technology.

3. The development of the UK mobile phone network

First generation mobile phones became viable in Britain in 1985 when the then Conservative government licensed two operators. These first generation analogue phones were bulky and it was not until the second generation of digital phones (2G or GSM) arrived that personal communication took off. The 2G phones used higher radio frequencies allowing greater data transfer and a reduction in battery size and so phones could become smaller (MOA, 2004). The disadvantage was that more telecommunications base stations were needed and by 2002, there were around 20,000 to 25,000 in the UK (Walton, 2002). The third generation of

phones (3G) relies on the same technology but with enhanced capabilities such as Internet access and video conferencing. The increased data transfer required means that the 3G cell sizes will have to be smaller. By the end of 2007, it is estimated that there will be around 48,000 base stations in the UK dealing with both 2G and 3G calls (MOA, 2004). The long-term attraction of mobile telecommunications for governments is the potential economic benefits of mobile e-commerce or m-commerce (Ayres and Williams, 2004). In particular, m-commerce has been perceived as Europe's secret weapon against the USA's lead in e-commerce (Kraemer and Dedrick, 2000). The UK government, however, has been accused of making short-term profit from the sale of licenses at the expense of this longer term potential (EEMA, 2001). Five mobile phone operators spent some £22.5 billion on obtaining the 3G licenses from the Labour government in 2000. The cost of the licenses and network construction together with poor handset availability has seen a sluggish start to 3G services (Budden, 2002). Most operators are now scaling back their estimates of the profitability of 3G (Wearden, 2003).

The license issued to mobile phone operators governs the quality of service, charging and the minimum level of geographical coverage. This last, together with the terrain are the most important factors governing the number of masts required. The 2G licenses required operators to cover 90 percent of the British population by 2000. The 3G licenses specified 80 percent coverage by the end of 2007 (PPG8, 2001: paragraph 27). Successive UK governments have recognized the difficulty that operators might face with local planning authorities (LPAs) in gaining permission to build the necessary masts. To overcome this, mobile phone operators were granted permitted development rights. Initially this allowed them to erect masts up to 15 m in height without planning permission or reference to the local population except in National Parks, Areas of Outstanding Natural Beauty and Conservation Areas. Increasing public concern, centered on the insensitivity of the chosen sites and the impunity with which operators were able to erect masts, has seen these development rights gradually curtailed. This is particularly the case in the devolved governments of Northern Ireland and Scotland where full planning permission is now required for all ground masts irrespective of size (Walton, 2002). In England and Wales permitted development rights have been maintained for masts less than 15 m in height but operators have to apply to the LPA for "prior determination." This then gives the planning authority 56 days to approve or refuse the mast site. If the operator does not receive a refusal within the specified period, they are granted planning permission by default (Walton, 2002).

These changes in planning law have apparently done little to persuade local protest groups that mobile phone technology is safe (Barkham, 2004; Hart-Davis, 2004). Thus, there have been a number of government-backed reports into the safety of mobile phones and base stations (Walton, 2002). For many commentators these have done more harm than good. In particular, the Stewart Inquiry has been criticized for endorsing the health fears of the public (IEGMP, 2000, cf. Balzano and Sheppard, 2002; Burgess, 2004; Walton, 2002). It recommended that the government adopt a precautionary approach to mobile telecommunications even though it acknowledged that the balance of scientific evidence suggested that there were no ill effects (IEGMP, 2000). Whilst the government did not introduce the full planning procedures suggested, it has led to a joint research program funded by the UK Department of Health and the mobile phone mast operators (MTHR, 2004). There is now also a requirement that retailers provide information on the SAR of each mobile phone so consumers can make an informed choice. The All Party Parliamentary Mobile Group conducted a public inquiry into planning law governing mobile phone masts but did not address the health issue (apMobile, 2004). In its findings,

however, the apMobile Group recommended that all masts should be subject to full planning permission (Askew, 2004).

4. The Berinsfield mast

Berinsfield is a small village of around 2000 inhabitants and is predominantly residential (Berinsfield VDS, 2002). It is in a semi-rural location north of a large conurbation in north-east England. Thus, to preserve confidentiality all names have been changed. Berinsfield beck runs in a shallow valley and the village is built on the low-lying hills either side of the stream. Much of the land surrounding Berinsfield is green belt and there are eight working farms in the area. There are several small woods, one of which has Site of Special Scientific Interest (SSSI) status (Berinsfield, VDS, 2002). Despite its proximity to a major city, public transport links are poor and there are few amenities (Berinsfield PP, 2003). Most people work outside the village in the nearby city and towns. The lack of shops means there is no village center; instead, there are six residential communities. The oldest part of the village, which contains the church and public house, is a conservation area. In this historic core, many of the buildings are listed and a country footpath runs through the area. The remaining five communities developed along the railway line, which closed in 1964 (Berinsfield PP, 2003). A major trunk road follows the route of the old railway line and separates the east community from the north, north-west, west and south communities.

By 2002, there were already four mobile phone masts within the parish of Berinsfield. In the west community two masts share a site within a caravan park. Two operators share a site just north of the east community and a fourth mast is on the edge of the north community. These last two masts had prompted some local reaction. The mast in the east community had originally been sited much closer to residential properties and was placed farther away as a compromise with local residents. Residents in the north community had campaigned against the mast there, as it is right next to residential housing. The LPA, however, granted permission for the site and protest stopped. In the spring of 2002, two operators applied for masts within the Berinsfield parish. The mobile phone operator Alpha applied for prior determination for a 12.5 m monopole site close to the conservation area. Later Bravo applied for a mast site opposite the south community on the far side of the trunk road, near to the wood with SSSI status. From local newspaper reports, it is clear that residents opposed both sites (Laue, 2002). The protest group that formed, however, was composed of residents primarily from the conservation area. These residents organized letters of objection and a petition. They made villagers in the other communities aware of the two mast proposals and rallied their support. The Berinsfield Mast Action Group that grew out of this therefore included villagers from outside the historic core and even neighboring villages. The couple living closest to the proposed Alpha mast, Adam and Elaine (see Table 1 below), set up a website to keep everyone informed. They gradually emerged as the focus for the group's activities and led most of the later campaign against the mast.

