The London School of Economics and Political Science

The public sphere according to UK stem cell scientists

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Declaration

I certify that the thesis I have presented for examination for the MPhil/PhD degree of the London School of Economics and Political Science is solely my own work other than where I have clearly indicated that it is the work of others (in which case the extent of any work carried out jointly by me and any other person is clearly identified in it).

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Abstract

In this thesis the concept of social representations is made relevant to the study of the 'public sphere' according to scientists. This is elaborated by the re-examination of the notion of a 'consensual' and a 'reified universe' substantiating a more socio-psychological approach in the study of relevant phenomena. Two processes generate social representations of the public: anchoring and objectification. The empirical study investigates the scientists' views of the public sphere, in relation to public perceptions, media coverage and the regulation of cloning technology. Elite media coverage of the stem cell debate and conversations with stem cell scientists are systematically analysed with multiple methods. Findings are based on 461 news articles that appeared in *Nature* and *Science* between 1997 and 2005 and on interviews with 18 U.K based stem cell researchers conducted between February and October 2005. The analysis compares the debate before and after the 'stem cell war' of 2002, and typifies a high tension in representing the public sphere, elaborated in metaphors and prevailing arguments. Central elements of the representation assume a strong disassociation of science from the public sphere; peripheral elements operate with a degree of blurring of those same boundaries, which recognises a common project. This representation, while being expressive of its context of production, constitutes a functional response to it.

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Introduction

What is this driving force behind the development of one's thesis? What are the complex circumstances that lead to its birth? Where is one to situate it and which theoretical, methodological and empirical tradition inspires to enrich? These pertaining questions constitute the essence of every piece of work and definite and absolute answers are hard and difficult to reach. They presuppose a certain degree of reflection; a distancing from one's conscious and unconscious drives and at the same time a certain extent of expertise, a deep and yet panoramic understanding of different but nevertheless interrelated fields of knowledge and research. It would be unrealistic to claim that during the development of this thesis I have acquired the mastery of silencing subjectivity while realising full intellectual competence. However, I can claim with certainty that I have struggled to trace or build bridges between previously unrelated conceptual fields, to relate theory to method, to see, listen, and read not only what is given in plain site but also what remains aloof, as well as to combine logic with the creativity and life imagination has to offer. While doing so, I also experienced the efforts of the people I set out to investigate, interview and analyse; to claim objectivity and universality while remaining close to both those people and the text, and of course, above all humane. If I could capture the purpose of the present thesis in one little sentence that would be the way experts in one field of biotechnological research represent and experience the perception, representation and regulation of their work by non-experts. Thus, focus is placed on the perceived relationship between the scientific and the non-scientific as theories, selves and the world are also illuminated. Moscovici's theory on social representations constitutes the backbone of this attempt, for it manages to offer a fruitful and holistic perspective of the plasticity and complexity of human thought in interaction and communication with the collective, the strange, the threatening, overall the other.

However, one of Moscovici's initial purposes was to offer a way with which to study the relationship between the scientific and the non-scientific. His attempt to map the different ways a scientific theory, that of psychoanalysis, was received, perceived and transformed by different segments of French society in the 1950s is paradigmatic of such an effort (Moscovici, 1961/1976). In some of his writings social representations per se are equated to a specific type of knowledge, that of science made common. This perspective seems to be further fuelled by his discussion of the ‘consensual’ and the ‘reified’. Thus, if taken literally, it suggests that the consensual is the world of social representations (common sense) while the reified the world of science. The purpose of the individual social psychologist then is to account and document perceptions, identities, shifts and changes in the former. The latter is out of reach, probably left in the hands of philosophers to understand and explain it. In my opinion such a reading does not do justice to social representations as a theory of knowledge nor to Moscovici’s intention to enrich the scope of social psychology, nor does it enhance common sense and science in any way. If this is indeed the case, then creativity and imagination are excluded from the scientific. Social psychology is restricted to common sense while the role of the non-expert is limited to the consumption of what the expert produces. This is a rather mundane picture where demarcation between different forms of knowledge dictates the grasp of reality. Is the world really divided into two? Well, in a way it is. Scientific facts are produced in the confines of laboratories through the elaboration of highly technical knowledge, tools and practices. This is a truly universal knowledge, in the sense that facts can be reproduced and replicated unrelated to their context of production. This authoritative knowledge then makes its way out of the laboratory offering advice and credentials, explaining the world and planning projects of action as it also provides solutions, treatments and ways of protection from diseases, economic and natural disasters, to name but a few. Thus, weather reports define holiday plans and destinations, electricity promotes everyday life while sustaining communication and drugs provide relief from pain. Progressively, the non-scientist comes to view and act in the world through these skilled pieces of information. Old prejudices and myths give way to more rational and logical understandings. It is not a daemon that has possessed the individual but a chemical imbalance in her/his brain. It is not that Zeus is having a fight with the other gods that thunder is produced but it is the sound of lightning, an electrical discharge in the skies. What is being performed here is the infusion of scientific knowledge into other forms of knowledge. One could term this process as the ‘scientification’ of common sense. Then Moscovici is right to bring our attention to the multiple ways in which the scientific enters and changes the common-sensical. Indeed, large-scale studies like that of the Eurobarometer (Gaskell and Bauer, 2001; Bauer and Gaskell, 2002) reveal and compare how different cultural contexts encounter and appropriate scientific knowledge.

Is this, however, just a one-way communication process, like the ‘reified’ and the ‘consensual’ might have us believe? Increasingly laboratory research is invaded by private and public agendas. The industry, the government, the army have all contributed in one way or another in determining not only the availability of material resources but also the direction of specific scientific projects and subsequent applications. Scientific facts not only penetrate other forms of knowledge but progressively challenge taken for granted conceptions of nature, the body, life itself. The significance of these challenges has ceased to assume a local character and are becoming more and more global; affecting a multitude of cultures, countries and individuals (Tenner, 1997). As a consequence, concerns are raised both regarding the risks as well as the ethics of scientific conduct. People become skeptical to the idea of science as progress (Tourraine, 1995). Consumers are organised to oversee what they eat and drink; religious and pro-life groups are formed to safeguard the embryo and its potential to human life; environmental organisations are set up drawing strategies and building rhetoric on nature and its form of exploitation. Scandals like that of the Bovine Spongiform Encephalopathy (BSE) or the Foot and Mouth Disease reveal the inadequacy of expert advice to deal with current threats. At the same time that trust in science loses its magnitude, there is also a kind of political crisis. People no longer believe nor rely on the motives and decisions of the policy makers to safeguard their constitutional rights (Gaskell et al., 2001b). Instead, they demand to know where their money is going, what they consume, how to protect themselves from an increasingly troubled environment and how to preserve individual beliefs and values relevant to their culture, ethnicity and religion. As a response to that, contemporary science policy is undergoing important alterations. Especially for the U.K, where decision making used to follow a less participatory more internalised pattern, this is a novel phenomenon. We have come a long way from the 1985 Royal Society document ‘Public Understanding of Science’ to the more recent report by the House of Lords ‘Science and Society’. While the former promoted educative efforts to ‘scientise’ the British public, the latter puts forward a more dialogical perspective calling for the integration and participation of public voices in the policy of science. At the same time, and in an effort to build a degree of public opinion management into their products, large companies like the Geron Corporation began incorporating the ethical concerns of the public over embryo research into their research plans, promoting a utilitarian image of human embryonic stem cell technology and cloning (Franklin, 2003). Another question then arises: how is the ‘consensual’ and the ‘reified’ to account for such a ‘politicization’ of science?

The present research stands at this crossroad. On the one hand, there is a demarcation between the scientific and the non-scientific, highly exemplified by the form of institutionalisation of science. On the other hand though, there is a progressive transcendence of those same boundaries. As social research strives to document, as well as, promote public understanding of science and scientific understanding of the public, the need to account for the way the scientific community experiences this reality is more topical than ever. The present thesis aspires to explore this phenomenon by focusing on one specific biotechnological type of research, that of human cloning or somatic cell nuclear transfer (SCNT) and its experts' representations of the public sphere, that is, public perceptions, media coverage and regulation of their work. The choice of human SCNT has been mainly dictated by the intense and large-scale public debate that occurred after the announcement of the birth of Dolly the sheep. Overcoming national barriers it is a vivid example of the controversial nature of current research and the progressive penetration of ethics in discussions about contemporary science. More specifically, the thesis attempts to provide a final typification of the various meanings of the public sphere, as they are imbedded in representational contents (anchors and objectifications); their interrelationships and possible functions. Relevant questions include ‘how do UK stem cell scientists conceptualise the public perceptions, media coverage and regulation of their work?’, ‘what types of communication and interaction between science and the public sphere do these meanings prioritise?’, ‘what are the possible functions of these meanings?’. In debates about science and the public sphere, words are the vehicles of persuasion, dialogue, exchange of ideas and perspectives, in one word, meanings. Rhetoric assumes a central stage. As such, two important rhetorical devices are investigated: metaphor and argumentation. Meaning however is not reached in the seclusion of the individual mind but through constant communication and exchange with the collective. Thus, different types of data and methods of analysis are triangulated, maximising the interpretative power of the present study.

Overall, the thesis comprises three sections consisting of two theoretical, two methodological, and three chapters devoted to empirical analysis and the subsequent interpretation of the data. *Chapter One* re-examines Moscovici's discussion of the ‘reified’ and the ‘consensual’ through a consideration of their different proposed readings and their respective ramifications on social representations both as a theory of knowledge and a phenomenon under investigation. Taking into account the conceptual pluralism with which the concept of social representations has been applied in relevant scholarship, either as science made common or as common sense, ideologies, values, so on and so forth, such a clarification was thought pivotal. More specifically and largely drawing from latest developments in relevant socio-psychological research (Bauer and Gaskell, 1999; Duveen and Lloyd, 1990; Foster, 2003; Jovchelovitch, 2007; Moscovici, 1993), in the context of the present thesis social representations are applied both as a theory of knowledge and a phenomenon under investigation. As a theory of knowledge, they highlight the constituted and constitutive nature of knowledge inviting the researcher to approach her phenomenon of study in a disinterested attitude (Bauer and Gaskell, 1999). As a phenomenon, they call for a consideration of the multiplicity of resources and processes engaged in knowledge making while illuminating the subjective, intersubjective and objective elements of representing (Jovchelovitch, 2007). By implication, and in response to recent criticism regarding the relevant tradition's lack of operationalisation of the processes generating social representations, an attempt is made to further link anchoring and objectification with discursive contexts of communication. More specifically, anchoring is connected to metaphoricity while objectification to argumentation. While I cannot claim originality over this conception, for Liakopoulos (2000) has already proposed a similar connection, I set to further develop his original ideas, mainly extending them by including Billig and his perspective on argumentation and rhetoric. I propose that metaphors and arguments are not only ways of expressing and persuading but they also reveal symbolic resources and projections of ideas, casting light on anchors and objectifications.

Chapter Two aspires to offer a brief yet exhaustive overview of relevant empirical research. Focus is placed on two related bodies of literature, that of sociology of science and the public understanding of science tradition. The purpose is threefold. At a first level, relevant research might help in the identification of possible empirical and methodological lacunae. At a second level, similar studies provide an important resource in further enhancing the understanding of the phenomenon of research. Lastly, they identify possible bodies of knowledge to which the present research might contribute.

The next two chapters are more methodological in nature. Thus, *Chapter Three* discusses human SCNT and the related public debate as it occurred after the birth of Dolly in the UK. In the first part of the chapter the reader is introduced to the technicalities and background of SCNT research. Adopting Bauer and Gaskell's (2002) proposed framework for researching the relationship between science and the public, the human SCNT debate is approached as a movement. The model has informed the design of the present research by enabling the identification of different actors and the demarcation between different interest groups while offering a clear and manageable operational definition of the public sphere. Public perceptions, media coverage and regulation are defined as the constitutive arenas of the public sphere. Considering the plurality of terms with which to refer to the non-scientific, such as 'common sense', 'society', 'everyday knowledge', 'lay', the definition is of great analytical value for the researcher. It is with such a connotation that all relevant terms are used in the context of the present thesis.

Chapter Four takes us to the heart of the research design. It discusses the specific methods used for the collection of the data and their subsequent analysis. Thus, articles from two scientific journals *Nature* and *Science* discussing public perceptions, media coverage and regulation of Cell Nuclear Replacement (CNR) technology from 1997 to 2005 are triangulated with material from individual interviews with UK scientists, conducted over a period of nine months, from February to October 2005. This is performed in an attempt to further enlighten both sociogenetic and ontogenetic aspects of social representations. Moreover, content analysis of the scientific media is combined with metaphor and argumentation analysis uncovering trends and patterns of coverage while accounting for the construction of social representations in formal settings of communication. Analysis of metaphors and arguments used by experts to refer to public developments of SCNT research while talking privately is also performed. In each case, reasons are offered grounding the choice of different types of data and methods of analysis. Examples are also given (mainly in the appendices section) further explaining the logic and mode of conduct.

The following three chapters are dedicated to the presentation of findings. Thus, *Chapter Five* discusses the results of the analysis of the scientific journals. What types of public events are discussed in the scientific press? Which 'public spheres' mostly preoccupy interest? Which voices are represented? What kind of metaphors and arguments are used? Are there any shifts across the years investigated? *Chapter Six* brings forth the ontogenetic element of social representations while allowing for comparisons with the data derived from the analysis of the journals. Again, what types of metaphors and arguments are employed in private? Are there any differences between individual accounts? And what about the self? *Chapter Seven* concludes the present work by offering a more synthetic view. Thus, a discussion of the social representations of the public sphere as indicated in the representational field analysed is offered. Meanings and contents are linked to structure and functions of representing while accounting for the overall context of their production. The chapter ends in a reflective tone by providing some preliminary propositions for future social representations studies.

Despite its limited focus the thesis manages to produce a set of rich and fruitful data, enhancing our understanding not only of social representations but of being and living in a highly complex and complicated world. Thus, it provides access to the experience of encountering different knowledge, competing views and opinions whilst operating in a highly debated field of research. As boundaries and demarcations are drawn protecting professional ideologies and ideals, at the same time they are mixed and blurred, sustaining future choices and practices. Such a hybridity is not only reflective of the world but also a functional response to it. Being in itself becomes hybrid, as the following pages will reveal. Overall, the present work extends both social representations tradition and relevant socio-psychological study of expert forms of knowledge. At the same time, it also makes developments in the study of rhetoric, sociology of science, public understanding of science and political sciences. Considering recent attempts to redefine and refine the relationship between the scientific and the public sphere, such an account is considered highly topical.

Chapter 1

Revisiting the 'reified' and the 'consensual' in the context of communication

The choice of a theoretical framework in the study of a given phenomenon is always expressive, among other things, of the researcher's conceptual stance in relation to current paradigms of research in her/his respective field of study. Thus, it is my personal contention that Moscovici's seminal theory expanded the discipline of Social Psychology both on theoretical and methodological levels by raising the attention of the researcher to the study of human thought and action as a dynamic and interactive process. By rupturing prior demarcations between the internal and the external, Moscovici revitalised the field with references to communication, rationality, diversity, the social and the individual, to name but a few. He has managed to offer a conceptual and methodological model flexible enough to account for the study of polyphony experienced in present conditions of living. However, when accepting a theory, one can also find oneself engaged in a dialogue about those aspects of it that are currently the object of further development. In such an instance, one can either work towards its expansion or on second thought dismiss it as lacking any explanatory power.

Over the past forty years or so an intense and fruitful debate has developed around the theoretical and methodological contributions of social representations theory in Social Psychology. In this vein, Farr (1993) recognizes the potential of the theory to enlarge the scope of the discipline by reinstating the importance of myth and magic, language, religion and customs while giving new significance to old methods of research. Overall, a vast corpus of authoritative work has been produced, pondering on the origins of Moscovici's work, on the nature and functions of social representations, on their operationalisation in research and so on, with a view to further extend his original ideas (e.g. Duveen & Moscovici, 2000; Deaux & Philogene, 2001; Wagner, & Hayes, 2005; Jovchelovitch, 2007). For others, however, inconsistency and vagueness lie at the heart of the theory calling it 'a pot-pourri of contradictory ideas, seasoned with some pieces of speculative cognitive psychology' (McKinley & Potter, 1987, p.484). By and large, in a review of the relevant literature Voelklein and Howarth (2005) identify four basic lines of criticism leveling reservations against social representations accounts, regarding what is seen as a) theoretical ambiguity, b) social determinism, c) cognitive reductionism, and d) lack of a critical agenda in the proposed relationship between scientific and commonsensical knowledge. It is not within my intentions to extensively discuss all relevant accounts, but rather to focus on two particular aspects of Moscovici's theory, which received much attention. That is Moscovici's treatment of the relationship between the scientific and the public realm, verbalized in the names of the 'reified' and the 'consensual', and his propositions regarding the contents of social representations, namely anchors and objectifications.