All planning applications and prior determinations are given to the parish council to comment on, even though their decision is only a recommendation to the LPA. The Berinsfield parish council suggested that the Alpha site should be refused. This was in line with the Berinsfield Village Design Statement (VDS), which sets out the villagers' aspirations for their village. It recommended, "further mobile phone communication masts should be avoided" (Berinsfield VDS, 2002). The LPA agreed with the parish council and at the local council Development Control Panel meeting on 21 May, it was decided that

permission should be denied (Laue, 2002). This decision was faxed through to Alpha on 23 May 2002. As the mast was subject to permitted development, the LPA had 56 days in which to notify Alpha of its decision from the date of application. The original prior determination had been applied for on 20 March 2002; however, the ICNIRP certificate had arrived eight days later. The local council claimed that it could not consider the application until the certificate arrived and counted March 28 as day zero, thus May 23 was day 56 in the proceedings. Alpha contested the fact that the LPA had to wait for the ICNIRP certificate and argued that in any case the day of its arrival should be counted as day one. Thus, the refusal from the LPA arrived one day too late and thus permission for the mast had been granted by default.

During the summer and autumn of 2002, the local council and Alpha continued with negotiations hoping to reach a compromise. The LPA suggested that Alpha consider site sharing with Bravo; this was turned down by Alpha as they argued it failed to give them the coverage of the trunk road they required. In the end, the local council refused Bravo permission for the single mast at that site. The local residents, however, were unaware of these discussions, having been informed by the ward councilor of the Development Control Panel's decision to refuse permission for the mast. It was only when a resident spotted workmen in early December 2002 that the residents knew that Alpha was going ahead with the mast. For the next six months, Alpha continued with the construction of the mast with the intention of beginning transmissions in June 2003 (Welldale and District News, 2003a). The local council issued two enforcement notices, which were dismissed by Alpha. The protest group received support from the local Member of Parliament (MP) and their action was highlighted on the local BBC radio and independent television news. They also received assistance from the national pressure group "Mast Sanity," which provides free advice to local mast protest movements through its website (Mast Sanity, 2004). Eventually Alpha decided not to start transmitting until after the dispute had been settled.

In an effort to resolve the issue, a public inquiry was held in Welldale in late September 2003. Both the LPA and Alpha had legal representatives and submitted written evidence to the planning inspector. Alpha also employed three expert witnesses—a physicist, a planner and a landscape consultant—to provide written and verbal evidence at the inquiry. Unusually, the Berinsfield Action Group chose to represent themselves separately from the local council. Adam and Elaine presented their evidence and paid for the services of an expert witness, a physicist who would speak on the health issues. As well as the expert witnesses, who spoke and were cross-examined by the parties involved, local residents were also able to express their opinion to the inspector. The written judgment was issued three weeks after the inquiry was held. It took none of the concerns raised by the residents into account. Instead, the planning inspector judged that the refusal had been received by Alpha on day 57, thus planning permission was gained by default. Adam and Elaine have continued the fight and now have permission for a judicial review (Dyke, 2004).

5. Methodology

At a national level, the pertinent issues surrounding mobile phone mast protests have apparently been identified. Therefore, this study did not set out to be a large-scale quantitative study but an in-depth qualitative study of a local protest, which might give rise to the possibility of contextualizing the main concerns of campaigners and thus provide a more nuanced understanding of the debate (King, 1994). The only other study of mobile phone protesters to date is that of Burgess (2004) where open-ended interviews were

conducted with 20 protesters including several prominent campaigners (p. 84). It was the intention of this study to look at the rank and file membership of such groups, to ascertain whether their views were reflected in the national debate. It is recognized that as such the results may not be generalizable but individual case studies can reveal insights into the local understanding and needs of a group (Burningham, 1998; Hall and Hall, 1996; Miles and Huberman, 1994; Schofield Clark et al., 2004; Tytler et al., 2001; Woods, 2003). Indeed Burningham (1998) argues, "each incident of local claims making contributes to the construction of a national problem" (p. 552).

The primary data for this study are in the form of tape-recorded interviews with members of the protest group. A semi-structured interview format was used and interviewees were initially contacted by phone and the details of the project were explained verbally to them. Most interviewees were gained by the referral or snowball method, although some were gained through existing contacts (Schofield Clark et al., 2004). The snowball method can lead to bias but the small and informal nature of the group precluded other sampling methods (Hall and Hall, 1996). From this method, 18 individuals were identified and approached, however, four refused and for one no convenient time for the interview could be found. Further interviews were sought from those with an official capacity; both the chairman of the parish council and the Principal Planning Officer of the LPA agreed to be interviewed. Unfortunately, neither the constituency MP nor the ward councilor was available for interview, although the MP's agent did informally answer some questions. It was considered that the result of the planning inquiry might affect people's attitudes. Therefore, initially it was planned that all interviews would take place prior to the outcome being known. This later proved impossible given that the verdict was delivered two weeks early. Thus, altogether 15 individuals were interviewed in 14 consultations during September and October 2003 (see Table 1).