Relating to the former, I set to further expand some earlier points made by Foster (2003), as to the different proposed readings of the reified and the consensual, the different interpretations of social representations that each of them entails and to the wider implications they hold for the socio-psychological study of different kinds of representations. While documenting this polyphony, the present thesis will be situated in line with some recent propositions offered by social representations researchers (Bauer & Gaskell, 1999; Duveen, & Lloyd, 1990; Foster, 2003; Jovchelovitch, 2007; Moscovici, 1993) that corroborate a more holistic understanding of representation as an over-arching phenomenon found at the basis of all knowledge systems, more or less expert. These propositions not only offer a clearer and more elaborate definition of social representations, both as a potential theory of knowledge and as a phenomenon to be studied, but they also put forward a well-articulated framework for performing relevant studies, and in so doing tightening the links between theory and research.

At a second level, and motivated by current on-going discussions about the lack of operationalisation in the study of the contents of social representations an attempt will be made to further elaborate on some earlier efforts by Liakopoulos (2000) to relate the study of rhetoric with that of anchors and objectifications. More specifically, anchors will be connected to metaphors and objectifications to arguments. While positivism asserts the neutrality of methods of research with respect to theory, I would agree with Farr (1993) that one should always consider the methods of research in relation to the theoretical framework adopted, for there should be a match.

The present chapter intends to clearly manifest and explain the rationale in which social representations are employed throughout this thesis, both conceptually and empirically. It is believed that such an understanding further expands Moscovici's initial ideas to promote and substantiate a more socio-psychological approach in the study of the relationship between different types of knowledge and their holders (Moscovici, 1987; 1993).

That stated, it is propounded that the choice of Moscovici's social representations theory should also be linked to the context of the Institute of Social Psychology at the LSE, which hosted the development of the present thesis in an atmosphere of on-going discussions about the contextual and polyphasic nature of human thought. It is these kinds of ideas and debates that have nurtured and cultured my understanding of Social Psychology as a discipline for the study of social phenomena, that is, phenomena situated in the world we live and create in.

1.1 Social representations: from the 'naïve' to the 'amateur' scientist

The concept of representation, as the making present of what is actually absent through the use of symbols has been central in social science's studies of the human mind, language, self, societies, and cultures; in one word, of human life. While it is not within the intentions of the present thesis to fully account for this rich and polychromous tradition[1], it suffices to say that various scholars have long pondered on the centrality of representation in the development of the human infant, in the construction of language and acquisition of speech, in the establishment of social order, and in the formation and transformation of different cultures, to name but a few. However, it is representation's epistemic function, that is, its ability to produce knowledge about the world that has been the subject of intense debate through the centuries. Questions such as, 'how does the human mind acquire access to the 'outside world'? or 'how valid can this representation be?' have preoccupied the minds and writings of a plethora of social researchers (Jovchelovitch, 2007).

In the context of Social Psychology and for the first half of the preceding century, a highly mentalistic perspective dominated the study of representation, both conceptually and empirically (Duveen, 2000). Drawing from Descartes' *cogito ergo sum* representations were studied as individual cognitive processes deprived of their contextual or symbolic nature. As a corollary, representations were treated as mere reproductions of an external reality, existing somewhere in the distant 'out there'. Confined within laboratory walls, social psychologists strived to document human

[1] For a more comprehensive account of work on representation see Jovchelovitch (2007)

mind’s information-processing procedures as analogous to that of a lifeless computer. In this vein, any observed discrepancies between external reality and internal cognition were accounted for as biases and errors. Soon, the idea of the individual person as naïve prevailed.

It is against this mundane and degraded image of the human mind that Moscovici’s innovative contribution can be fully appreciated. Retracing his steps, Moscovici (2000; Moscovici & Markovà, 2000) reports how his understanding of such diverse works as that of Durkheim, Freud, Heider, Lévy-Bruhl, Piaget and Vygotsky provided the main intellectual background for his battle against social psychology’s behaviouristic, individualistic and positivistic dominance. With his original work on the way psychoanalysis was received and consequently appropriated by different milieus in the French public sphere of the 20th century, he set to restore the concept of representation by recuperating the links between the social and the cognitive (Moscovici, 1961/1976). By connecting knowledge to its social and historical conditions of production he reinstated the rationality of the individual person, not as a neutral observer of the world but as an active subject in the process of constructing it. Knowledge *of* something is always knowledge *of* someone in a specific place and time. At the same moment, knowledge is contested, communicated, discussed and transformed. As such, knowledge is never fixed or static and its plural and changing nature needs to be appreciated. It does not merely reflect certain representations and attitudes about the world but also situates people in the world, debunking social and psychological identities. As Jovchelovitch (2007) astutely points out, Moscovici set about to establish that:

> (a) there is no such thing as ‘free’ knowledge, produced by a subject ‘free’ of others, history and belonging; (b) that ordinary people can hold knowledge and know what they are talking about; (c) that history and structures do not exist independently of the subjects that produce them in the first place. (p.44)

However, at the same time this was also a study of the relationship between different forms of knowledge, both scientific and common sense. The centrality for social psychologists that Moscovici (1987) affirms to such an endeavor has made him proclaim that:

Any science devoted to the study of thoughts and beliefs in the society of our times must come to terms with an obvious epistemological problem: the relationship between scientific and non-scientific thought, or what one refers to as popular thought, common sense, the thinking of lay men and women, ideological thought e.t.c. (p.513).

Indeed for Wells (1987) Moscovici's social representations could be seen not only as a theory of understanding knowledge, its conditions of genesis and functions but also as a meta-theory offering explanations of the relationship between science and common sense. This latter point, calls for a consideration of what Moscovici has described as 'consensual' and 'reified' universes. The different possible readings of this proposed dichotomy hold profound ramifications not only for the definition and consequent empirical uses of social representations theory both in general and in relation to the present thesis, but also for the potential role of social psychology in the study of different types of knowledge and their inter-relations.

1.2 The 'reified' and the 'consensual' revisited

According to Foster (2003) Moscovici's discussion of the consensual and the reified offers the possibility of a number of different readings postulating in this way different understandings of the relationship between science and common sense as well as different definitions of social representations as theoretical concepts, inevitably leading to distinct empirical routes.

A first rather strict and literal meaning of the 'reified' and the 'consensual' seems to suggest a clear demarcation between science and common sense, splitting reality into two distinct and incompatible worlds. Hence, in some parts of Moscovici's work (1981; 1984; 1987) the reified universe is discussed as the mode of knowledge corresponding to science. Its purpose is to construct a map of the forces, objects and events that exist 'out there', independent of human interaction. Thus, as he proclaims, things here become the measure of man. In contrast, the consensual universe corresponds to social representations:

'a set of concepts, statements and explanations originating in daily life in the course of inter-individual communication. They are the equivalent, in our society, of the myths and belief systems in traditional societies; they might even be said to be the contemporary version of common sense' (Moscovici, 1981, p. 181).

While the purpose of science is to turn something familiar into something unfamiliar, the purpose of social representations, and thus common sense, follows the opposite direction, making present and concrete what had remained absent and aloof. Here man is the measure of things. By implication, social psychology is to become a science of this consensual universe.

Such a reading seems to hold immense ramifications for the understanding and study of scientific and common-sense knowledge by social psychologists. Thus, seen in this light, science emerges once again as an amnesic, ahistorical, ahuman, almost mythical endeavour (Bangerter, 1995; McKinley & Potter, 1987; Purkhardt, 1993). Descartes' *cogito ergo sum* resurfaces in the form of what Jovchelovitch (2007) terms 'the psychology of the pure object' proclaiming the purity of a world that is seen as detached of any human input. However, the ethnographic study of scientific laboratories, with the work of Latour and his colleagues (1999; Latour & Woolgar, 1986), as being more paradigmatic, has indicated how reification, that is, what we come to acknowledge as a scientific fact, as a true depiction of our world, is not an *a priori* condition of science but rather the *ex-post facto* of a long process that in its making includes a number of different resources, more or less esoteric to science. More specifically, the reification of a scientific fact is as much the product of **hybrid** processes that include personal motives and aspirations, scientific instruments, expeditions and sites, interrelations among like-minded peers, between different scientific groups, and between holders of different types of knowledge, more or less expert (such as activists, politicians, the public, the media and so on and so forth), as of **purified** processes, like the distanciation between: self and the world, humans and non-humans, science and common sense (Bachelard, 1938; Knorr-Cetina & Mulkay, 1983; Latour, 1987; Latour, 1993; Latour & Woolgar, 1986). That is, reified scientific knowledge as ahistoric, objective, ahuman, and context-free is only but the outcome of historic, subjective, human and contextual procedures. This realisation, however, should not be taken as a relativistic understanding of reified representations, but as a realistic assumption that what we understand the world to be is a product of human thought, action and inter-action. Even scientists' purposeful attempts to discard their own subjectivity so as to acquire an objective understanding of the world is both the constituted product of more or less consensually reached norms (Kuhn, 1970), as well as constitutive of scientific communities, identities and ideologies (Bangerter, 1995;

Jovchelovitch, 2007). And while to a non-scientist, scientific theories and studies may turn something familiar into the unfamiliar, for a scientist familiarity, concretisation and explanation lie at the heart of science's modus operandi and scopes. Since social psychology's establishment *per se* has been based on the making sense of such complex and live phenomena, why should we exclude them from its study? Is it, perhaps, because it lacks analogous rich explanatory potential? It is my personal conviction not to rush to such a conclusion lightly. Moscovici's theory of social representation has the ability to form the basis of such an endeavour. However, before further elaborating on this point, one should finish what one set out to accomplish. Therefore, it is time to return once more to the reified-consensual dichotomy and ponder on the consequences of this first and rather literal reading on common sense.

The allocation of common sense in a universe operating in the exact opposite way to that of science runs the risk of neutralising one of Moscovici's great intentions, that is, the restoration of the rationality of common sense. If reification, in other words, the production of objective knowledge about the world, is only part of the game of science, then how is one to assess the ontological power of other forms of knowledge? Hence once again, Descarte's dichotomy between subject and object returns to institute what Jovchelovitch (2007) calls the 'psychology of the pure subject'. The human mind once again finds its route back to the seclusion of its private thoughts, biases and errors. The underlying hierarchy between different types of knowledge that such an understanding of the reified and the consensual suggests, takes social psychology back to its positivistic past (Foster, 2003). As it has been argued so far, this is not what Moscovici aspired to achieve nor is it in line with relevant socio-psychological findings (some examples include Gervais, 1997; Gervais & Jovchelovitch, 1998; Jodelet, 1991; Moscovici, 1961/1976). Indeed, to an observer certain representations may seem to be irrational, unfounded or stereotypical but they still remain, for those who hold them, the product of historic, social and contextual processes while performing a series of functions, such as, producing theories about the world, providing identity, assisting communication, resisting; in a word, situating oneself in the world while taking a stance towards it (Moscovici, 1988).

Another reading of Moscovici's discussion of the two universes focuses on the proposed relationship between science and common sense. On some occasions, it seems that Moscovici (Moscovici & Hewstone, 1983) proposes a uni-directional mode of rapport between the consensual and the reified. Postulating a transition from first to second hand knowledge as the phenomenon of our times, he appears to suggest an alteration in the flow between scientific and common sense knowledge. Thus, while in the past science was born out of common sense, the revolution of communication has neutralised this process. Now, the flow of information has been reversed with the diffusion of scientific facts into common sense and the birth of social representations. Social representations *per se* are equated to a particular type of knowledge, that of ‘science made common’, a modern version of common sense. As a corollary, social representations research comes to occupy a middle space between science and society, studying the transformations of scientific knowledge as it enters the world of the non-scientist. In his terms, “from its inception, the notion of social representations was conceived in order to study how the game of science becomes part of the game of common sense” (Moscovici & Hewstone, 1983, pg. 101). As such, the idea of a ‘true common sense psychology’ is promoted while the theory of social representations becomes anchored in the tradition of Public Understanding of Science studies as a form of interpretationist research (Michael, 2002). Such a treatment of social representations as ‘science made common’ seems to be problematic on the basis of two premises. On the one hand, it appears to favour a particular type of research, thus restricting the scope of the theory to empirically account only for the transformations scientific concepts undergo once they enter the consensual realm. As Foster (2003) also points out, such an account does not seem to reflect the reality of relevant research. Thus, a number of social representations studies have expanded Moscovici’s theory by examining representations not necessarily originating from science but from common sense understanding, like Jodelet’s (1991) scholarly work on the representations of madness in a French community or Philogene’s (1994) study on the representations of ‘Black’ and ‘African American’. On the other hand, this proposition seems to deprive public understanding of science from having any significance in the reification of scientific knowledge (Bauer & Gaskell, 1999; Bauer & Gaskell, 2002; Foster, 2003). However, as has been argued so far, this assumption falls short. Moreover, although rationality is reinstated in the world of common sense, a canonical account of science communication is sustained. As a result, a unidirectional view of the communication process prevails with science remaining the sole original point of departure, while transformation processes are located in the later stages of scientific construction (Bucchi, 1998). Such a treatment seems to be out of step with current science communication research and its subsequent identification of more complex ways in which science and non-science interact (Hargreaves & Ferguson, 2000; Lewenstein, 1995).

Another reading of Moscovici's discussion on the consensual and the reified has been proposed by Duveen & Lloyd (1990). They report that Moscovici's real intention was to draw attention to the differentiation between scientific and common-sense understanding as a phenomenon of our times, and not to propose a particular philosophy of science. Such a reading invites the idea that Moscovici was in fact trying to reflect the way contemporary Western societies, in representing different forms of knowledge, create distinctions and assign different degrees of status. Again, Foster (2003) brings to discussion a series of references in Moscovici's writings that seem to entertain this perspective, neutralising the centrality of the 'consensual' and the 'reified' in the theory of social representations. She reports how on certain occasions Moscovici talks about the two universes as 'categories' and 'contexts' (Moscovici, 1984; 1988). Moscovici (1993) himself propounds on how the separation between common sense and science as incompatible and the subsequent hierarchical treatment of knowledge, could be seen as a co-product of the dominant social psychology of his time where the distanciation of knowledge from its social and historical context of production led to the degradation of common sense as prone to errors, biases and stereotypes, and to the elevation of scientific knowledge as objective and reified. Yet, a close examination of the reification of science, like that proposed by Latour and his colleagues (Knorr-Cetina & Mulkay, 1983; Latour, 1987; Latour, 1993; Latour & Woolgar, 1986), as the product of a long contextual, historic, social, in one word, human process, brings forth a number of questions, still under-examined by social psychologists, like: 1) Under what conditions and by what processes does a certain group of experts produce a certain representation about and of the world? 2) How is this representation received and appropriated by the rest of the scientific community? 3) How is this representation received and appropriated by other groups more or less expert (like the general public, politicians, the media or interest groups)? 4) What kinds of roles (if any) do these groups play in the reification (or non-) of such a representation? 5) What are the processes of communication and persuasion connected to these conditions?

One could go on with such questions since each one of them represents but a whole tree of other interrelated questions, like for example, 'what kind (if any) of human and non-human resources are mobilised in the formulation of a scientific representation? (Latour, 1999)'; 'under what conditions do scientists share and discuss knowledge? (Moscovici, 1993)'; 'what kinds of transformations does a scientific representation undergo by non-experts? (Moscovici, 1961/1976; Gaskell & Bauer, 2001)?'; 'what kind of transformations do scientific representations undergo by scientists themselves so as to render them suitable for propagation within differentiated publics? (Bucchi, 1998, p.7)'; 'what kinds of representations of the relationship between science and non-science are enacted in this process?' The present thesis makes a more socio-psychological contribution to this last question, also investigated by other social scientists, as will be discussed more closely in the next chapter. However, before proceeding any further, the question still remains: If such complex phenomena are indeed the case then how can Social Psychology contribute to their study? It is my assertion that once again one should return to the concept of representation and its subsequent treatment.

If reification is but the mixed product of different types of representations held by different types of representations holders, then representations are what there is to begin with (Jovchelovitch, 2007). The tradition of decontextualising representations from the people who hold them, from the historical conditions in which they are created, and from the possible symbolic functions they could potentially play, has resulted in splitting the world into two: one world in which rationality reigns and another where irrationality is the norm. From its inception, Moscovici's theory of social representations has been a forceful polemic to such an idea. It is to this, now almost 50-year long tradition of social psychological research that one could turn in order to base a more symmetrical treatment of all representations, originating either from expert or less expert contexts. Moscovici's (1993) assertion that all representations, including scientific, are social, that is, they are constituted *by* and constitutive *of* the communities of people who produce and share them in a specific place and time, opens the way to such an endeavour. A number of social representations researchers over the years have come to cultivate, promote, and expand such an understanding and employment of Moscovici's original theory. It is in the context of such an understanding that Moscovici's social representations are likewise employed in the present thesis.

Recently Jovchelovitch (2007) argues for a socio-psychological approach to knowledge:

'[T]hat can retrieve its connection to the personal, interpersonal and sociocultural worlds in which it is produced. Representation is at the basis of all knowledge systems and understanding its genesis, development and realisation in social life provides the key to understanding the relationship that ties knowledge to persons, communities and life words' (*ibid,* p.2).

Thus, while representation forms the basis of all knowledge systems, every representation comes as the symbolic outcome of the interrelations between self, other, and the object world. More specifically, as Bauer and Gaskell (1999) argue, to represent, that is, to produce symbols that provide meaning, involves a minimal triadic system comprised of two people and one object. Meaning is not produced magically in the mind of the individual but always in relation to another, implied or imagined (work by scholars like Piaget (1962) and Winnicott (1967; 1985) corroborates such an understanding). To this basic triangle 'a time dimension, both past and future, is added to denote the implied or espoused project (P) linking the two subjects and the object' (Bauer & Gaskell, 1999, p.170). Thus, knowledge *of* something is always knowledge *by* someone in relation to other subjects, their interrelations and communication as taking place in a specific context and within a time horizon. It is these intersubjective and interobjective relations that define the symbolic shape of objects in the social world and ultimately, the set of a shared system of symbolic codes that determine what is to be accounted for as real or not in a given context and time (Jovchelovitch, 2007).

In this light, Moscovici's social representations come both as: (1) a theory of knowledge, seen as constituted *by* and constitutive *of* its contexts of production; and (2) a phenomenon, a set of empirical regularities comprising the ideas and practices of a specific group of people towards a specific object to be studied in close connection to the social and communicative processes that produce and reproduce them. Moscovici's (1961/1977) initial attempt to study the way psychoanalysis was received and perceived in different French milieus of the 20th century, pointed to a possible way in which to study relevant socio-representational phenomena. Work in this tradition has both expanded and crystallised Moscovici's intentions, by offering a paradigm of how to approach social representations as phenomena of research (Bauer & Gaskell, 1999; Duveen & Lloyd, 1990; Flick, 1992a; 1992b; Farr, 1993; Gervais et al., 1999; Jovchelovitch, 2007 and Sotirakopoulou & Breakwell, 1992). Although a fuller account of the way this work has informed the empirical elaboration of the present study is given in subsequent chapters (see Chapters 2 & 4), one needs to return to the wider ramifications that the theory of social representations holds for the socio-psychological study of knowledge.

1.3 Researching social representations

If representation, seen as the symbolic outcome of subjective, intersubjective, and objective processes, is the basis of all types of knowledge, then, the illumination of these processes forms an essential part of the work of social psychologists. Jovchelovitch's (2007) discussion of these processes as the 'who', 'what', 'how', 'why' and 'what for' of representation offers a clear and comprehensive framework for relevant studies. Thus, if one is to account for social representations as a theory of knowledge, then the purpose of relevant research should be to proceed by taking into account whose knowledge it is set to investigate, the content of this knowledge, and its links to the conditions of its genesis and multiple functions.

The 'Who' of representation. It is in social milieus, that is, groups of people bound together by a common project that social representations are born and circulate, embodied in behaviours, individual cognitions, informal and formal settings of communication (Bauer & Gaskell, 1999). Hence, representations are always constructed by someone in relation to someone else (Jodelet, 1991; Moscovici, 1984). The illumination of who is representing, that is, the specification of appropriate social segments for the study of social representations can constitute an *a priori* condition for the elaboration of one's study or its *ex-post facto* outcome. In some cases, it is the object of representation that becomes a self-referential point for the formation and organisation of more or less clearly defined and identified social milieus to be investigated (for example, self-referential groups, like environmental or religious ones). In other cases, however, it is the outcome of a study that makes this segmentation possible, as was the case in Moscovici's original work on the introduction of psychoanalysis in the French public sphere of the 20th century that resulted in the differentiation among three distinct social milieus toward psychoanalysis, the urban-liberal, the Catholic and the communist milieus (Bauer & Gaskell, 1999). Whatever the case may be, the illumination of who is representing calls for a consideration of the identity (individual or social) and the history linking this group of people together. And while for some groups knowledge of something also seeks to represent the people who carry it, for others it is the bracketing out of the identity of the knower that may well be at the forefront of representational processes, the clearest example being science (Jovchelovitch, 2007). Therefore, the position of a group *vis-à-vis* an object and the mode of engaging in representational processes offer the possibility for comparisons among different social milieus, holding different types of representations (Bangerter, 1995; Gaskell & Bauer, 2001; Gervais, 1997; Moscovici, 1961/1976).

The 'What' of representation. The 'what' of the representation relates to the construction of the object, that is, the ideas, themes and significations that are ascribed to it; in one word the content of the representation (Jovchelovitch, 2007). According to Moscovici (1981; 1984; Moscovici & Hewstone, 1983) it is through transformative processes, namely by anchoring and objectifying, that the symbolic construction of an object is performed. As such, the illumination of the content calls for the mapping out of all possible anchors and objectifications of a given object in a given group of people at a given time. This is what Bauer & Aarts (2000) call a process of typification. Therefore, either through the study of words and/or visual images, and/or bodily movement, and/or non-linguistic sounds, the purpose of the individual social representations researcher is to map out the content of representation; the making known of previously unknown attributes (Bauer & Gaskell, 1999). Such an illumination of the content of the representation could then open the way to further conceptual developments, like for example: a) the identification of core and peripheral elements, that is, of the structure of the representation in a given group at a given time (Abric, 1993); or b) the comparative analysis of contents of representations among different groups of people in a specific time-frame; or c) the investigation of the transformations the representations of a given object undergo in the history of a group of people. At the same time, it is through the study of the content of the representation that the analysis of its 'how', 'why' and 'what for' is further substantiated.

The 'How' of representation. It is through social interaction and communication that representations are formed and transformed. It is the consideration of such processes that involve the study of the 'how' of representation in close affinity with its content. More specifically, the content of a representation may reveal the possible communicative style adopted by a social milieu in relation to others. Does the content of a representation entail the recognition of other perspectives or is it indicative of how one voice is imposed over another? (Jovchelovitch, 2007).

The 'why' and the 'what for' of representation. The 'why' of the representation denotes not only its cognitive function to create knowledge about the world but also its symbolic function to express motives, intentions, and emotions. As such, the investigation of the content of the representation sheds light not only on a group's worldview but also on personal and emotional logic. Added to that, one finds the functions of the representation, that is, its 'what for' elements, closely connected. And while a lively discussion on the demarcation of social representations from other types of knowledge, such as myths, ideology or attitudes, to name but a few, has flourished over the years (Flick, 1998; Gaskell & Fraser, 1990; Jahoda, 1988), social representations research has re-directed relevant questions by showing them to be part of the numerous functions of representing. Thus, social representations may serve, at one and the same time, different functions for a social group be they ideological, mythical, familiarising, providing identities, sustaining conformity, enabling resistance, assigning attitudes, or planning and scripting intentional activities (Bauer & Gaskell, 1999; Gervais & Jovchelovitch, 1998; Herzlich, 1973; Jodelet, 1991; Jovchelovitch, 1995; Liakopoulos, 2000; Moscovici, 1961/1977, Philogene, 1994). Future research may enrich and further substantiate such a long list.

Thus far, an overview of the various readings of Moscovici's discussion regarding the 'reified' and the 'consensual' has been offered. It has been argued that a rather literal understanding of the 'reified', as the world of science, and the 'consensual', as the world of common sense, hence, social representations, runs the risk of treating old hierarchies between different types of knowledge as an *a priori* to their study. Such an understanding not only threatens the rationality of non-expert knowledge, but also has the potential to reduce the scope of Social Psychology to a positivist approach of knowledge. A second reading of the 'reified' and the 'consensual' resulted in restricting social representations to a specific type of knowledge, that of science made common, while promoting a, so far ungrounded, uni-directional understanding of the relationship between science and common sense. In light of recent developments in the social representations tradition of research and the social study of science, an alternative understanding of the 'reified' and the 'consensual' has been offered; one that suggests Moscovici's intention was to highlight such a dichotomy more as a phenomenon of our times. This alternative reading offers the opportunity for the re-direction of relevant research questions of the relationship between science and common sense, as well as a different conceptualisation of Moscovici's social representations *per se*, both as a theory of knowledge and an empirical phenomenon to be studied. At the core of such an interpretation, lies the assumption that representation is at the heart of every type of knowledge, be it more or less expert. Representation, however, is not treated as the amnesic, asocial creature of an individual mind but as the symbolic outcome of communicative interrelations among subjects over an object at a specific place and time with the potential for the individual to produce knowledge about the world while situating itself in it. Nevertheless, reconnecting knowledge with the people who hold it and their conditions of living and interacting at a specific time should not be treated as a way to trivialize it as subjective or biased. Indeed, to argue for the objectivity of the world as socially constructed does not make it less objective (Jovchelovitch, 2007). As it has been argued, objectivity is but the product of contextual, historic, individual and social processes. It is its pre-existence as a *fait-accompli* that such a treatment of representation, and consequently, knowledge seeks to renounce. Indeed, if there are consensual and reified categories of knowledge they should be the subject of empirical verification of relevant social psychological research, not a blindly accepted presupposition. Moscovici's social representations as a theory of knowledge have the ability to fill such a lacuna.

At the same time, the above discussion offers a clear understanding of the way social representations are conceptualised and employed in the present thesis, both as a theory of knowledge and as a phenomenon under investigation. As a theory of knowledge, social representations highlight the constituted and constitutive nature of knowledge inviting the researcher to approach her phenomenon of study in close connection to the conditions of its genesis in a disinterested attitude (Bauer & Gaskell, 1999). Indeed, to an observer certain representations may seem irrational or biased, however, one may well account for their functionality when taking into account their social and historical dimensions. As a phenomenon, social representations invites the researcher to consider and further highlight the subjective, intersubjective, and objective elements of representation, that is, the 'who', 'what', 'how', 'why' and 'what for' of the representation (Jovchelovitch, 2007). A complete overview of the design of research and relevant questions will be further clarified in subsequent chapters (Chapter 2 & 4). Following, another highly debated topic of Moscovici's theory will be explored, which relates to the operationalisation of the transformative processes that generate social representations, in other words, anchoring and objectifying. Since the typification of anchors and objectifications, hence, the content of representation, forms an important pre-requisite in the investigation of its communicative and functional features, one should strive to further establish such an attempt. It is in this view that the discussion turns to some earlier efforts by Liakopoulos (2000) to relate the study of rhetoric with that of anchoring and objectifying.

1.4 More on transformative processes: anchoring and objectification

Moscovici (Moscovici & Hewstone, 1983) argues for representation as a prerequisite to learning. One cannot know without having engaged in the act of representation. Representation, however, is not to be treated as the product of a mechanistic mind operating in solitude as some sort of information processor, but rather as a transformative and highly creative process of a plastic, historic, in one word, interactive mind. Thus, the representation of an object is but an amalgam of ideas, themes, and significations that are at one and the same time constituted *by* and constitutive *of* their conditions of genesis. To further clarify such a point Moscovici discusses representations as anchors and objectifications, consequently establishing the historical and ontological correlates of knowledge (Gervais, 2002).

There is no spontaneous parthenogenesis of knowledge. That is, there is no knowledge of something without consideration of the past. Rather, every representation is to be seen in continuation of a previously established set of contents to which it is connected through processes of anchoring. Moscovici (1981; 1984; Moscovici & Hewstone, 1983) argues for anchoring as an inner-directed process, which through naming and classifying, attaches the object of representation to a recognizable reference point. Rosch's ideas on prototypes and basic level categories, as discussed by Moscovici (1981), are evidence of her influence as a source of inspiration for his conceptualisation of anchoring. More specifically, and in a first step, anchoring, per Moscovici, involves the assignment of a name to the object represented. Such a naming permits the incorporation of the object of the representation into a group of people's pre-established network of categories, that is a set of ideas, words, mental images; in one, word, already existing meanings. At a later stage, this process of classification involves a comparison of the object of the representation with what is considered the typical member of the category in which it has been classified. Anchoring, hence, is a process of categorisation. In Moscovici's (1981) terms:

'categorising someone or something is tantamount to choosing a prototype among all those embedded in our memory and establishing a positive or negative relationship with it' (p. 195).

As soon as something is anchored, it can then be described, with certain qualities or intentions imputed to it; it can be distinguished from other objects, while becoming subject to a convention between those who use it and share the same convention (Moscovici, 1981; 1984).

However, Moscovici (1961/ 1977; 1981; 1984) observes how some of those ideas, words, mental images, that is, meanings assigned to an object, do not merely serve as a way of classifying it into a pre-established stock of knowledge but progressively become the object *per se*. This process has been identified by Moscovici as a procedure of objectifying, in other words, assigning ontological features to a previously mental construction. More specifically, Moscovici discusses objectifications as 'figurative nuclei' that is, as a set of words and images that do not merely symbolize the world but are the world in itself. In his study of psychoanalysis (1961/1977), he monitors the elaboration of such a metamorphosis of mental images and words into physical objects by the different milieus of the French 20th century public sphere. He observes how in some cases the psychoanalytic term 'complex' loses its previously mental and highly abstract matter to become a real, living and concrete object that manifests its existence through actual behaviours. Thus, objectifying is an other-directed process aiming at defining the world as it is. Objectifications are but a set of concrete ideas and images of the world, as perceived in its actuality, by a group of people at a specific time and place. At the same time however, the objectification of something or someone is also evident and expressive of this same group; in Moscovici's (1984) own words, 'don't we objectify precisely so as to forget that a creation, a material construct is the product of our own activity, that something is someone?'(p.41).

For Moscovici (1981; 1984) both anchoring and objectifying serve to familiarize us with the unfamiliar: anchors are instances of transferring something or someone into our own frame of reference, whereas objectifications are instances of reproducing this same something or someone in the manner we perceive it to be in our thoughts, words and actions. Consequently, Moscovici invites us to treat the content of each representation as expressive of the memory and the reality of the people who hold it. Hence, the individual researcher is to approach knowledge in connection to the history of the people who share it and by implication, to not to regard it as a mere epiphenomenon, but rather as a constitutive of those same people and their world.

Moscovici's discussion of anchoring and objectification invited criticism mainly by discourse analysts along two relevant lines. The first line of criticism is related to a wider debate regarding the 'paradox' of the universal and particular aspects of social representations as a theory of knowledge (Gervais, 1997). Can the theory be employed to account for knowledge production in the particular conditions of modernity or can it be used to account universally for phenomena across time and cultures? Billig's (1988) proposed solution to the debate was to discuss anchoring as a universal feature of all knowledge systems, and objectification as particular to modern society. He propounds for theological theorising as a set of beliefs functioning contrary to objectification, and as a consequence, rendering something material abstract. In this way, he suggests a division between a society with objectified social representations and a religious society, thus limiting objectification to the conditions of less traditional settings. I would argue that what Moscovici set out to emphasise when talking about objectification is the capacity of the thinker not merely to produce ideas and explanations about the world but to actively participate in the construction of reality. People do not just theorise, they also create. Even abstract notions like 'God, or 'spirit' not only represent a certain, mental manner of pondering on the world, but also define it, and as such, human thought and action. Gervais (1997) has also argued extensively on the matter by bringing forth a quantity of empirical evidence confirming examples of objectification in traditional as well as modern societies. More recently, Jovchelovitch (2007) hypothesizes over reflexivity as a possible way of differentiating between more and less traditional settings of knowledge formation. Overall, I would agree with Duveen and Lloyd (1990) that although at an analytical level and for the purposes of research anchoring and objectification can be distinguished; they are, nevertheless, interrelated. In their own words "[Objectification and anchoring] are interdependent, in the sense that a representation can become securely anchored to the extent that it is also objectified, and *vice versa*, that objectification would be impossible unless a representation were anchored" (*ibid*, p. 2).