Interviews were conducted with residents in their own homes with the exception of one male protester and the Principal Planning Officer who were interviewed at their workplace. At the start of the interview, the interviewees were given a letter to explain the study and they were also reassured that they could withdraw from the study at any time. Given the small-scale nature of the study, interviewees were informed that the identity of individuals and place names would be anonymous. Approximately nine hours of interview material was recorded and transcribed by the author. After transcription, a copy of the interview was sent back to the interviewee for any corrections they wished to make. The interviews were then imported into NUD*IST (Non-numerical Unstructured Data, Indexing, Sorting and Theorizing) for ease of coding and evaluation (Gahan and Hannibal, 1998). NUD*IST has been most closely linked to grounded theory as a methodological approach (Glaser and Strauss, 1967; Travers, 2001). It provides, however, a general toolkit for qualitative data analysis, allowing text units, which can be anything from words to paragraphs, to be coded into categories. NUD*IST can be used to code automatically, looking for individual words or phrases, which can provide a quantitative content analysis. In this study, however, it was used as a substitute for more traditional manual coding methods allowing text units to be coded within multiple categories. Thus, whilst categories did inevitably emerge from the data, the purpose of the coding was to explore the campaigners' narratives surrounding the mobile phone mast and the protest group. Coding of the interviews centered on the themes of environmental impacts (essentially the planning regulations under current guidelines) and health. The dominant themes to emerge are illustrated in Figure 1.

A membership list of the protest group was not available to the author so it is unclear whether the sample of interviewees is characteristic of the village or not. In order to gain some idea of how representative the sample was comparisons were made to 2001 census

Table 1. Details of interviewees including their primary concerns (where two concerns are listed they were generally of equal importance to the interviewee although the first named seemed preferred)

Interview	Name	Age group (years)	Census 2001 social class	House location	Years in house	Main concern about mast
1	Ann	60–74	3	East	15	Health/planning
2	Betty	30–44	2	East	10	Health/planning
3	Carol	30–44	2	Neighboring village	8	Health
4	Daisy	60–74	2	South	31	Planning/health
5	Elaine (partner, Adam, not interviewed)	30–44	1	Historic core	5	Health
6	Fiona	45–59	4	Historic core	30	Health
	Brian	60–74	2	Historic core		Planning
7	Clive	45–59	2	West	4	Health
8	Gail	30–44	4	West	12	Health
9	Holly	30–44	1	West	7	Health
10	Ivy	45–59	2	Historic core	6	Planning
11	Duncan	45–59	2	Historic core	18	Planning
12	Eric	45–59	1	Historic core	13	Planning
13	Frank	30–44	Principal Planning Officer	Non-resident	NA	Planning
14	George	60–74	Chairman of parish council	Historic core	12	Planning

data for the Berinsfield area. There were no interviewees from the north and north-west communities. This may well reflect the location of the proposed Alpha and Bravo masts, which are quite some distance from these communities. Rumors of another mast at the north community site have led to a secondary protest group forming there. The mast location may also partly explain the high social class of the protest group with interviewees coming predominantly from social class 1 or 2 occupations of the new socioeconomic classifications. There are high property prices throughout Berinsfield and the surrounding villages (Berinsfield PP, 2003). The historic core, with some of the oldest and largest properties, also commands some of the highest property values. Thus, it seems likely that the socioeconomic status of the residents of this area will be higher. All the interviewees are over 35 and census data show that 70 percent of the population is over 30. The parish plan also notes that the "population is skewed to the older end of the age spectrum" (Berinsfield PP, 2003: 10). The census data reveal, however, an almost even split between male and female residents. This is not reflected in the sample with nine of the 13 campaigners interviewed being female. Unfortunately, interviewees tended to suggest females rather than males for interview. Also, there was a reluctance on the part of males to be interviewed that was not noted amongst potential female interviewees. In order to obtain a more even gender ratio two male campaigners were questioned after the planning inquiry's decision was known, as well as the Principal Planning Officer and the chairman of the parish council, who were also male. None of these interviewees felt that the decision had significantly altered their opinion.

Documentary data were also obtained from various sources including local newspapers, parish newsletters and documents, the Berinsfield Mast Action Group and the Local Planning Authority. Documentation held by the LPA pertaining to the planning process and