The second line of criticism leveled at anchoring and objectifying relates to social representations as a phenomenon, that is, as a set of empirical regularities comprising the ideas of a group of people vis-à-vis an object to be investigated, and their mode of study. More specifically, certain discourse analysts have pointed to the possibility of reducing the investigation of social representations to the cognitive level (Jahoda, 1988; Parker, 1987; Potter & Litton, 1985; Potter & Wetherell, 1987; Potter & Edwards, 1999; Semin, 1985). Since related criticism has been extensively discussed elsewhere (Voelklein & Howarth, 2005), the present account is of a more epigrammatic nature. Overall, critics have drawn the attention of social representations scholars to the dangers of limiting their focus to what happens in a person's head and thus excluding any consideration of wider social, ideological and cultural conditions. In this context, and in contrast to Moscovici's intention for a more anthropological approach, social psychologists run the risk of confining the study of social representations, as a phenomenon of research, in laboratory-experimentation settings. To remedy such an approach, Potter and Litton (1985) suggest an understanding of social representations as linguistic phenomena. They assert that such an attempt will rectify certain theoretical ambiguities, with regard to the nature of social representations and their formation, and will contribute to empirical expediency. By studying social representations as linguistic repertoires, attention is redirected to language and its use in relation to its context of production. Billig (1988, 1993; Potter & Billig, 1992) makes a similar point, warning social representations theorists not only against treating anchoring and objectifying as purely cognitive processes but also undermining the human capacity to think, argue and negate by overemphasising consensual agreement. As a corollary, he invites social representations scholars to a more dialogical consideration of the human mind and calls for an empirical examination of argument and conflict as they take place among social actors.

Accounting for the above, Voelklein and Howarth (2005) discuss a number of social representations studies emphasising the cognitive as well as the social, cultural and ideological nature of anchoring and objectifying. In relation to Potter & Litton's proposition, they identify the danger of reducing social representations to the study of language as a methodological absence in the study of knowledge. In this vein, they point to a series of empirical findings suggesting that social representations are not only evident in linguistics but also apparent in artifacts, like drawings and pictures, and in actions. Indeed, both Jodelet's (1991) study of the representations of madness and Howarth's (2006) research on racism indicated how at times social representations are only visible through action. This is in line with Moscovici's (1985) thesis that although any representation may pass into discourse, the study of discourse can never reflect all possible representations. Complementing Billig's view over the static and consensual nature of social representations, Markovà (2000; 2003) discusses the dialectical nature of social representations as reflected by Moscovici's triangular semiotic triangle Ego-Alter-Object. She astutely demonstrates how Moscovici's conception of knowledge-making, taking place in triads, corroborates the idea that knowledge of something by someone is always developed within the context of communication processes, where people seek to negate, change, transform, and argue about the world while being in it. More to the point Rose et al. (1995), provide evidence of the dynamic character of representing as demonstrated by relevant research. Yet, time and time again social representations scholars have welcomed Billig's argumentative account of social thinking as a source for potential contribution in the study of representations (Duveen, 2000; Moscovici, 2000; Augoustinos, 2001). Voelklein and Howarth (2005) invite social representations researchers to methodologically account for the dynamic and dialectical aspects of knowledge. Recently, Moscovici (1998) himself restated the importance of language in the representational process calling for a further exploration of the discursive aspects of representing.

It is to the above discussions that the present thesis seeks to contribute by studying anchoring and objectifying in the context of discursive interaction and communication. In light of recent criticisms over the lack of operationalisation in the study of the contents of representations, the current account seems topical (McKinley & Potter, 1987). As such, an effort will be made to further pursue an earlier attempt by Liakopoulos (2000). In his study of the social representations of biotechnology in Britain, he set to establish a conceptual and methodological bridge between anchors and metaphors, and objectifications and arguments. While following in his steps, the present thesis strives to further expand his account by bringing Billig's discussion of arguments to the foreground. Such a choice has also been dictated by the phenomenon of research, a point fully developed towards the end of the present chapter. As a corollary, when studying the way experts discuss about the public sphere in formal and informal settings of communication, one is obliged to account for the rhetorical and argumentative aspects of their discourse. For, the human cloning debate is not only a debate about the natural and the unnatural, the ethical and the immoral, but it also entails a wider discussion on the relationship between scientific and common sense knowledge, science and society, what is and is not true and false.

That stated, I do not mean to suggest that what is being proposed here is an exemplary model for the operationalisation of anchors and objectifications but rather a form of casting light on the possible contents of the representation of the public sphere by a group of experts within a discursive context. Anchors and objectifications can also be found in actions, images and drawings, among others. Nor do I seek to further establish social representations as linguistic repertoires, as per Potter and Litton (1985), for I agree with Moscovici that discourse is just one place where knowledge is created and manifested. Rather, I wish to underline the importance of rhetoric when studying social representations as a phenomenon and put forward a possible way for its integration in relevant research.

1.5 On metaphors and anchoring

Aristotle was among the first to provide a definition of metaphor. In his *Poetics* he defines metaphor as consisting of giving something a name that belongs to something else (Ortony, 1993). His definition inaugurated a fruitful discussion over what is to be counted as metaphorical, and although is still topical, it is not universally accepted (Cohen, 1979). Metaphor is a linguistic trope used to mean something other than what is literally said. For example, to call somebody 'a pig when he eats' is an instance of a common metaphor used to define something in a non-literal manner, since humans are not pigs. Although the distinction between literal and non-literal types of speech is not straightforward, as it is dictated by individual characteristics and social norms, the identification of metaphor follows the simple procedure of focusing on the figurative properties of speech (Liakopoulos, 2000).

Over the centuries, metaphor has been the focus of study in rhetoric, linguistics, philosophy, and the social sciences. Liakopoulos' (2000) authoritative review of the relevant literature exempts me from providing an exhaustive account. That stated one could argue, however, that the different conceptualisations and proposed treatments of metaphors relate back to Descartes' *cogito ergo sum*, and to the fundamental question of the relationship between the mind and the world. For some, the answer is to be found in the idea of an 'outside world' existing independently of human interaction. The idea that objects have the perceived properties they have based on their inherent characteristics and independently of anyone who experiences them, calls for the demarcation of well-articulated and appropriate tools for their study. Literal language, for its precise, unambiguous and testable nature, has often been thought of as the most paradigmatic tool with which to provide objective representations of the world (Ortony, 1993). In this vein, any other use of language is to be treated as meaningless. Metaphors, thus, are but an example of violations of linguistics rules, a series of parasitic devices left in the hands of politicians and poets. Though, for others there is no objective representation of the world without a simultaneous consideration of the holder of the representation. That is, knowledge of an object, namely the perception of its inherent characteristics, does not arrive spontaneously but through a highly interactive process between the object and the person who is representing, his previous knowledge and the context in which this has been acquired. Such a conceptualisation of the relationship between the mind and the world proposes a more holistic understanding of language, debunking its lively and creative nature. In this light, any demarcation between literal and non-literal figures of speech is to serve more quantitative rather than qualitative purposes (*Ibid*, 1993). Based on this view, metaphor is not just a rhetorical, meaningless device used by poets and politicians but it is pervasive in language as well as ordinary thought. Lakoff and Johnson's (1980) theory of metaphor is the most paradigmatic of such treatment. Though not as novel as they initially proclaimed, for their theory seems to echo the ideas of a number of influential and pioneering 19th century philosophers (Nerlich & Clarke, 2001), their work provides a clear and well-elaborated understanding of the manner in which metaphor forms part of representing, that is, of making sense of the world.

For Lakoff and Johnson (1980), there is no such thing as an external and objective reality, independent of how human beings conceptualise the world. On the contrary, people actively construct the world they live in and categorisation plays a crucial role in this process. Rosch's ideas on the centrality of categorisation in representing have once again, as per Moscovici, proved a solid basis for the elaboration of their theory of metaphor (Lakoff & Johnson, 1980; Lakoff, 1987). More specifically, and drawing from Rosch's conceptualisation of prototypes and basic-level categories, they proclaim that:

‘Because so many of the concepts that are important to us are either abstract or not clearly delineated in our experience (the emotions, ideas, time etc.), we need to get a grasp on them by means of other concepts that we understand in clearer terms (spatial orientation, objects etc.)’, (Lakoff & Johnson, p.115).

Categorisation is a way of identifying one thing or experience in terms of another. Categories are defined by prototypes as well as family resemblances to prototypes and are adjustable in context, given various purposes. A choice of a certain category highlights particular properties of the categorized object, while downplaying others. Since most human understanding involves conceptualising one kind of entity in terms of another, then most of our thinking is metaphorically based, for the essence of metaphor is to make sense and experience one thing in terms of another[2]. As such, and in contrast to classical theories, Lakoff (1993) situates metaphor not in the context of language but in that of thought. Metaphors function as mappings across conceptual domains. Thus, metaphor is conceived as a mapping from a source domain to a target domain. Entities in the source domain correspond to entities in the target domain. More on this point, Lakoff and Johnson (1980) suggest a strategy called ‘mnemonics’ to further illustrate the correspondences involved in a conceptual mapping. Thus, to say that a relationship has hit a *dead-end street*, is to conceptualise one domain (‘love’) in terms of another (‘journey’). This entails a number of correspondences like (Lakoff, 1993, p. 207):

LOVE IS A JOURNEY

The lovers correspond to travelers.
The love relationship corresponds to the vehicle.
The lovers’ common goals correspond to their common destinations on the journey.
Difficulties in the relationship correspond to impediments in travel.

A common feature of mappings is that they refer to superordinate categories. For example, in the LOVE IS A JOURNEY mapping, a love relationship corresponds

[2] Again this idea of metaphors creating similarities rather than pointing out pre-existing, objective similarities is not as novel as Lakoff & Johnson proclaimed but has also been elaborated by scholars like Richards and Black (Nerlich & Clarke, 2001)

to a vehicle, that is, the vehicle is the superordinate category that includes other basic level categories, like car, train, boat and plane. Moreover, metaphorical mappings can be seen as being in close connection to each other, revealing lower-order and higher-order mappings. Thus, the conception of love as a journey entails a higher-order mapping, that of ‘life is a journey’. The conceptualisation of life as a journey relates to a purposeful and goal-oriented conception of life. Purposes are destinations and the means one chooses to undertake them are paths. As a corollary, the LOVE IS A JOURNEY metaphor inherits the structure of the LIFE IS A JOURNEY metaphor. Lovers are travellers and their love relationship is a journey. The rest of the mapping is a consequence of THE LIFE IS A JOURNEY metaphor.

According to Lakoff and Johnson (1980), the choice of a certain metaphor is not idiosyncratic. Rather, each metaphor has an experiential basis. That stated, however, they claim that ‘it is hard to distinguish the physical from the cultural basis of a metaphor, since the choice of one physical basis from among many possible ones has to do with cultural coherence’ (1980, p.19). For example, to talk about value as ‘more is better’ is an exemplar of much of the Western way of thinking and living. However, since each culture is comprised of different subcultures and individuals, this does not necessarily entail that such a metaphor would be universally shared. As such, the choice of a particular metaphor not only points to the experiential basis of knowledge but also to its context of production.

Following from the above, it is evident that metaphor cannot simply be reduced to a meaningless linguistic trope but rather it can provide data as to the wider categorisation processes that take place during the understanding of an object, namely during its representation. In the tradition of social representations, metaphors have, in one way or another, always been part of research (Gervais, 1997; Jodelet; 1991, Jovchelovitch; 1995). Moscovici himself has commented on their potential role in the creation of knowledge, stating that “it appears that metaphors play an important role in the creation of social representations, precisely because they slot ideas and images which are little familiar into others which are already familiar” (2001, p.20). In studying the representation of sperm and ovum in conception, Wagner and his colleagues (Wagner et al., 1995), discuss Lakoff and Johnson’s account of metaphors in relation to objectification. More specifically, they argue for the ability of metaphors to provide a mental image to a previously abstract concept, theory, or phenomenon as indicative of objectification processes while, based on their findings, they conclude on the way 'the social is often the point of reference for a group's system of knowledge, be it about 'natural' or other phenomena' (*ibid*, p.285). However, Moscovici's discussion of objectification relates not to the assignment of a mental image to a previously unfamiliar object as a reference point - this is more indicative of the work of anchoring - but to the way specific mental images and ideas progressively lose their symbolic properties to become the object in themselves. In his terms, objectification takes place 'when the words we use to give an abstract form to complex substances or phenomena become the substance or the phenomenon' (Moscovici, 1984, p.43). Indeed, there is no evidence in Wagner's et al. (1995) investigation of such a use by their 'subjects' of the images created by the metaphors employed in their study. In contrast, the use of the metaphors by the researchers *per se*, as a list of pre-determined 'variables' (*ibid*, 679), 'comparisons' (*ibid*, 684) or 'points of reference' (*ibid*, 685), from which their subjects could draw and potentially discuss about conception is more akin to the mechanism of anchoring than that of objectification. I would, therefore, argue that metaphors and their analysis are more a way of identifying and typifying the kinds of pre-existing symbolic resources (mental ideas and images as source domains) employed by an individual or a group of people to name and to categorise a given thing, person or object (possible target domains). This is in order to describe it, distinguish it from other things, persons or objects and provide a common point of reference, thus, sustaining inter-subjective communication. One cannot dismiss the similarity with which Lakoff and Johnson talk about metaphor as a way of experiencing one thing in terms of another through categorisation in order to make sense of it, and Moscovici's discussion of anchoring as the employment of pre-existing stock of meanings, ideas, and mental images as reference points from which to draw in the process of naming and categorising and, and in so doing make sense of another thing. I, hence, concur with Liakopoulos on the study of metaphors as a way of illuminating the process of anchoring. Moreover, the treatment of the human mind and knowledge as at one and the same time historic, social, subjective, objective and inter-subjective designates another point of convergence between the two theories.

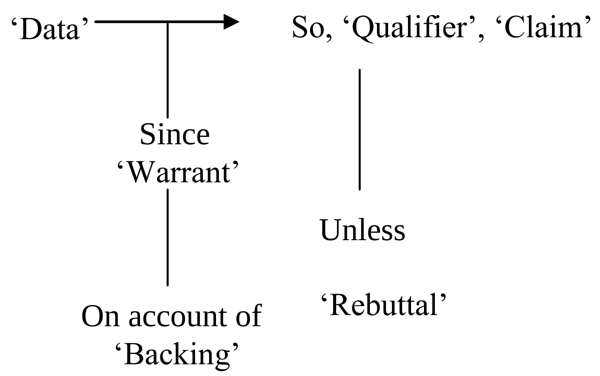
That stated, two points call for further clarification. Firstly, metaphor is not the only linguistic trope of categorising function. Glucksberg and Keysar (1990) discuss simile as serving related purposes. That is, to say that someone is 'like a lion in conversations' also categorises an object in terms of something else implying metaphoricity. As such, it could be stated that, although anchoring does not always include metaphor, metaphoricity seems to play an integral part when anchoring. Secondly, the above discussion should not be perceived as an attempt to treat metaphors exclusively as part of anchoring processes. The study of metaphors may offer a way of researching anchoring as it takes place in discursive interaction, illuminating cultural and contextual resources employed in conversational settings to classify the object of representation. However, one cannot dismiss the possibility of certain metaphors being objectified. In a recent study of the employment of the biological metaphor of 'neocortical warfare' in Serbian conspiracy literature, Byford (2002) demonstrates a rather interesting phenomenon. He describes an initial phase in which the 'neocortical war' metaphor by Serbian conspiracy theorists was used preserving its non-literal meaning to anchor practices of information warfare in biological terms. Progressively though, the metaphor was dissociated from its non-literal features and was transformed to refer to actual brain manipulation. Byford (2002) discusses such a literalisation as an instance of objectification. Thus, it is suggested that although certain metaphors may play a significant role in the familiarisation of a given object of representation by classifying it into already existing categories, some metaphors may progressively assume a more ontological status, becoming the thing itself. In this vein, one could argue that although the study of metaphors may illuminate wider categorisation processes, some metaphors may well present instances of objectification processes. Indeed, if this is the case, then it is more a point of empirical verification than of conceptual certainty. Therefore, I would argue that it is the phenomenon of study that explains itself and calls for the attention of the researcher to fully account for its complexity. It is with such an approach that I set to investigate the use of metaphors in the human somatic cell nuclear transfer debate by experts when discussing its public dimensions.