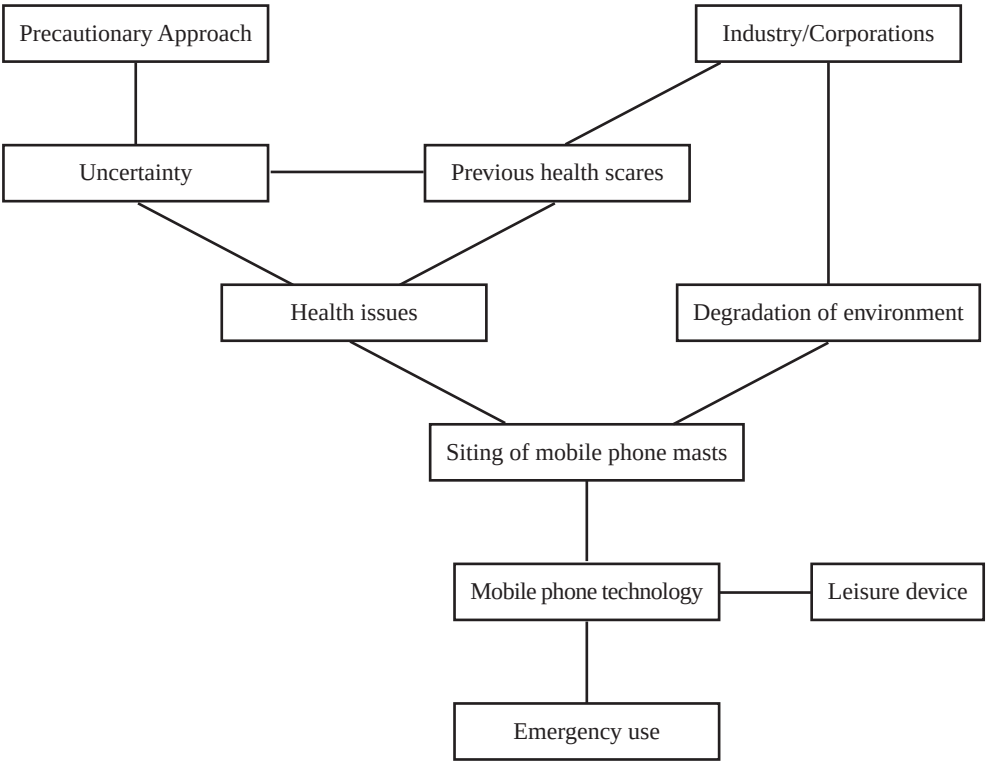

Figure 1. Main themes raised by protesters.

planning inquiry into the Berinsfield mast was consulted. The Berinsfield Mast Action Group also supplied copies of all the written evidence submitted to the planning inquiry that they had access to. This included not only their expert witness evidence but also that of Alpha and the LPA. In addition the author was able to observe parts of the planning inquiry and listen to the cross examination of the expert witnesses. In order to provide further complementary data to the interviews a simple quantitative and thematic content analysis of the local newspaper coverage was completed (Brannen, 1992). Over the 18-month period from May 2002, when the first article appeared, until October 2003, reporting the outcome of the planning inquiry, some 19 articles on the Berinsfield mast were published. A summary of the content analysis can be seen in Table 2.

6. Empirical data

Health issues

At the outset, it became clear that the protest group was not one unified band, as Ivy commented, “different people concentrated on different parts of the argument.” It was possible, however, to identify two distinct clusters. There were those for whom the mast was a planning issue, whereas for others the main concern was health (see Table 1). The location of the household seemed to have little effect on which cluster the interviewee was in. If anything, those living closer to the mast were more concerned about planning than health.

Table 2. Summary of content analysis of local newspaper from 17 May 2002 until 17 October 2003 (19 articles)

Number of occurrences of "Plan," "Plans," "Planning," "Planned"	Context of masts	Area in which mast is being placed	Number of occurrences of "Health," "Medical"	Health context
48 (does not include names such as council planning department)	Ugly Degrading Criminal Ruin(ing) Eyesores Avoided Intrusion Unsightly Devastating	Green belt Conservation Beautiful Heart Restore Country way footpath Houses Small village Historic Quiet backwater (in subheading) Ancient duck pond Enjoy	4	No risk Dying Tumor Blood brain barrier Chromosomal disintegration Acceleration of malignant cell growth (neurological disease) Cancers and leukemia clusters Sleep problems Headaches Decreased immunity Decreased resistance to some cancers Danger

The notable exception to this was Elaine, who living closest to the mast was also the most concerned about health. Neither side denied the importance of the other's viewpoint but those who saw the planning regulations as the major issue usually stressed that they had not looked into the health question. They were merely aware that there was uncertainty but for them it was not important. Even so, most of this cluster felt that people's health fears should be taken into account in the planning process. Two campaigners including Elaine had initially seen the mast "as an inappropriate development" rather than a health issue. As they had become more involved in the group health concerns had begun to dominate; a finding also noted by Burgess (2004). For three others in the health cluster it was a more personal issue, as they, or their relatives, suffered from medical conditions that have been linked to mobile phone technology.

The depiction of protesters by experts as lacking appropriate knowledge to appreciate scientific debates has been challenged by the findings of previous case studies into local disputes (Tytler et al., 2001). Leaders of local environmental protest groups are often those with science training, giving them the confidence to question the dominant scientific paradigm. Both Elaine and Adam are medically qualified and Elaine had taken undergraduate courses in the history and philosophy of science. Elaine chose to focus her concern on the long-term effects of microwave radiation, rather than on the thermal effects, which have been extensively studied. In particular, she noted that ICNIRP guidelines are entirely related to thermal effects. Under government guidelines these are used to negate the discussion of health issues in the planning process (PPG8, 2001). Two of Alpha's three expert witnesses drew attention to this at the planning inquiry, with one stating that given the mast met ICNIRP guidelines: 'The [health] concerns put forward [by residents] therefore have no rational basis' (Planning consultant Alpha expert witness; Proof of Evidence, p. 13, paragraph 4.2.35). Elaine regarded this focus on thermal effects as a total misrepresentation of the scientific evidence, leading people to assume there was no potential for harm. She argued that a lack of literature on the non-thermal effects was a reflection of a lack of research and thus an incomplete evidence base. This criticism reflects those of prominent

critics of NRPB guidelines and the expert witness employed by the protest group at the public inquiry (Burgess, 2004). It also parallels concerns in medicine that drug company sponsorship may have an unhealthy influence on medical research outcomes (BBC, 2004; Moynihan, 2004).

There have been claims that the growing availability of the Internet will widen access to scientific information and increase participation in local democracy (Burgess, 2004; Tytler et al., 2001). In this group, only three members actively looked for any information. Two accessed original documents downloaded from websites such as the Mast Operators Association (MOA), but principally from Mast Sanity. These were then distributed to the rest of the group, often through the Internet. The third member also looked for information but her interest was principally about planning and she researched other action groups. Mostly the group relied on news media reports or assessing the papers that had been passed to them, particularly from the group leaders. This reliance on Adam and Elaine may be a feature of such protest groups but it could also be a reflection of their profession. Doctors are frequently ranked amongst the most trustworthy of professions (MORI, 2004). Indeed as Daisy noted, "if the doctors are concerned, then I think certainly we should be." This is not to suggest that the group were unaware of the potential bias in the articles selected for distribution. Rather they (three) acknowledged their predisposition to believe these articles over those that discounted any harmful health effects.