1.6 Argumentation and objectification

The first theory of argumentation was formulated in the fifth century B.C. by Corax and Tisias as a tool for assisting in the elaboration of the debates emerging in the context of the Greek *polis* (Liakopoulos, 2000). Progressively, the art of rhetoric developed as a philosophical branch of its own, with Sophists representing its specialists. Since argumentation for the Sophists served the purpose of persuasion, they set about establishing a number of strategies, teaching prominent Athenians the way to successful rhetoric. Their equation of argumentation to success in persuasion induced an intense debate whose repercussions are still traceable in contemporary treatments of arguments. Thus, Aristotle was among the first to raise the importance of logic and validity in the study of arguments. He distinguished between inductive reasoning, where the premises support a general conclusion by naming specific cases, and deductive reasoning, where the conclusion necessarily follows from the preceding propositions. It was in the context of deductive reasoning that he situated the study of argumentation and devised a set of rules to measure its validity. Emphasis was given to the microstructure of arguments, that is, in the examination of the logical form of the argument and its internal structure, and in the identification of common fallacies (Freeman, 1991). A successful, and thus, valid argument is one in which the conclusion follows logically from its premises. Aristotle's deductive logic dominated the study of arguments until the nineteenth century, when studies of argumentation asserted the inability of formal logic to account for the analysis of arguments in ordinary life (Antaki, 1994). A new approach developed termed 'informal logic'. Although general parity exists amongst scholars regarding the definition of argument as a more or less complicated set of premises supporting a conclusion, they part company on their respective approaches. Thus, in the North American tradition of argumentation study focus was given to the argument as a set of premises of a single coherent piece of reasoning, as exemplified in the works of Thomas and the like (Antaki, 1994). On the other side of the Atlantic, the European tradition has tended to emphasise arguments more as a dialectical process, pointing to the context of argumentation, its audience, and language. Two are the most influential works in this approach, those of Perelman and Olbrechts - Tyteca (1969) and that of Toulmin (1958; Toulmin et al., 1979). They both approach argumentation within the context of a debate in which two or more interlocutors try to persuade each other and their audiences over the validity of their respective claims. Toulmin's account, however, goes a step further by identifying the constitutive parts and in so doing leading to a more functional approach in the study of arguments. It was on the basis of Toulmin's approach that Liakopoulos (2000) aimed to establish a link between argumentation and objectification. While presenting his account, an attempt will be made to further elaborate on his original ideas by bringing into the discussion Billig's ideas on argumentation on the study of social phenomena.

For Toulmin (Toulmin et al., 1979), argumentation is "the whole activity of making claims, challenging them, backing them up by producing reasons, criticising those reasons, rebutting those criticisms and so on" (p.13). Every argument can be conceived as both a process and a product. The idea of the argument as a process reflects the internal structure of each argument and its constitutive parts, whereas the argument as a product refers to the wider activity of discourse and debate of which the argument forms a part. According to Toulmin, in order to understand the structure of arguments as products, one first needs to account for the functional roles statements may play in argument as process. In this vein, he offers a diagrammatic presentation of the argument as constituting certain premises and conclusions. Thus, the basic structure of any given argument can be conceived as including a *claim*, the conclusion of the argument; of *data*, a set of preceded facts establishing the conclusion; a *warrant*, that is, premises asserting the legitimacy of the data to support the claim; and *backing*, a set of universal statements or facts that support the authoritative status of the warrant. In some cases, the force of the process from data to claim in virtue of a warrant is expressed by using *qualifiers*, such as, 'necessarily', 'probably' and so on. Close to qualifiers are *rebuttals*, statements that express the conditions under which the warrant does not have an authority. Figure 1.1 presents Toulmin's schematic representation of the argument structure as a process.

Figure 1.1 The structure of the argument as a process



Toulmin distinguishes between analytical and substantial arguments. While in analytical arguments the claim necessarily follows from its premises, like in arguments found in logic or mathematics, in substantial arguments this is not the case, for they are produced in the more fluid and abstract context of ordinary life. Though deductive logic can account for analytical types of arguments by applying the rules of formal validity, it cannot assess substantial argumentation. To account for such arguments one needs to specifically address the context of their production. That is, the content and the form of the argument are depended on its conditions of production. Elaborating further on this idea, he introduces the notion of 'argument fields', propounding that some aspects of the argument are basically the same regardless of the context, while others are context specific. Examples of fields include politics, law, art and others. Each field has its own standards for developing and understanding arguments, thus, universal criteria over the validity of all possible arguments are simply irrelevant. Up until now, no consensus has been reached over the field-invariant and field-dependent elements of arguments, nor the number of possible fields (Liakopoulos, 2000). However, Toulmin's theory has been used in the study of argumentation emerging in different contexts, like in politics (Ball, 1994), in the media (Chambliss and Garner, 1996), and in local settings (Putnam and Geist, 1985), to name but a few.

According to Liakopoulos (*ibid*), argumentation constitutes an integral part of public debate over a given object. Since, argumentation, per Toulmin, involves a series of statements structured around certain manifest and concrete contents with the aim of persuading a particular audience in the context of a larger debate, then the individual researcher's purpose, when studying relevant phenomena, is to further illuminate those contents. In Liakopoulos's terms, since language is one way in which social representations are created and communicated in the context of a public debate, then the study of argumentation is pivotal, for it enables the elaboration of thought in a way that is easily understood by everyone. If argumentation is the elaboration of thought, and thought consists of dominant representations, then the argument is treated as a highly visible vehicle for the process of objectification. Thus, in the study of a public debate, arguments become the locus in which the objectified meanings assigned to an object are clearly reproduced for the various purposes of communication.

I concur with Liakopoulos that when people argue over some idea, project or action, for instance, argument becomes the place where ideas and meanings are reproduced in a highly structured and elaborate manner, in the way Moscovici discusses objectification. However, as Billig astutely points out, there is more to an argument than just that.

Drawing from the Sophists' philosophy on rhetoric, Billig has written extensively on the rhetorical and psychological implications of their maxims for social psychology's conceptual and methodological treatment of various social phenomena (Billig, 1985; 1988; 1989; 1993; 1994a; 1994b; 1996; 1997; Billig & Cochrane, 1979; Potter & Billig, 1992). At the same time, he also demonstrates the implications of the rhetorical account of argumentation for cognitive psychology. Based on Isocrates' claim that the same arguments people use when speaking to an interlocutor, also inhabit their internal thinking, he postulates that argumentation is not only confined to language but also to thought. More specifically, Billig argues that thought is not static and monologic but rather that it is a natural dialectical process, since private thinking is modelled on public argument. As a corollary, he invites social psychologists, and especially social representations researchers, to study the thinking society by focusing on the argumentative aspects of communication. Such an invitation seems to be in line with Moscovici's assertion of the dialogical nature of the human mind, a point also discussed earlier. In Moscovici's own words (Moscovici & Hewstone, 1983):

> 'When people uphold some view about a person or group, and explain their view, we can be sure that they are not simply giving an interpretation of the observed facts. They are at the same time comparing this interpretation with some others made by a real or imaginative partner…All representations are then triangular - subject, object and third person. But the third person may vary and the 'audience' for a representation may change, in which case different forms of language will be used to verbalize the ideas (p. 117).

In line with Moscovici's assertion, Billig states that to hold a point of view is to take a stance in a matter of controversy, that is, to argue, to give a response to a continuing dialogue. In contrast to the tradition of deductive logic where primacy was given to the form of the argument, Billig insists on its content. Following Protagoras' maxim that there are two sides to every issue, he propounds that each argument is not only reflective of ideas or attitudes towards the object of a debate but also of the people who hold it and their interlocutors at a specific place and time. More specifically, to understand an argument and its content one should ask the question ‘what is this attacking, what is the counter argument?’ In this vein, the choice of a certain argument is not merely expressive of the arguer’s positioning towards an object of the debate but also reflective of what the arguer believes her/his counter-position to be. That is, when people argue about something as a way of criticising the counter-position, they also reproduce the way they actually understand and believe this counter-position to be, that is, their objectifications of their interlocutors.

The above discussion has certain important ramifications for the present research phenomenon and its study. As it has been aforementioned, the reification of a scientific representation is but the product of a long process of negotiation and argumentation between different types of knowledge and their holders (interlocutors). Somatic cell nuclear transfer research has been at the focus of an intense debate not only regarding its technicalities but also its wider social, ethical, economic and political aspects (see chapter 3). As different actors elaborate and assemble with a view to settle its future as a reified fact, a parallel debate takes place regarding ‘who’ is entitled to participate in this process. Thus, arguments and counter-arguments are put forward contesting, defending, scrutinising, and questioning public ideas on human cloning, individual and media representations, and regulatory developments. The purpose of the present research is to account for the way scientists conceptualise the public sphere and its role in these debates. That stated, it seems pivotal to take into account the structure and content of the arguments employed by scientists to discuss the public sphere. However, and in addition to Liakopoulos’ (2000) claims, arguments are not only a way of elaborating and concretising individual thoughts but also, as Billig suggests, a way of taking a stance in relation to counter views. In this vein, when people argue about something as a way of criticising the counter-position, they also express what that counter-position is. Thus, when scientists employ certain arguments to talk, for example, about the media coverage of SCNT research by a newspaper, they also reveal, in their choice of argument, their positioning of the media as interlocutors in the wider debate over the reification of scientific representations. That is, they reproduce the way they actually understand and believe the media to be. Hence, the choice of words, ideas and meanings with which to argue reveals the thing in itself. As a corollary, an argument is at the same time a worldview, a counter-position, the past, the future, the visible or invisible interlocutor; in a sense, it is a way of typifying objectifications. In studying arguments one is invited to account for the choice of a specific argument as expressive of the discursive context, in this case the wider debate over human SCNT research, the interlocutors and counter-positions; that is, the various actors and their various positions in the debate. In the context of the present thesis, a point also discussed in chapter 4, Toulmin's identification of argumentation structure will be retained as it offers a clear and elaborate technique with which to typify the various objectifications.

1.7 Conclusion

Moscovici's seminal theory of social representations has undoubtedly contributed to a revival of old debates in social psychology, while introducing novel propositions for the study of knowledge. Certain dichotomies of the past, like those between subject and object, opinion and truth, individual and collective have been revisited with a view to promoting a contextual and more dynamic perspective of human thought and knowledge. The idea of communication has been central to Moscovici's conception of social representations, overcoming the notion of the person as a neutral observer or even worse as a prejudiced thinker. People think and talk in relation to each other with a view to discussing and debating, to preserving and to changing. It is this dynamic and pluralistic view of the world that drew my attention to the theory of social representations and, partly, prompted my curiosity over the relationship between more or less expert forms of knowledge and their holders. Indeed, the relationship between the scientific and the non-scientific has been at the heart of Moscovici's theory ever since its first conceptualisation and elaboration in his study of the reception of psychoanalysis by different French milieus. His discussion of the consensual and the reified and their different possible readings hold important ramifications not only as to Moscovici's treatment of science and non-science but also as to the overall standing of his theory in relation to knowledge and its study. By implication, it also proved a troubling issue for the elaboration of the present study; an issue calling for further clarification.

It has been suggested that certain readings of this proposed dichotomy confine social representations both as a theory of knowledge and a phenomenon under investigation. Thus, a literal reading of the reified and the consensual proposes the splitting of knowledge, and hence reality, into two worlds, an objective, namely that of science, and a subjective, namely that of common sense. As such, social representations become a theory of common sense knowledge confined to the study of relevant phenomena. A second proposed reading equates social representations with a particular type of knowledge, which is that of science made common, while relevant research is restricted to the investigation of the diffusion of scientific concepts in the public realm. It is thought that both readings run the risk of oversimplifying the relationship between science and common sense, as well as reducing the scope of Social Psychology to a positivist approach of knowledge. Instead, the different understanding of the consensual and the reified that has been proposed, invites for a redirection of the questions on the relationship between science and non-science, which consequently calls for a more holistic account of all types of knowledge.

In this vein, reification is not the *a priori* condition of certain types of knowledge, but the *ex-post-facto* of a highly historic, human, and contextual process of interaction between different types of representations and their holders. Here, the importance is not to explain how science or common sense work as separate units of a common sphere, but how they manage to co-exist as one body of a continuous flow of information and knowledge (Latour, 1999). Knowledge emerges as the triangular architecture of subject-object-subject. The study of its production, circulation, and transformation across different milieus becomes central to such an endeavour. It is believed that Moscovici's social representations and his conceptualisation of the constituted and constitutive nature of knowledge offers a rich and well-elaborated framework for the study of all types of knowledge, be it more or less expert. It is through such an understanding of Moscovici's social representations that the present thesis has been cultivated, conceptualised, and elaborated.

Hence, in this study social representations are employed both as a theory of knowledge and a phenomenon under investigation. As a theoretical framework, they point to the constituted and constitutive character of all types of knowledge. Knowledge *of* something is always knowledge *by* someone in a specific place and time. This, however, is not to be taken as a revival of relativism but rather as an assertion of construction as the basis of objectivity. As a corollary, knowledge is not to be treated hierarchically but with respect; in relation to those who hold and preserve it, their history, past, present and future. It is with such a disinterested attitude that the present phenomenon of research is approached.

As a phenomenon, social representations of the public sphere among experts in SCNT research, are not to be treated as a way of illuminating 'common sense' notions of 'common sense' or 'amateur transformations of expertise knowledge' about 'common sense'; it should be treated as a set of empirical regularities comprising the ideas and meanings of a specific group of people towards a specific object (the public sphere), to be studied in close connection to the social and communicative processes that produce and reproduce them. In this light, research is to fully account for the objective, subjective, and intersubjective elements of knowledge. More specifically, the purpose of the study is to provide a typification of the possible meanings of the public sphere among experts, that is, the content of representation, and by that to further elucidate their historical and contextual origins, and their possible structures and functions. In light of recent criticism regarding shortcomings in the operationalisation of the study of the contents of representations, namely anchors and objectifications, an attempt was made to promote a previous analogous effort by Liakopoulos (2000) in the study of words and rhetoric. As such, Moscovici's anchoring has been connected to Lakoff and Johnson's conceptualisation of metaphor, while objectification has been connected to Toulmin's and Billig's accounts of arguments. It has been argued that the use of metaphors in language, either in the context of a text or in a discursive situation, can cast light on anchoring, while argumentation can enlighten the process of objectification. An argument may implicitly contain a metaphor in the same mode as a metaphor may contain an argument (Liakopoulos, 2000). In such a vein, the distinction proposed is more of an analytic rather than of a conceptual nature, for the two processes are part and parcel of the same continuum.

Having presented the main theoretical backbone of the present study, it is time to assume interest in the relevant research undertaken thus far to account for scientists and the way they conceptualise lay publics, media coverage of science, and science policy. Though the contribution of social representations research has concerned mainly the way different publics represent scientific developments, literature in other fields of research, like in the sociology of science and the public understanding of science tradition, have recently turned their attention to the study of scientists and their respective representations of the public.

Chapter 2

The public according to scientists: reviewing the literature

The relation between science and the public, and consequently between scientific and common sense knowledge, has been an issue of intense debates ever since Plato and Aristotle provided some first definitions on the different forms and functions of knowledge. Initially focusing on issues of demarcation, that is, what counts as scientific and what not, scholars have moved to the conceptualisation of different theoretical models accounting for the nature and functions of communication between the scientific and the public realm. However, and more to the point of the present study, *how are scientists themselves conceptualising this relation*? Empirical work relevant to this research topic has been identified in the context of two related bodies of literature, that of the Sociology of Science and the Public Understanding of Science tradition, which will be presented respectively. The purpose for doing so does not stem from an attempt to define the phenomenon of research beforehand. Rather, it is performed mainly to demonstrate the kind of research that has informed the present work, assisting in the design of its conduct while casting light on the existence of possible conceptual, methodological and empirical lacunae. Furthermore, relevant studies provide a fruitful resource for a better understanding of the phenomenon of research. Lastly, they aid in drawing links with possible areas of knowledge to which the present thesis may contribute both theoretically and empirically. The dual distinction of the literature in Sociology of Science and Public Understanding of Science is performed mostly to suit the practical needs relevant to the clear and manageable presentation of related work and not to reflect any conceptual demarcation on my behalf.

2.1 Studies in the Sociology of Science

In parallel to efforts to treat the demarcation of science from other intellectual activities as a philosophical problem *per se*, some scholars in the sociology of science have approached it as a practical issue in itself for scientists. The most paradigmatic work in this context originates from the writings of Gieryn (1983, 1985, 1995). Gieryn tackles the problem of demarcation not as an inherent characteristic of science but rather as part of the ideological efforts of scientists to define their work and its products in an attempt to distinguish them from non-scientific intellectual activities. He examines the rhetorical style adopted by scientists in a series of debates regarding the relation between science and religion and mechanics, in the struggle for the scientific legitimation of phrenology, and in the relations between science and public policy. In public debates the rhetorical styles adopted by the scientists are seen by Gieryn as instances of boundary work, that is, occasions in which the presentation of science to the general public and the political authorities is performed in such a way so as to simultaneously defend their professional autonomy while enlarging their material and symbolic resources. This strategic play between being ‘close but not too close’ to the public, in the words of Gieryn, is highly exemplified in a study of the rhetorical style adopted by a National Academy of Sciences report, in the context of a public debate in the United States concerning the circulation of scientific knowledge to enemies of the State and national security. Scientists were found to construct a boundary between the production of scientific knowledge and its consumption, distinguishing between the insiders of knowledge production, represented by themselves, and the outsiders, represented by the exploiters of such knowledge and the governmental efforts to control it. According to Gieryn this demarcation served so as to take the blame for undesirable consequences away from basic scientific research and thus limiting political interventions in its conduct, while preserving public support by reminding legislators of the contributions of science to technological progress. In the same line, research by Jasanoff (1987) illuminates analogous boundary practices in the discourses of U.S scientists involved in carcinogen regulation. Another influential work of the interface between scientific and non-scientific knowledge is Wynne’s widely celebrated case study on the interactions between government scientists and Cumbrian hill farmers in the aftermath of the Chernobyl accident, which demonstrated the validity and complexity of local knowledge (Wynne, 1991, 1992a, 1996).