Although the news media were an important source of information, the campaigners primarily referred to anecdotal evidence to support their health concerns surrounding mobile phones. Tumors and headaches were the health problems most frequently cited. These worries reflect the medical conditions found in the group and not just media reports. Elaine feared that the additional background radiation from the proposed mast would increase her susceptibility to migraine attacks: a point she made in her evidence to the planning inquiry (Elaine, Proof of Evidence, p. 2, paragraph 4). She was convinced that mobile phones were a major cause of her migraines, and used the model of flickering lights causing epileptic fits as an analogy (Hyland, 2000). Another campaigner also suffered from migraines and was a member of the Migraine Action Association. They mentioned that the association's newsletter sometimes contained articles about the potential influence of mobile phones on migraines. There were also claims that pupils and teachers at a local senior school suffered disproportionately from headaches. This was blamed on a mobile phone mast, which is situated on top of a teaching block at the center of the school grounds (two campaigners). Two members of the group have been diagnosed with brain tumors and they both felt that mobile phone technology "irritated" their tumors. The local newspaper highlighted these worries by reporting that one person had died from a tumor and four others in the area had similar medical conditions (Welldale and District News, 2002). As well as reference to individuals, cancer clusters associated with Menwith Hill Station (a UK Ministry of Defence satellite communications center) and other mobile phone masts were mentioned (three protesters).

Practicing safe mobile phone use

One might expect that within the cluster for which health issues were the primary concern mobile phone ownership would be low or nonexistent. This was not the case, however; phone ownership was high and the principal reason was that it was there for safety and emergency use. Thus, the existing 2G networks were framed almost as an essential service. Even if the interviewee did not own a mobile phone, there was one in the household. Ownership even extended to the children within four families, despite the fact that half the

residents expressed concerns about the potential health effects of mobile phones on children. The interviewees recognized this paradox themselves, that their own desire for mobile phones fueled the need for mobile phone technology. This was, however, perfectly rational given that mobile phones were viewed as a means of enhancing safety. This was seen as important in Berinsfield with its few transport links and where the nearest senior school is a bus ride away (Berinsfield PP, 2003; ODPM, 2000). Children were given mobile phones as a means of keeping them in contact with their parents. As Betty expressed, "I think it's fantastic that I can sit here and talk to my son while he's walking the dog in the woods." The elderly were also seen as benefiting from mobile phone technology as they could call for help quickly in case of an emergency. Ironically, the two campaigners suffering from brain tumors were made more reliant on their mobile phones. As neither of them can now drive, they rely on public transport and having a mobile phone enables them to contact home quickly.

Scientific experts often claim that the public seeks a risk free environment and that the mobile phone controversy is an example of scientific misunderstanding given that radiation from a base station is typically 10,000 times weaker than that from a handset (Henderson, 2004). The interviews showed, however, that the issue was the control of risk taking. Most protesters agreed that mobile phones were probably more dangerous than the masts and acknowledged the scientific evidence to back this. Nevertheless, ownership of a mobile phone lowered risk by providing an emergency lifeline. Furthermore, the interviewees argued that the way they used their mobile phones lessened the associated dangers of mobile phone ownership in comparison to the masts. They had a control over the mobile phone, whether to use it or not but "when somebody sticks a mobile phone mast on your doorstep that is something you have no influence over" (Duncan) (cf. Slovic, 1987). Nearly half of the protesters (five) explained that life was about taking risks. Three used the analogy of driving a car, saying that every time they took a ride they could have an accident, which was a risk they accepted. With their mobile phones nearly all the residents emphasized how they were for emergencies and that they minimized their use of them. Children were only given enough money to text, which was perceived as safer because they were not holding the phones to their heads (four families). The NRPB confirmed that text messaging is likely to lead to lower radiation levels for the individual (Ros Thorne, Press and Information Office, NRPB, 2004, personal communication). There was no mention of any dangers in relation to children's ownership of mobile phones, even though children are particularly vulnerable to mobile phone thefts (Home Office, 2002). Thus, as they effectively rationed their use to increase their safety it was argued that their children were unlikely to suffer any medical consequences from their mobile phone ownership.

The current network of masts provided more than adequate coverage for this safety net and given the health concerns protesters saw no need for more masts. The planning law was perceived as ignoring these local anxieties and favoring instead the needs of large corporations. None of the protest group expected the existing mobile phone masts to be removed. What they did demand was no further extension of the mobile phone network until the safety of the technology was proven. There was a focus on the potential for long-term health effects, given that mobile phones were a recent introduction (six protesters). This led to calls for more research from five protesters but the question became one of who should pay for and conduct this research. Two interviewees favored research conducted by the medical profession but one suggested that as the mobile phone companies were making so much money some of that should be invested in further research. From the outset, however, it seems unlikely that the interviewees would accept research funded or conducted by the mobile phone industry. On initial contact by the author, most interviewees had to be

reassured that the study was not funded or promoted by the mobile phone industry (cf. Burgess, 2004: 21). In the course of the interviews previous industry cover-ups of health related issues such as smoking, BSE, asbestos and thalidomide were referred to as proof that industry could not be relied on to provide objective scientific evidence (six protesters). This was because big business is about making profits and belief in corporate social responsibility amongst the interviewees was low. The mobile phone industry was perceived as no worse or no better than any other industry.

Permitted development rights were granted to network providers specifically to avoid local councils responding to local concerns. If full planning permission was required, as the Stewart Inquiry recommended, "feared" risks regardless of scientific evidence could be taken into account in any planning consideration (Walton, 2002). For half the campaigners the health risk was a planning issue, particularly where masts were sited close to residential housing. While acknowledging that there was no proof that mobile phone masts caused any health problems, the lack of proof that they didn't was enough for six interviewees to damn them. This would suggest a very strong interpretation of the precautionary principle. Only Elaine was fully familiar with the precautionary principle and cited both the Stewart Inquiry and Maastrict Treaty interpretations of the principle as a blueprint for its application to mobile phone technology (EU, 1992; IEGMP, 2000). For her, this led logically to the conclusion that, as a nation, if we wanted mobile phone technology then there should be only one network, to minimize the background radiation. The latter formed a significant part of her argument at the planning inquiry. Three other interviewees also questioned the need for five mobile phone operators and the development of five independent networks. Two campaigners suggested that we should have gone down the route of a national grid; that is one network with many service providers.

Onwards and upwards? Technology in question

Given that Berinsfield already had four masts, it is perhaps not surprising that residents felt that was enough and would question the need for more. It was perceived that all the mobile phone operators were doing was seeking to increase their coverage to promote sales. In the future 3G services would exacerbate this situation by requiring more masts for services the locality did not need (five campaigners). Owing to the limited use that protesters made of their phones, for five of them, holes in coverage were acceptable. After all, if you were at home, you just used the land line and if you were in your car, you could wait until you went "down the next hill" (Betty). Four interviewees pointed out that using a mobile phone while driving a car was a hazard. They said that this danger was one that the government had recognized and was going to legislate on (Direct Line Insurance, 2002). Thus, the claims of Alpha that the mast was needed to provide better coverage for the village and the trunk road were flawed (Welldale and District News, 2003b).

The UK government appears convinced that the 3G networks will aid e-commerce and the country's economic competitiveness. For the protesters their health and environmental quality were being sacrificed for a leisure device. The proposed services, e-commerce and video conferencing, that 3G promise to bring were described as little more than gimmicks designed to sell mobile phones to the younger generation. Clive commented that the operators seemed to be promoting taking photos of yourself on holiday—"was there really a need for that?" There appear to be strong parallels here between the marketing of computers and mobile phones with both technologies sold as a necessity and a leisure item (Schofield Clark et al., 2004). Four interviewees complained that marketing was directed at teenagers specifically to produce a demand for the network operators. Thus, mobile phones, whilst

being acknowledged for their safety potential by all ages, became interpreted as a toy, particularly in the hands of children. Contrary to other commentators three interviewees saw the mobile phone as the death of conversation, with teenagers preferring to text their messages rather than talk to the person standing next to them (cf. Fox, 2001). The only other main use of mobile phones that three protesters noted was to keep in contact with the office. Again, this was almost as a lifeline rather than an integral part of business activity. Two interviewees derided the concept that a small screen could increase business opportunities.

There remained, however, an essential faith in new technology; they were not "Luddites" (Brian). Broadband had just arrived in Berinsfield at the time of the interviews and two interviewees were having it installed immediately. For one interviewee this was the way forward for Internet connections. It was suggested that all these new masts would soon be superfluous as a new technology would come along and sweep them all away (three protesters). One protester identified satellite technology as the next step. Over half the residents (seven) called on the operators to mast share but only one of those seemed to appreciate that there might be technological limitations to mast sharing. Senior interviewees were more inclined to question the value of new technology and three noted that their views might not reflect those of the next generation. Of the four interviewees aged over 60 only one household possessed a computer and one other noted that her involvement with the protest group had declined as it became more technical. What older interviewees questioned, however, was not the value of the progress made but the unbridled consumerism that they perceived the technology to promote. As Brian complained, "Why have we got to go for [economic] growth all the time? It's quality of life that matters."

7. Discussion

The continuing health debate has been interpreted as a consequence of raised expectations of the Stewart Inquiry and a precautionary approach by government (Burgess, 2004; Walton, 2002). Whilst only two interviewees had heard of the precautionary principle, it is clear from the opinions expressed by those campaigners concerned with health that a strong interpretation was applied. Also, the actions of the protesters, in minimizing their use of mobile phones and in text messaging, imply that they endorse a precautionary approach. In contrast, government actions were seen as a weak interpretation of the principle. The failure of government to implement the Stewart Inquiry recommendation that all mobile phone masts should be subject to full planning permission was particularly criticized. The extent to which many of the protesters realized the significance of full planning permission to the health debate, however, is unclear. Given this adoption of the precautionary approach perhaps the greatest surprise in this study is the high level of mobile phone ownership amongst the protest group. This includes the sub-group that claimed health issues were their main concern. This contrasts markedly with other recent health scares in the UK such as BSE, MMR and GM foods. In these three cases, claims made by a small number of scientists about adverse health effects led to concern in the media and a drop in the consumption of beef, take-up of the MMR vaccine and a rejection of GM crops (Cook et al., 2004; Dyer, 2004; Miles and Frewer, 2003; Jacob and Hellström, 2000). The continued ownership of mobile phones by interviewees must, in part, reflect the way in which they use their mobile phones and the perceived trade-off between occasional emergency use and the probability of harm. This contextualization of the protesters' concerns explains the apparent paradox of owning a mobile phone whilst protesting against a mast. The social role of mobile phones may also explain why the potential health concerns have had little impact on

ownership in general. In particular the precautionary advice that children and young adults should minimize their mobile phone use appears widely ignored (Burgess, 2004). In this the mobile phone health debate may mirror that of smoking, where even proven health risks often fail to deter young people from adopting the habit (Austin, 1995).