Further extending similar scholarship, Mike Michael and his colleagues (Michael & Birke, 1994a; 1994b; Michael & Brown, 2000; Brown & Michael, 2001) undertook analysis of the discourse employed by scientists in the context of two important disputes, the animal experimentation controversy and the case of xenotransplantation. In the former, the main aim of the study was to measure the impact of the 1986 Animal Act on relevant scientific research. The purpose of the study was the examination of the scientists’ views on British legislation. A qualitative approach was assumed, which involved interviewing 43 scientists of diverse professional status and in different institutions, all engaged in animal experimentation procedures. The analysis stressed the employment of two different sets of discourses each serving complementary purposes. The first set of discourses reflected an overwhelmingly positive attitude of the scientists towards the then recent legislative measures. Legislation was seen as further promoting an already ethically-sound established scientific endeavor while enhancing the reflexivity of the experts upon their doings. In Michael's and Birke's terms (1994a) "before the act we were good; after the act we are no more or less good but we think about it more now" (p.195). The second set of discourses represented the efforts of scientists to demarcate their practices from those of a variety of 'others' involved in the debate. As such, explicit references were made to specific groups of actors, like foreign scientists, the cosmetics industry, agriculture and abattoir representatives and pet lovers in an attempt to contrast themselves as morally superior. On a more implicit level, the general public was derogated as ignorant, morally compromised, and hypocritical, even strategically regretful. Animal activists were seen as manipulators of public emotionality, thus rendering them as inauthentic or pathological. All in all, non-experts were doomed as ethically and epistemologically flawed. Commenting on the functions of such rhetorical means, Michael and Birke (1994a, 1994b) demonstrate their utility in the presentation of animal experimentation in a relatively positive ethical light. Furthermore, scientific discourse was discussed in the context of Gieryn's findings on boundary work and Collins' (1981) propositions on the scientific core set. As such, scientists were seen as engaged in an enveloping activity in which the various criteria for a legitimate contribution to the debate were defined. Scientists presented themselves as willing to discuss with the public and other interested groups within the context of a rational, non-violent and authentically emotional debate. However, while the content of the debate remained open, these same criteria served the double role of including and excluding relevant interlocutors, thus controlling who is and who is not to contribute to the debate. Further on this study, Michael and Brown (2000) have pondered on what they call 'lay political science'. Accordingly, lay political science refers to the idea that scientific discourse not only reflects specific versions of nature, scientific facts and procedures but also versions of publics and proposed models of communication between science and non-science. The analysis of the scientific discourses in the animal experimentation case suggests, according to Michael and Brown, a specific form of dialogue committed to a specific version of democracy, that of competitive elitist democracy. Thus, by defining a set of characteristics necessary for one to enter the debate, the scientists were proposing a competitive elitist model of communication in which decision is performed by a highly selected group of skilled people in the name of a largely ill-informed public.

The later study regarded the analysis of the British press coverage of the activities of two biotechnology companies involved in xenotransplantation research over the period 1992-1995 (Brown & Michael, 2001). The analysis focused on the way scientists and medical practitioners defended the selection of the pig as the best species from which to 'harvest' transplant tissues in the future. While in the case of animal experimentation the scientists interviewed were found to contrast themselves to the public, in this case research portrayed them engaged in a process of dedifferentiation. Discussing the technicalities dictating the choice of the pig as the best donor species, scientists adopted a more internal set of discourse restricted to specialist arguments over the naturalness of the procedure. Drawing from their expertise scientists were portrayed as the sole people capable of making relevant judgments, leaving the public out of such matters. When moral and cultural criteria entered the discussion, Brown and Michael observed a switch in scientific discourse employing a 'non-expert-popular' rhetoric and in that way identifying themselves as members of the public. Thus, by proclaiming the superiority of their expertise while aligning themselves with the public, the borders between science and the public were played out in such a way so as to allow the scientists to define the debate exclusively in their terms. By setting themselves as representatives of the public, scientists seemed to favour another form of democracy, that of protective democracy. According to Michael and Brown (2000), this model of democracy suggests that sovereignty lies with the people but is to be found in their representatives who act based on the general good. Again, scientists were portrayed as acting for the general good while the public was not even invited to contribute to the debate, for they were rendered as technically incompetent.

2.2 Studies in the 'Public Understanding of Science' tradition

According to Bauer (2003) the term 'Public Understanding of Science' or PUS presents a dual nature, encompassing on the one hand the activities of those interested in promoting lay understanding and communication of science, and on the other a growing field of empirical social research intended to measure the public's apprehension of science, its modus operandi and its products. Over the past 25 years, research in the public understanding of science has mobilised interest in a variety of academic fields like sociology, psychology, history of science and other related areas of work. One could say that it has become a field in itself with the publication of two peer-reviewed journals, *Public Understanding of Science* and *Science Communication*, and a growing number of graduate and postgraduate programs in science communication and its research (Gregory & Miller, 1998).

In a review of European studies in the Public Understanding of Science tradition Bauer (2003) identifies three successive paradigms of research, each more or less distinct from the other both chronologically and conceptually. In each paradigm the relationship of science and the public realm is configured in a different light, contributing a deficit either to the public or to science itself. In each case different research questions, methodologies and intervention strategies are proposed for the betterment of the scientific future.

In the post-war period (1960s-1980s) relevant research unfolded in the context of the 'scientific literacy' idea, which identified a deficit in the scientific knowledge of the public on the basis of either ignorance or illiteracy and proposed analogous ways for its enhancement, mostly in the form of educational programs. In this vein, the measurement of knowledge by quiz-like items was prioritised. Focus was sustained on psychometrics and the operationalisation of the factual and methodological aspects of science. However, criticism was soon expressed pointing both to the definition as well as to the measurement of 'scientific literacy'. The condemnation of such an approach led to a second wave of theoretical and empirical work that dominated the field over a span of almost 10 years (1980s-1990s) under the title Public Understanding of Science (PUS), sometimes with an added T for technology (PUST).

In the U.K this transition was marked by the Royal Society's publication in 1985 of a report entitled 'The Public Understanding of Science', also known as the Bodmer report. Overall, the report reflected an alarming concern amongst the scientific establishment over the political vulnerability of research funding due to what was seen as an esoteric ethos of scientific practices vis-à-vis the public (Miller, 2001). As Bauer (2003) astutely demonstrates, the new model shared certain conceptual commonalities with the previous one, for it too stressed a public deficit.

However, in this case it is less a knowledge gap and more the issues surrounding public attitudes towards scientific developments that preoccupied relevant research. The rationale of this paradigm unravels around the idea that scientific literacy would in fact increase support for science, or widely known as ‘the more they know the more they love it’. As a corollary, while the practices of those promoting PUS were orchestrated around efforts to increase the popularisation of science (some exemplars of which include the setting up of the ‘Coalition on the Public Understanding of Science’ or CoPUS, a tripartite organisation whose main objective was to promote public understanding of science through the engagement of the scientific community *per se*, and the establishment of science communication grants and annual prizes for the best popular science books and so on), social researchers focused their attention on the study of public attitudes towards science and technology, tackling both theoretical and methodological issues of significance. Large-scale public opinion surveys were coupled with the analysis of media coverage further extending the range of concepts, methods and data considered relevant (Bauer, 2003). An intense, yet unfortunate, debate also occurred between quantitative and qualitative research over the determination of the sole legitimate ‘scientific study of PUS’. While the correlation between knowledge and attitude remained inconclusive, criticism started verbally attacking both the methodological as well as the theoretical assumptions implied in the paradigm. Thus, a fruitful discussion emerged regarding the employment of large-scale literacy surveys. Furthermore, studies on the ‘lay local’ by such workers as Wynne (1991, 1992a, 1996) and, although to a lesser extent visible in the debate, on social representations by Gervais (1997) pointed to the contextual and sophisticated nature of lay knowledge. Overall, criticism re-examined the definitions of the ‘public’, ‘understanding’ and ‘science’ as they were implied in research under the PUS paradigm (for an elaborated discussion see Gregory and Miller (1998), Irwin and Michael (2003), Irwin and Wynne (1996), Levy-Leblond (1992), Sturgis and Allum (2004) and Wynne (1992a, 1992b, 1995)). At the core of the criticism lay what was seen as a disparity between a degrading portrayal of public and media opinion and a caressing of scientific authority and legitimacy. All in all, soon the finger of guilt was pointed at the deficit model of public understanding and calls were made for a more reflexive approach in the PUS research tradition (Miller, 2001). In the context of this critique a new paradigm of research emerged leading to new questions. This time the apportionment of deficit fell on the opposite camp, that of science and scientific experts, due to their lack of trust in the public. Politically, the transition was once again marked by the publication of a House of Lords report entitled 'Science and Society' in 2000. In contrast to Bodmer's references to public ignorance and media inconsistencies, this report gave priority to what Miller (2001) terms the 3-Ds, that is, dialogue, discussion and debate. PUS research is currently operating under the new Science and Society paradigm. As scholars are widely debating whether it is truly an instance of genuine reflexivity or yet another disguise of the more traditional PUS paradigms (for instance Michael, 2002), research is experiencing a broadening of its scopes and questions. As such, while the measurement of public opinion, knowledge and attitudes dominated the field for years, new investigations, this time of the understanding of the public by the experts, come to light. It is this work that is of great informative value to the present study.

When the present thesis was first conceptualised, almost 6 years back, the review of the relevant PUS literature before 2000 revealed a small number of works under this subject. Most of PUS research, as has been mentioned so far, was preoccupied with the study of public understanding and media coverage of scientific developments. Little attention was given to the other end of the spectrum, that of scientists and the way they conceptualised issues of public opinion and science policy. An exception to this was the work by Rabino (1994), an American biologist. Prompted by an intense public interest in biotechnology and genetic engineering, as reflected in publicity and regulatory developments at that time, Rabino set to investigate the attitudes of his colleagues involved in genetic engineering research on both North American and European ground. His interest was focused on the measurement of the perceived possible impact of public attention, political advocacy and regulatory developments on biologists' works. Thus two surveys were conducted; one involving a sample of 430 US recombinant DNA scientists and the other 400 scientists associated with the European biotechnological community. A comparative analysis indicated that although both US and European researchers agreed with the relative impact of public attention on their work, there were certain attitudinal differences. Overall, European researchers were found to hold more negative attitudes, considering public attention as harmful. Subsequent analysis revealed that this difference correlated well with the relative severity of regulations, explaining variations both between US and European scientists as well as among European researchers. Negative attitudes were reported with regard to the perceived influence of public opinion and pressure groups over what was seen as unjustifiably strict regulatory controls. Although not against the idea of regulation per se, negativity was reported mainly amongst those European researchers with the most stringent regulatory controls, such as the Germans and Swiss. Overall, the analysis revealed the tendency of US and European researchers to prefer a more exclusive pattern of decision making, involving only experts in the field. A perceived gap between the public understanding of science and research was also reported by the respondents, with the majority of their recommendations reflecting rectifying and educational intentions.

As has been aforementioned, the publication of the 'Science and Society' report by the House of Lords, constituted a clear point in PUS research in Britain, prompting the investigation of scientific attitudes and notions of public opinion and science policy. In the context of the new proposed communication model between science and non-science, the Wellcome Trust commissioned a UK large-scale survey by MORI with the intention to further contribute to the development of a "national strategy which moves beyond the Public Understanding of Science towards genuine public dialogue" (MORI, 2000, p. 3). The survey, which was termed 'The role of scientists in public debate', focused on the investigation of scientists' attitudes towards communicating science issues. The survey was organised along five research objectives all centred on the exploration of the preferred model of communication by scientists, the identification of individual differences amongst scientists, as well as perceived barriers towards more effective communicational practices. The study was conducted over a four-months period, from December 1999 to March 2000, and questioned scientists in both biomedical and non-biomedical fields of research receiving funding from a multitude of resources. Results indicated an overall positive attitude towards communication with the public. Science communication was portrayed by the participants as a matter of duty for scientists for the betterment of public decision making and the restoration of the relationship between scientists and the public, seen as experiencing a period of crisis and public mistrust. Results also indicated a distrust of most popular media by the scientists. Discussing variations amongst scientists, the study revealed a tension between biomedical researchers' sense of duty to communicate with the public, which was found to be stronger compared to non-biomedical researchers, and their limited reported activity in science communication. The concluding part of the paper, entitled 'Building a new dialogue:

discussion', is indicative of the remedial nature of the study. Thus, MORI included a number of recommendations to the institutions and funding authorities engaged in scientific research for the encouragement of a 'legitimate culture of dialogue' (MORI, 2000, p 71). These can be grouped roughly in seven different categories and embraced recommendations for 1) the promotion of the understanding of science communication in the scientific community, 2) the promotion of scientists' communication skills, 3) the promotion of communicational services, 4) the promotion of collaborative activities between funders and institutions, 5) the promotion of collaborative activities between scientists and journalists, 6) the promotion of communication language, and 7) the stimulation of participation in science communication activities of the least involved groups of researchers.

Further extending this prescriptive tradition of social research into PUS and science communication, Waterton et al. (2001) conducted a qualitative study involving interviews with 52 scientists working in the domains of ecological protection, climate change, Bovine Spongiform Encephalopathy (BSE) and genetic engineering (GM) between 1998 and 1999. The project was part of a series of other research and practical policy initiatives, like the British Council's programme 'Towards a Democratic Science' and the activities of the House of Lords Select Committee on Science and Society. The research aims intended to explore the way different scientists reflected on their doings in relation to science policy and the discursive repertoire adopted while discussing these subjects. This last point drew heavily from the observations by Gilbert and Mulkay (1984) of the employment by scientists of two different rhetorical repertoires in formal and informal settings of communication. In formal situations scientists were found to exert an empiricist representation of science. Thus, scientists and scientific knowledge are presented as objective, rational and value-free, in absolute separation from the social fabric. In informal situations though, scientists were more reflective on their activities, portraying them as contingent, that is, influenced by personal and social circumstances.

Interview results indicated a tension experienced by scientists between the preservation of their professional identity and the demands and needs of a variety of funders, be they the public or the private sector. As a community, scientists appeared fragmented and weak, united only in instances of public mistrust like the BSE and the GM food controversies. Overall, scientists were found to regularly switch between the ‘empiricist’ and the ‘contingent’ repertoire, with those working in less controversial areas using the contingent repertoire to a greater extent than those whose research experienced periods of public scrutiny. Based on this finding, the study concludes with suggestions on further encouraging a public, more ‘contingent’, self-representation by scientists on the assumption of further promoting the general public’s sense of comfort with modern science and thus enhancing the emergent public-dialogue mood (Waterton et al., 2001).

An Internet survey by Burchell (2003) was also conducted amongst UK biotechnologists and geneticists working in the public sector. The study took place in 2001 and can be seen as a further extension of Waterton and his colleagues (2001) research. While interested in investigating scientific attitudes towards science and scientific knowledge, the Likert-style questionnaire distributed, contained items intended to measure attitudes towards the general public and media coverage as well. Overall, the study reported what was termed as a poor view of the public and the media. Scientists portrayed the public as irrational and were found to view the media as a conduit between the producers of scientific knowledge and the people. With regard to political decision-making, a primacy of expertise was also evident, though coupled with a conviction to the usefulness of holding public views accountable. Variations were also observed with female scientists, less senior researchers and environmentalists holding what were called ‘less classical scientific perspectives’. Based on these differences the author drew some optimistic predictions regarding the possibility of a change in scientists’ understanding and attitude towards the public, while inviting social research for a future ‘group work with both scientists and members of the public’ (Burchell, 2003, p. 16).