Continued high ownership rates may also reveal, however, that health issues are only part of the story for mobile phones, another significant factor is the siting of mobile phone masts and the way in which local views are taken into account in the planning process. Burgess (2004) has noted that for many protesters, concerns usually start with objections to the siting of the mast. That also seems to be happening in this protest group; however, the apparent evolution of the protest group from one concerned with planning to one with health issues in this case is more a reflection of the interests of the group's leaders rather than a shift of interests within the group. It is noticeable that the local newspaper chose not to emphasize the potential health consequences but instead focused on the planning issue in nearly all of its articles (Table 2). Three of the four articles to cite health risks are due to quotes from Elaine. This is in contrast to the perceived role of the media as one of heightening health concerns and again illustrates that local context is an important factor in understanding these debates. This is just one small group but if the diversity of concerns raised is a reflection of other local protest groups then this will pose problems for the engagement model of science. Even encompassing and listening to the views of key secondary stakeholders may fail to identify all of the issues that concern the public.

The demise of the "deficit model" of scientific understanding has been partly in response to a greater acknowledgement of the importance of "lay knowledge" and the willingness of campaigners to get to grips with detailed scientific articles (Miller, 2001; Tytler et al., 2001). The Internet provides an easily accessible gateway to such material; however, it is different in that there are also a wide variety of opinions that would never be accepted by peer review journals (Burgess, 2004). Campaigners appeared aware of the potential for bias; however, there is some evidence to suggest they were already predisposed to favor articles that supported their arguments. The interviewees seemed less conscious of the difficulties in using anecdotal evidence to support their case. Whilst observational evidence of cancer clusters can provide interesting insights into potential causes these are usually only confirmed by large-scale epidemiological studies (National Cancer Institute, 2004). The large number of different tumors means that true cancer clusters are, fortunately, extremely rare. Protesters did see a need to invest in long-term scientific studies of the type that could answer these sorts of questions. The problem became who should fund such studies. Although some campaigners suggested industry should fund scientific research into the health issue, there was little evidence that their findings would be accepted. The distrust of industry meant that research funded by companies was seen as inevitably biased (also see Powerwatch, 2004). This included recent partnership initiatives such as the MTHR project (MTHR, 2004). This has implications for involving industry in research collaborations and the current trend for a closer relationship between government policy and industry sponsored science

In his book, Burgess (2004) notes the growing importance of the Internet to the local campaign groups. Not only did it provide access to data and to other protest groups, it also helped to sustain their involvement in the protest. It is generally recognized though that older adults make less use of computers and the Internet than younger adults (Selwyn et al., 2003). This study suggests that this may marginalize their representation in protest groups. Within this group though, there was an unexpected lack of active Internet searching. Individuals still relied on those with scientific knowledge (and leaders) to provide information, often via computerized links. Elaine felt that in leading the campaign, she had had to

learn far more about computing and subsequently she has sustained her links with Mast Sanity. In contrast, another campaigner, a home-based teleworker who also used e-Bay frequently, avoided researching for information on health and mobile phones. This was because she did not want to find out further details about her tumor. On the other hand yet another interviewee was never interested in the health campaign and surfed the net for her own ends and saw herself as "drifting in and out of the edges" of the group. Therefore, although there appears to be a distinct difference in information gathering between those at the forefront of the campaign and those at the edges it is difficult to assess whether this is a result of the Internet or merely an emphasis of preexisting tendencies (cf. Bimber, 1999).

There are few signs of "technophobia" although the study suggests a link between age and the perceived usefulness of new technology. More recently, the notion of technophobia has been questioned, leading the way for ideas of technological stigma addressing "the apparent paradox that science and technology can engender distrust, even as they extend and enhance modern life" (Clarke and Short, 1993: 384). The problem is that the protesters do not see more mobile phone technology as enhancing their life or providing social progress (cf. Burgess, 2004: 121). Even without considering the claimed health issues, the masts are seen as degrading their environment and the mobile phone as diminishing social interaction. It was more a case of "technology fatigue" for older residents who have witnessed successive technologies and the accompanying claims for the progress they make. Furthermore, the attractions of small mobile technology must seem less to older citizens who are more likely to suffer from reduced dexterity and visual acuity (Selwyn et al., 2003).

In common with the findings of Burgess (2004), all the interviewees recognized the safety potential of the mobile phone and the lifeline it provided. What was lacking was the recognition of the need for services beyond basic text and voice messaging. Thus, the campaigners did not see the relevance of 3G services to their lives. It is tempting to interpret this to the limited worldview of campaigners; however, analysts have also drawn attention to the lack of a "killer application" for 3G (Ayres and Williams, 2004; Reece, 2004). This shows that local communities can reject incremental innovation in cases where certain stakeholders remain opposed to the basic technology (Hall and Vredenburg, 2003). There are also concerns over poor compatibility between operators on key 3G services, requiring users to communicate with others having the same technology (Budden, 2002; also noted by one protester). Industry studies have also revealed that consumers want practical devices and not "infotainment" and that there is a need for the mobile phone industry to appeal to more than just the youth market (Budden, 2002; Patel, 2004). Instead of the seismic shift once predicted in communications, it appears that there will be a much longer term evolution (Ayres and Williams; 2004; Reece, 2004).

Most of the campaigners were not against mobile phone technology per se but against the number of masts within their parish, a finding that echoes those of Burgess (2004). This partly stems from a sense of control over phone use as compared to the location of masts (Slovic, 1987). It also reflects the feeling that the current network provides the service they need. Again, this provides evidence of the need to appreciate local knowledge when considering protesters' claims. It is difficult to assess to what extent the campaigners' skeptical view of the operators' commitment to mast sharing is warranted. There are undoubtedly technical and topographical limitations to mast sharing. What is clear is that the number of masts has been determined by the conditions of the license issued to mobile phone operators by the government. The government's objective was "to secure for the long-term benefit of UK customers and the national economy . . . sustained provision of third generation services" (EEMA, 2001). To achieve this it was felt necessary to auction five licenses requiring five separate networks. The subsequent fall in telecommunications

profitability has engendered criticism of this approach, in particular the conditions of the licenses (Ayres and Williams, 2004; EEMA, 2001). Industry analysts have doubted that more than three networks are needed to provide a competitive market (Wearden, 2003; Wallage, 2001). It is claimed that network sharing would have led to a 70 percent reduction in the number of masts and maybe up to 40 percent reduction in the deployment costs for operators (Planning Sanity, 2004; Wallage, 2001).

It is tempting to reduce this debate to one of Not In My Backyard (NIMBY) and one that requires local resolution. This is especially true in this case where the loss of a particular concept of the rural landscape appears at stake. This, however, ignores the issue of scale that also exists within the planning debate as national policy governing mobile telecommunications impacts upon local communities (cf. Woods, 2003). It also fails to acknowledge the power of individual stakeholders to legitimate certain discourses. Mobile phone corporations appear to benefit from a two-pronged sales pitch in much the same way as other information technology companies (see Schofield Clark et al., 2004). Mobile phone providers attempt to sell the network to consumers on a leisure and entertainment basis. At the same time, network providers are able to sell the expansion of the network as a national benefit, increasing the potential for e-commerce. In so doing, the corporations and governments are able to deflect calls for tighter planning regulations, framing such demands as NIMBYism. Concern for the local environment does not have the same legitimacy as encouraging national economic growth, nor the urgency of potential ill health. Thus, the protest group possesses none of the attributes required for stakeholders to be listened to. In abandoning emotive arguments about the landscape, in favor of the health issue, protesters encounter another powerful discourse as "planning policy and planning law . . . emphasize technical discourses and verifiable arguments" (Woods, 2003: 286). The discourse of scientific expertise and knowledge again bolsters government and corporate claims of a rational policy towards technological developments. It provides yet another argument against requiring full planning permission for masts.

8. Conclusions

From the protesters' perspective government planning policy seems to prioritize national economic performance over their quality of life. In so doing, it appears a deficit model approach to the scientific evidence has been favored over the engagement model. It may seem that campaigning against a mobile phone mast whilst owning a mobile phone is either irrational or based purely on self-interest. In listening to the arguments presented by the protesters, one can begin to appreciate that it is neither of these. For several of those involved there was a genuine fear that mobile phone masts could exacerbate preexisting medical conditions. The protesters concerned about health used their phones in such a way as to minimize the perceived potential health risks and maximize the benefits of mobile phone ownership. They were more concerned about the masts, not because they thought they posed a greater risk than the phones, but because they had no control over that risk (Slovic, 1987). Health concerns, however, did not dominate the interviews. This supports the conjecture that the national media have over-emphasized that relationship (Burgess, 2004). The conclusion by Burgess (2004) that the government's precautionary approach has encouraged this health fixation is less well substantiated. Planning issues remained the primary concern for almost half of the campaigners. This may be a particular facet of rural protest groups. Campaigners did not cite scientific articles claiming a link between ill health and mobile phones. What they did refer to was the lack of proof that mobiles phones did not

affect health. This would suggest that some protesters require a level of "assurance" that science cannot provide (Frewer et al., 2003), although the interviews provide ample evidence that they did not expect a risk free environment. For them, the current mobile phone network and masts provided all the services that they required. They did not perceive an immediate need for 3G technologies in their neighborhood. In this, they are not alone and their arguments appear to reflect current analyses of the technology and the industry's economic status.

The rejection of mobile phone masts but the acceptance of mobile phones can be more easily understood by taking an engagement approach to the issue and contextualizing the concerns of residents. This does not, however, address the question of whether those concerns should be legitimated. Whilst not all stakeholders' needs can or should be met it is often easy to dismiss their demands as irrational (Freeman, 1984: 23). The Stewart Inquiry has been criticized for confirming the health worries of protesters but it should be recognized as a genuine effort to engage with secondary stakeholders in a scientific debate. Had the government accepted the Stewart Inquiry recommendation that mobile phone masts should be subject to full planning permission, it would have satisfied the needs of both protesters concerned with the planning issues and those with health fears. It has to be admitted that such a strong precautionary approach might have significantly slowed down the introduction of the 3G networks but it would not have stopped them completely. Keeping the public happy by slowing the pace of technological development, however, contradicts the view that increased technological innovation is needed for economic growth (Fuller, 1997). Therefore, it should also be realized, that the justification for ignoring this significant part of the Stewart Inquiry has been made by powerful actors using recognizable scientific and economic discourses (cf. Cook et al., 2004). By engaging the public in scientific debates, the government is responding to the perceived inadequacies of the deficit model. While this is to be welcomed, this raises the expectations of all the parties involved that their worries will be listened to. In areas of uncertain science it seems unrealistic to expect that a consensus can always be reached; stakeholders may well have irreconcilable differences (Hall and Vredenburg, 2003). Briefly engaging with protesters at a national level only to deny them any local involvement, however, seems almost certain to fail. The engagement model and the precautionary principle appear to be providing unwelcome challenges to the dominant discourses in both scientific and economic policy. It will require larger and more detailed studies of science debates to ascertain whether these new approaches can have a significant impact on policy decisions.

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