A qualitative analysis involving GM scientists was also conducted by Cook and his colleagues (2004), comprising interviews with 18 GM experts within one academic institution. The study focused largely on the communicational language adopted by the researchers as well as their perceptions of non-experts and anti-GM opposition. One of the intentions of the study was to assess the actual effect of the communicational style adopted upon non-experts. Thus, it also included the analysis of 15 ‘non-experts’ within the university under study (comprised of administrative and technical staff, and students) as well as 10 ‘outside advisers’ holding a professional interest in GM food from a variety of areas. The conclusions of the study focused mainly on the interview data with the scientists, using the data from interviews with the other two groups as reference points. Findings indicated a three-dimensional categorisation of the participants in the GM debate by the scientists, as involving ‘scientists’, ‘the public’ and ‘the opponents of GM’. The communication style preferred by the interviewees varied according to the group targeted. ‘Scientists’ as a category was thought of as a homogenous, unproblematic grouping, standing in a binary opposition to the ‘public’. Public disquiet over GM food was characterised as irrational and emotional, to be overcome by the dissemination of more scientific facts. There was little room for reflection on the wider economic, political and ethical concerns explicitly addressed in the responses of both ‘non-experts’ and ‘scientific advisers’, mirroring the need of scientists to limit discussions over GM technology to a technical context and thus excluding other participants from entering in the debate. Anti-GM non-governmental organisations (NGOs) and the media, classified by the interviewees in the opposition category, were also seen in a hostile vein, driven by their own professional and ideological agendas and motives. Overall, scientists were reported as advancing communication in the frame of ‘empirical objectivity’ with the purpose of transforming expertise language into more simplified versions, easily digestible for the non-experts. Cook et al. (2004) commented on the inability of scientists to take notice of other dimensions of the debate as a failure to appreciate simultaneously the opportunities as well as the challenges offered by crop genetic modification. Moreover, the interviewers report what they view as an ironic paradox between scientists’ criticisms over the emotionality and irrationality of the public and their own use of highly emotive language and selective examples.

Still within the context of the ‘GM crisis’ Burchell (2007) reports the results of data derived from the analysis of 18 semi-structured interviews with scientists involved in crop genetics research, conducted in 2003. The aims of the study were in line with his previous internet-based survey (Burchell 2003) exploring mainly scientists’ views on the status of scientific knowledge, the status of public knowledge and their relation and the role of science policy, media coverage and NGOs. The findings present certain analogies to previous studies as to the degrading view scientists hold about the public understanding of GM and its media coverage. Again, scientists were bound up in an empiricist repertoire, distinguishing their knowledge, activities and relevant motives as legitimate, objective and straightforward. This was in direct contrast to the way they talked about the practices of four ‘others’, the public, the media, environmental NGOs and other unspecified scientists, all rendered ‘contingent’ and thus illegitimate, based on a number of reasons respectively. In this instance, Burchell’s conclusions were less optimistic identifying what he views as a discouraging finding in the context of the promotion of the science-non-science dialogue towards the amelioration of public controversy surrounding technological developments.

Two additional recent studies come to extend relevant scholarship in the U.K by focusing exclusively on industry and its representatives. Burngingham and colleagues (2007) report the results of a qualitative study that took place amongst representatives of the area of chemicals industry. The research formed part of a larger project set to investigate the way lay environmental knowledge was conceptualised, accessed and used within the UK chemicals industry. The study was prompted both by the general switch in PUS research and practices towards more participatory models of science communication and also by new policy changes specifically addressing the chemicals industry in the context of EU regulations. In order to detect possible variations, interviewees were selected from 4 different companies reflecting differences in size (small versus multinational) and orientation (business-to business versus business-to-consumer). On the whole 34 semi-structured interviews were conducted with senior executives in the areas of chemicals/cleaning products. The interviews addressed questions of definitions of the public/s, characterisation of public environmental concern and knowledge, communication with publics and policies of corporate social responsibility and sustainability. Interviewees drew distinctions between the general public as citizens and more specific publics like ‘consumers’ and ‘neighbours’. While ‘consumers’ were at times referred to as parts of the larger public, the ‘neighbours’, identified as the local communities residing in the neighbouring surroundings to those of the companies’, were rarely discussed in such terms. It was these two groups that tended to be seen as the actual publics of relevance to the participants. When it came to the evaluation of public, consumer or local knowledge, they were mentioned less as holders of knowledge, though invalid in both extent and quality, and more as advocates of concerns and complaints. Thus, the general public’s worries were seen as irrational and media driven, the consumers’ reservations as lacking ‘hard’ scientific knowledge, and the neighbours’ objections as relying on the senses rather than on logic. The results also indicated two variations of the deficit model employed in the discourses of the interviewees. Thus, when discussing the public understanding of industry, respondents reflected on extending communication with the public in the view of restoring both understanding and a perceived lack of trust. However, when the issue was the public understanding of chemical products, the perceived deficit of knowledge was conceived as reasonable and in no need of any rectifying intervention. With the exception of the executives representing the multinational business-to-consumer company, there was little reflection amongst the interviewees over the value of an extensive public dialogue around the assumptions and the general visions underpinning industry activities. This was also manifested in the communication practices of the companies, which were mostly prompted by substantive motivations to address risks, impacts and preferences.

Researching the electricity supply industry, the Devine-Wrights (2005) further contribute to the field by studying the representations of domestic electricity consumers amongst UK electricity industry stakeholders. The study was qualitative in nature, comprising 18 semi-structured interviews with relevant representatives and was conducted in the light of recent developments in renewable energy technologies. The main aim of the interviews was to explore the way industry representatives thought about demand-side management in the U.K. Interviewees' discussions were found to be negatively worded and developed mainly around the electricity consumers' or customers' lack of socio-cognitive skills, socio-economic resources and socio-morals necessary for the participation in demand or supply activities. Pondering on their results, the Divine-Wrights bring to the attention of the policy-makers the need to change the 'deficit beliefs' reinforced by current UK government schemes, for, together with the existing industry regulations, they were conceived as an impermeable barrier for the development of a more participatory, decentralised system of energy production.

Concluding the review of PUS studies relevant to the present research topic, is a study conducted in Canada. Focusing on another controversial scientific field, that of aquaculture (the commercial growing of fish and shellfish in nets or other semi-contained areas in fresh and marine waters), Young and Matthews (2007), report the results of an Internet survey of the views of 300 aquaculture experts on the role of lay contributions in scientific and political debates over this controversial industry. Questionnaire items were designed to reflect respondents' views on the participation of potential stakeholders in relevant policy and regulation, on the role of the media in the debate and on their assessment of the knowledge and values of 'general public opinion'. Findings indicate a correlation between the respondents' general stance to aquaculture and their attitudes towards incorporating local and native knowledge in formal scientific practices. This means that those experts more sceptical to the idea of aquaculture tended to be more willing to integrate other forms of knowledge. Responses to open-ended questions however, indicated that this incorporation was mostly conceptualised as a way to further increase the legitimacy of expert opinion, that is, as complementary to scientific views, rather than as a form of knowledge of potentially contributing value. A similar correlation was reported regarding the measurement of experts' views on the role of media coverage. However, an overwhelmingly poor assessment of the media contribution to relative debates was measured based mostly on accusations of the institutional ethos of the media as driven by capitalist values. Negative opinions were also measured on items and open-ended questions referring to the 'lay' general public. The public was seen as making poor decisions due to either cognitive limitation or to partial media reporting, albeit not purposely. Commenting on their findings, Young and Matthews (2007) suggest that a certain paradox is identified. On the one hand, scientists deny public opinion by referring to biases in media representations and lay interpretations of science, while on the other hand they claim it by incorporating stakeholders' opinions in the view of legitimising their own doings. The authors reconfigure this tension as a struggle for control over claims and knowledge. Certain conclusions need to be drawn from this study. Firstly, under conditions of scientific controversy scientists assign different degrees of legitimacy to different types of knowledge. Secondly, media and public understanding of science is downplayed for it is performed outside the experts' control. Thirdly, public and stakeholder participation is invited only in the 'post-production' period of scientific knowledge, complementing scientific knowledge and thus keeping the control over knowledge in scientific hands.

2.3 Reviewing the literature: the path ahead

Prior knowledge always forms part, in one way or another, of present and future thoughts, ideas and actions. The present study and its investigation of the way experts in one area of knowledge conceptualise the public sphere, bares no exception. Hence, there is a need for a certain degree of reflexivity in identifying the way prior research on the relationship between science and the public as perceived by scientists themselves, has informed the present study. Although a fuller account of its rationale and design will be offered in subsequent sections (see Chapter 4), some epigrammatic ideas shall now be addressed.

Thus, the aforementioned studies present an interesting amalgam of a variety of theoretical, methodological, empirical and motivational resources from which to draw and approach relevant phenomena. Indeed, by assuming a disinterested attitude towards the phenomenon under their investigation, works like that by Gieryn (1983; 1985; 1995) and Michael and his colleagues (Michael & Birke, 1994a; 1994b; Michael & Brown, 2000; Brown & Michael, 2001) contribute to the present study by providing a specific portrait of the scientists investigated as a distinct group of experts bound together either under a common ideology or a set of similar interests. In each instance, scientists are depicted as a highly active assembly, who in their attempt to protect their autonomy while securing wider public support, negotiate the boundaries between: science and the public, expertise and culture, insiders and outsiders, in a strategical and sophisticated manner. However rich and informative they may be, the above studies run the risk of undermining the relationship between language and thought and consequently the subjective (who I am), objective (how the world is) and intersubjective (who the other is) elements of knowledge. Discussions on their findings suggest a tendency to regard scientific discourses about the public as instances of linguistic repertoires. By accounting for variations in scientists' discussions solely in connection to their conversational context, these studies seem to undermine the importance of representation in the making sense of, thinking about, talking in, in one word, living in the world. Is the purpose of a shift in a person's rhetorical style solely to be accounted for on the basis of persuasion? Yet, what point does persuasion have if, at the same time: who is talking; her/his relation to other like-minded individuals; their common project; any possible shared history; their possible representations of the world; and the potential structure and functions of these representations in, for instance, forming, sustaining or resisting communication with others, is not taken into consideration? Though at times implied, the above studies fail to explicitly make such links. By taking a more socio-psychological approach, it is thought that the present research addresses such a lacuna.

Studies like those by Burchell (2003; 2007), Burngingham (2007), MORI (2000), Rabino, (1994), Waterton et. al, (2001) and Young & Matthews (2007) provide a more heterogeneous picture of the scientific community, with opinions and views about publics, public opinion or science-policy varying according to nationality, seniority, gender, institution as well as, the general technical and more social conditions affecting each field of research. These are all points for *a priori* consideration in the elaboration of one's research. Nevertheless, most of the above accounts provide a more attitudinal perspective, overshadowing the investigation of possible links between knowledge and those who hold it at a particular place and time. Concurrently, their sustained focus in large-scale settings and interview situations, attempting either to draw vast generalisations or less widespread but richer information, has no analogous counterpart in the form of endeavours to assess more formal channels in which knowledge is produced, transformed and communicated. However, as is fully discussed in chapter 4, research on social representations has, time and time again, pointed to the conceptual and empirical necessity of investigating different settings of representations.

One final comment, and more to the point of the PUS studies presented so far, regards the *why* recent PUS activities expanded their focus to include the study of experts and the significance of this on relevant social research, including the present study. Bauer (2003) points scholars' attention to the recent blurring of the borders that has taken place between social research and intervention. Thus, there is a sense that in the context of the new Science and Society paradigm, what has been termed as a 'crisis of confidence' has as much to do with public distrust of scientific developments as to experts' distrust of the public. Therefore, as the argument follows, views by scientific experts of the public, the media and the democratic process (and so on and so forth) come under scrutiny with the intention of detecting and rectifying them in order to re-gain the public's hearts and minds. As Bauer points out, this might well be an instance of a reverse PUS deficit. In his terms "this agenda, academically grounded as it may be, is in affinity with political and business consultancy with whom it shares a decidedly pragmatic outlook. Much of this activity takes the form of practical advice sold in a market place" (2003, p.11).

In some cases more explicit than others, this remedial agenda was found to affect relevant empirical work in three main ways. Thus, it seems to have prioritised research focus on some 'hot' topics for science policy, like the GM and the BSE disputes. This view has also been reflected in such research items and questions, set to measure scientists' knowledge of public opinion formation, attitudes towards a series of channels and modes of communication as well as to assess possible hurdles impeding the realisation of a more 'public dialogue'. Lastly, traces of it can also be identified in the form of prescriptive recommendations made to the relative authorities in order to tackle communicational barriers or 'deficits', as well as, in the form of predictions about the future of the science-non-science relationship.

It would be a lapse to ignore the influence of the current *zeitgeist* in PUS research on the present study. Much of the interest in studying the social representations of the public sphere among experts in SCNT research was born in the context of these wider conversations upon the relationships between science and society. Thus, the present work could be seen as constituting a further contribution to these recent discussions. However, the present thesis has no socio-therapeutic aspiration in the sense of identifying 'biases' and drawing strategies for their omission. This is reflected in the choice of social representations, both as a theory and phenomenon (as discussed in the previous chapter), and in its overall execution, allowing the scientists interviewed to bring into the discussion those aspects of the public sphere that are of interest to them rather than those belonging to a pre-determined consultancy-based list of themes (covered in chapters 4, 5 and 6).

2.4 Conclusion

The relationship between science and non-science as viewed by scientific experts has been mainly addressed by studies in the Sociology of Science and the Public Understanding of Science traditions. Both, successfully depict the numerous ways, rhetorical devices, opinions and attitudes, scientists hold over issues of much philosophical interest, as are the demarcation of science or its distribution. Some draw on a desire to practically tackle hurdles in the public communication of science, whereas others stand out as being more academically oriented towards the interface and border-construction between different forms of knowledge. As a corollary, some studies point to 'deficits' in expertise knowledge about the processes involved in the formation of 'lay' knowledge and public opinion, in the conduct of media coverage, and the development and application of regulatory frameworks. In this vein, prescriptions are drawn with a view to further promote public trust in science and democratic decision-making. Other studies point to the mastery with which scientists define and redefine notions, such as 'science', 'society', the 'lay' and specific 'publics' in their efforts to sustain control over the production of knowledge and the definition of their professional identities. Whatever the case may be, all studies constituted rich and informative sources of great conceptual, methodological and empirical value to the present research. At the same time, they all, in one way or another, point to certain lacunae that underlie the importance for a more socio-psychological approach to the study of relevant phenomena, as a way of illuminating the objective, subjective and intersubjective elements of scientists' representations of the public sphere, in different settings of communication and in relation to their historical and geographical contexts, in other words, their time and place. The present research is expected to address such a lacuna.

At this point, the presentation of the theoretical underpinnings of the present thesis is concluded. In the following section light will be shed on the meaning and the technicalities involving SCNT research, while looking into the UK public debate that arose following the announcement of the birth of Dolly the sheep, as a movement. This will be followed by a presentation and subsequent discussion on the rationale, design and conduct of this study prior to reporting its findings.

Chapter 3
The Human Cloning Debate in the UK

The aim of the present chapter is to provide the reader with background information on somatic cell nuclear transfer, both as a scientific procedure and as a subject of intense public debate in the UK. More specifically, the chapter starts by briefly discussing the technology of somatic cell nuclear transfer, its history and applications, to move on to the presentation and conceptualisation of the UK human cloning debate, based on the framework developed by Bauer and Gaskell (2002) for the study of the relation between biotechnology and European publics. In so doing, the debate is approached as a movement calling for the identification of actors, publics and the dynamic relations between among them. In this way, it is thought that the reader will become better acquainted with the technical, historical, and geographical context of the phenomenon of research, that is, addressing the *when* and *where* of the social representations of the public sphere among experts in this study. The debate is approached in a manner flexible enough to capture the complexity of the phenomenon yet simple enough to allow, at a later stage, a comprehensive analysis of the relation between science and the public as viewed by scientists themselves. It is presented, as it unfolded up until the completion of the present research, covering relevant UK developments from 1997 until 2005.

3.1 Which 'cloning'?

Much confusion is generated when one encounters the word cloning (McGee, 2000). Etymologically the word originates from the ancient Greek for 'twig'. In biology literature the words *clone, clones*, *cloning* and *cloned* have been used for years to denote a variety of different procedures, from the cultivation of groups of cells and DNA molecules to more complex techniques such as the production of whole organisms (for a more elaborated description see Appendix 1). In contrast to the multifaceted polysemy encountered in the scientific vocabulary, in the public domain words like *cloning* and its synonyms have been equated with the use of the nuclear transfer technique on animals and humans for a plethora of applications[3]. It is this technique, involved in the creation of Dolly the sheep, along with its experts that constitute the focus of the present research.

Nuclear transfer (or Somatic cell nuclear transfer (SCNT) or Cell Nuclear Replacement, CNR) involves an unfertilized egg, whose nucleus is removed and replaced by another nucleus with the full number of chromosomes, which is stimulated through an electrical pulse[4] to start developing as an embryo. The transferred nucleus can originate either from an embryonic, a foetal or an adult cell, thus resulting in different success rates. This is because cells taken in different developmental stages are more or less specialised or differentiated. Differentiation refers to the progressive restriction in possible cell fates, until only one cell fate is left (Gurdon & Byrne, 2002). Early embryonic cells (the blastomeres) are totipotent cells, meaning, they are not differentiated cells, and have the potential to generate an entire organism. As the embryo develops, its cells become more specialised or ‘differentiated’, losing their potential to generate all the different tissues of the body, and becoming restricted to only those they are destined for (Sureau, 2002). Therefore, when the transferred nucleus is taken from an early embryo, the success rate of the procedure is greater than when a nucleus from a foetal or adult cell is used. For example, Dolly the sheep, which was created by using the nucleus of an adult cell, was the only lamb born out of 277 attempts (McLaren, 2002a). It is this potential of the technique to replicate an entire adult organism that resulted in an intense debate after the announcement of Dolly’s creation. For the first time cloning of an adult organism became less of a fictional scenario and more of a feasible reality.

Some initial attempts in the development of the nuclear transfer technique date back to the beginning of the twentieth century (Gurdon & Byrne, 2002). Spemann, in

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3 In the present thesis the term ‘human cloning’ is used to refer to overall somatic cell nuclear transfer (SCNT) or cell nuclear replacement (CNR) research and its various applications on humans, reproductive as well as therapeutic

4 This is the technique Campbell and Wilmut followed for the creation of Dolly, relying heavily on Willadsen’s practice of electrofusion in order to trigger embryonic development. However, this is not the only route, as was demonstrated by Hawaiian scientists, who cloned dozens of mice in 1998 through nuclear microinjection (Wakayama et. al., 1998)

1914, was the first to experiment with amphibian cloning. He managed to conduct nuclear transfer with early newt embryonic nuclei. He continued in 1938 with the publication of his book '*Embryonic Development and Induction*' proposing for the first time a 'fantastical experiment' involving the cloning of an adult animal. After Spemann, various other experiments were performed, albeit always on amphibians.

The first attempt to perform nuclear transfer on mammals was made in 1975 by Bromhall. Yet, most of the potential of mammalian cloning required the use of differentiated or adult donor cell nuclei (Gordon & Byrne, 2002). This problem remained unresolved until 1996 when Ian Wilmut and Keith Campbell announced the birth of Megan and Morag (for more on the history of nuclear transfer on vertebrates see Appendix 2).

PPL Therapeutics was founded in 1987 as the commercial branch of the government funded institution Animal Breeding Research Organisation, now known as the Roslin Institute in Scotland. The purpose of PPL was to commercialise the production of proteins using transgenic technology in animals. The main goal of the Megan and Morag experiment was to 'produce animals from an embryo derived cell line that had differentiated in culture' (Klotzko, 2003, p.11). The purpose of the research was to establish a routine technique for the genetic modification in animals for transmission through the germ line. The two sheep were cloned by inserting identical nuclei from an embryo-derived cell into enucleated eggs, that is, eggs whose own nucleus had been removed.

As an extension to a series of nuclear transfusion experiments that involved nuclear donors from embryo, foetal and adult cells, the Roslin Institute announced in 1997 the birth of Dolly. Dolly was created by cells taken from the udder of a six-year old Fin Dorsett ewe (that is, adult and thus even more differentiated cells). 277 of those cells were fused with 277 unfertilized eggs, resulting in 29 viable reconstructed eggs that were implanted in Blackface ewes. One of them led to the birth of Dolly (Wilmut et al., 1997).

The creation of Dolly managed to successfully solve one of the greatest mysteries in the study of cell development, namely that of differentiation and the possibility of turning a cell back to its early stages of development. After this experiment, the scientific world flourished with announcements of similar attempts. Thus, PPL announced the creation of a transgenic lamb, Polly, which carried a human gene in every cell of her body, and was created by nuclear transfer from cells that had been grown in culture and had been genetically modified. There were also announcements of cloned mice (Wakayama et al., 1998), cows (Kato et al., 1998), goats (Baguisi, et al., 1999) and pigs (Polejaeva et al., 2000).

3.2 Prospects of Nuclear Transfer Technology

The technique of nuclear transfer can be applied for the pursuit of a variety of different goals, involving the cloning of both animals and humans.

Some of the most notable applications of the procedure on animals involve a)low cost biopharmaceuticals and the generation of human proteins in transgenic animals; b)nutraceuticals relating to the modification of animal milk for the improvement of its nutritional value; c)xenotransplantation to overcome problems of animal organ rejection by the human body; d)disease models, for the production of disease models in animals that share physiological commonalities with humans; and generally, e)transgenics technology where the nuclear transfer procedure offers the possibility of the direct genetic modification of cells in culture for the creation of transgenic animals (Campbell, 2002). In addition to the above applications, nuclear transfer has been proposed as a secure way for the preservation of animal species that are currently threatened with extinction. It is also argued that animal cloning research could enhance scientific understanding regarding cell reprogramming techniques, cell regulation, and differentiation.

Two are the most prominent potential applications of cell nuclear replacement on humans, both involving the creation of a human embryo resulting either in the birth of a child or in its use for a number of medical and therapeutic purposes. The first application is usually called human reproductive cloning, while the latter human therapeutic cloning (for the purposes of the present research, and in order to sustain clarification, this distinction will be retained, although this terminology is accepted by neither the whole of the scientific community nor by other actors relevant to the technology).

Human reproductive cloning involves the application of nuclear transfer technology in order to produce an offspring that would be genetically identical to another human being. In 2001, Severino Antinori a Rome-based obstetrician, Panayiotis Zavos a fertility researcher from Kentucky, and Avi Ben-Abraham an Israeli physician, were the first to announce their intentions to produce the first human clone of an adult organism. Their experiment was set to take place in an unnamed Mediterranean country; however, to date there has not been any evidence or publicized data confirming the successful result of such an attempt. In the same year, a religious cult called the Raelians that believe that all life on Earth was created by alien scientists and that cloning is the key to the future, were about to sue the US government for not permitting them to continue their research into cloning human beings. Soon after, they announced the birth of the first human clone; however, they have omitted to provide any scientific data of the proclaimed event.

The term therapeutic cloning is considered ambiguous, as it has been taken by some to embrace reproductive cloning as a therapy for infertile couples (Royal Society, 2000). In the context of the present thesis, it is employed to refer to applications of cloning that include the creation of an embryo but do not result in the birth of genetically identical individuals. The term therapeutic cloning has been widely equated with the application of the nucleus replacement technique for the creation of an embryo, in order to extract pluripotent embryonic stem cells (Appendices 3 and 4).

Stem cells are able to produce at least one type of highly specialised descendant, while almost all types of stem cells have the capacity for prolonged self-renewal (Holland et al., 2001). Stem cells can be found in adult organisms, foetuses or early embryos and can be classified into four basic categories, on the basis of their malleability (Royal Society, 2000; Nuffield Council on Bioethics, 2000): Totipotent stem cells, pluripotent stem cells (embryonic stem cells and embryonic germ cells), multipotent cells, and stem cells with more restricted potency (for more on stem cells see Appendices 3 & 4).

Pluripotent embryonic stem cells (ES cells) have been the focus of intense scientific interest ever since the first successful derivation of human ES cells by researchers at the University of Wisconsin in 1998 (Thompson, et al., 1998). Embryonic stem cells could be cultured *in vitro*, and unlike foetal or adult stem cells, they can result in the production of all cells and tissues in the human body.

Embryonic stem cells can be extracted from blastocysts (early embryos) created either by *in vitro* fertilisation (IVF) or by cell nuclear replacement. The application of cloning techniques for the extraction of stem cells offers a considerable advantage compared to ES cells derived from embryos created by IVF. Although both cell types can give rise to all the cells and tissues in the human body, therapeutic cloning guarantees genetic compatibility with the person being treated (HGAC & HFEA, 1998b). As a result, this procedure could provide immunologically compatible tissues for the treatment of degenerative diseases or repair damage to skin or bone. In this way, risk of tissue rejection would be avoided while there would be no treatment of the patient with immunosuppressive drugs, which in many cases can lead to cancer.

In the U.K the first license to create human embryos for research purposes by cell nuclear replacement was issued in June 2004 to scientists at Newcastle University, setting the beginning of a new era in the treatment of diabetes. There is still a variety of questions to be answered with regard to cell differentiation and the successful manipulation of ES cells in order to result in the desired tissue. In the long run, scientists believe that by perfecting the use of nuclear replacement technique, knowledge and understanding of cell differentiation will be enhanced, obviating the need to create embryos as a source of stem cells.

3.3 The human cloning debate as a movement

In their comparative study on the reception of biotechnology across different European countries, Bauer and Gaskell (2002) propose a framework for the social scientific analysis of the changing relations between science, technology, and the public. Based on the writings of such a variety of scholars as Giddens, Habermas, Latour, Moscovici and Piaget, to name but a few, this framework has been the backbone for the conceptualisation of the human SCNT debate as a movement, while assisting in the design of the present research, mainly in three ways. First, and in line with social representations research as discussed in Chapter 1, it offers a clear specification of appropriate social segments, that is, milieus, groups of people bound together towards a techno-scientific development, mostly defined in terms of self-referential assemblages (for example, activists, religious, scientific experts). It also manages to put forward a clear operationalisation of the term ‘public sphere’ for the purposes of empirical work, at the same time as it invites the researcher to promote the understanding of the polymorphous relations among those involved in the debate, while enhancing it further.

More specifically, the conceptualisation of human SCNT research as a movement, permits a straightforward identification of the ***structure*** of the human cloning debate in terms of actors and the public. Three different groups of actors are identified: a) the scientific-industrial complex, situated at the heart of the human cloning movement and comprised of individuals involved in the making, promotion and exploitation of CNR research; b) those who see a benefit in this research; and c) those who resist it. The public sphere assumes a triangular hypostasis, comprising the arenas of the mass media, regulation and public perceptions. The operationalisation of the public sphere, as three different arenas, permits the identification of the various relations between regulation, media coverage and public perceptions, while bringing the attention of the researcher to the complexity of those links. In the words of Bauer and Gaskell (2002) "each arena must be understood in the context of the other two, and in the context of the activities of the biotechnology movement" (p.363). Table 3.1 gives a schematic depiction of the way the three arenas have been presented by the two scholars in terms of their modus operandi, achievements, and functions (*ibid*, 2002, p.18).

Secondly, the framework offers a clear understanding of the ***dynamics*** among actors and the public, discussing relations, functions, and actions in terms of challenge and counter-challenge, frames of discourse, and changing representations in the context of a competitive, almost Machiavellian course.

As such, the model enables the researcher to ponder on the changing relations between science and the public in a simple yet flexible manner, while promoting and assisting the study of issues that are still underdeveloped, as is the relation between science and the public from the scientific viewpoint.

Table 3.1 The operating principles of the three arenas

Public arenas	Public conversations and perception	Mass media coverage	Regulation
Modus operandi	Medium cycles Some consistency Memory	'media logic' Short cycles News values Imperative of novelty Little consistency Hardly any memory Framing	Long cycles Bias against novelty Consistency Long memory
Achievements	Opinion, Attitude Stereotype Schemata Awareness Skills	Dissemination Propagation Propaganda Advertising Education and training Agenda setting	Regulatory regimes
Functions	Being able to act on it; Communicating with other people;	Information; Entertainment; Linking domains of societal action;	Allocation of responsibility; Assimilation and accommodating public opinion; Enabling technology;

3.4 Contextualising the UK human cloning debate

Before visiting the debate around human SCNT research as it unfolded in the UK after the birth of Dolly and within the 9-years time frame specified, it is pivotal to account for prior scientific and social developments, as they seem to have provided the background by having already shaped patterns of argumentation, as well as, forming interlocutors.

Thus, the 1960s and 1970s have been characterised as periods of great transformation both in terms of scientific discoveries and social change. These were times of radical advancements with regard to assisted reproductive technologies and birth control. Developments in artificial insemination in animals were followed by the first successful attempt to produce a baby through IVF that resulted in the birth of

Louise Brown, in July 1978. Other babies soon followed; whereas just over a decade later, in 1989, a total of around five thousand egg donations were estimated to have occurred in the United States alone (Maienschein, 2003). The advancements in assisted reproductive technology brought into discussion a plethora of issues.

In contrast to the promises raised by IVF for many infertile couples, the conservative press, the Church and some ethicists argued against the ‘unnaturalness’ of a procedure that brought into question the values of the traditional family, while at the same time increasing the risks of serious health problems for future generations. Worries were also expressed about designer babies, invoking images of a ‘Brave New World’. Furthermore, important legal problems arose, such as, who is entitled to an egg; who owns a fertilised egg or a frozen embryo; how extra fertilised eggs are to be treated; and how should research involving human embryos be regulated. Questions were also raised about the cost of these procedures and its potential inclusion in existing health care systems.

This was also a period of great social changes where primacy was given to individual civil rights and personal autonomy. The reproductive freedom of women and the right to have an abortion was also one of the most debated issues of that period, while discussions over the status of the human embryo and its right to life are still ongoing amongst ethicists. While feminist organisations were demonstrating for the right to abortion and controlled pregnancies, the Church and a strong anti-abortion movement were declaring against abortion as an act of murder, initiating discussions about the return of eugenics.

The human SCNT debate in the UK is to be conceptualised as a continuation of the above debates. There is relevance both in terms of the arguments put forward but also in terms of central actors mobilised. Thus, the discussion on the ethics of human SCNT research has re-initiated debates on what is natural and what is not; health risks involved; and discussions about the status of the human embryo, points that will be further addressed in the following part of the present chapter. In terms of actors, as it will be latter shown, the same forces have once again mobilised, reestablishing existence in the context of a novel biomedical development.

Despite the great similarities with past debates, the ethical debate over human SCNT research has also been informed by some important changes since the 1970s. These changes embrace mainly three important areas, namely, the current status of bioethics, the right to reproduction and the patients’ movement (Callahan, 2003).

Bioethics was established as a discipline in the 1960s in the midst of social turmoil in the United States, where a general suspicion of technology was articulated by many intellectuals. Although there is no consensus over the degree of technological acceptability by bioethicists, some argue that current bioethicists are more likely to support a scientific development (Callahan, 2003), while others argue for the contrary (Caplan, 2003), developments in genetic engineering and human genome research have undoubtedly matured the discipline giving way to more holistic and informed moral discussions. As such, bioethics has come to contribute greatly to the way a novel biomedical development is received by the public and the regulatory authorities.

Secondly, the right to procreate has been given primacy ever since the first discussions about artificial insemination, IVF and surrogate motherhood took place in the 1970s and 1980s. According to Callahan (2003) the right to become a parent in any way possible has become almost a moral absolute, in contrast to the early 1970s when the reproductive rights movement was just being formed.

Lastly, recent years have experienced the mobilisation of a powerful patients' movement that has lobbied regulatory authorities intensively achieving great increases in government support of biomedical research while advocating for the right to relief from infertility and from serious diseases.

3.5 The UK human cloning debate

In scientific terms, research on somatic cell nuclear replacement has a long past with the first experiments dating as far back as 1914. However, it was the media announcement of the birth of Dolly the sheep on February 1997 that commenced the first public discussion of the ramifications of this technology, in ethical, economic, social, and political terms. While the debate initially focused on the meanings of human reproductive cloning and the prospects of duplicating oneself, the first successful isolation and culture of pluripotent stem cells from human blastocysts in 1998, raised additional issues concerning the therapeutic applications of the technique and the potential moral and social impact of creating and using human embryos for stem cell research (Nippert, 2002). The UK debate on SCNT research has been mainly a dispute regarding the use of this technique in the creation of human embryos as sources of human embryonic stem cells that could eventually lead to therapeutic applications. As such, it can be approached as an amalgamation of opinions and discussions relevant to human embryo research, stem cell technology, and human reproduction issues. Overall, it reflects what Giddens (1994) has identified as the double-nature of science and technology, offering beneficent promises, as well as, new dangers and risks for humankind. Generally in the U.K, as well as in other countries, there is a parallel in both the issues of discussion and of the actors mobilised. It is the developments in the public sphere though, especially in terms of the regulation of this technology that distinguishes the U.K worldwide. As pointed out above, the presentation of the debate covers the period from 1997 until the end of 2005 matching the time frame of the study. More intense in the first years after the creation of Dolly, the public debate seems to have followed developments in the regulation of human cloning and stem cell research, and gradually lost its severity. At the time of the study, SCNT was discussed mainly in the context of embryonic stem cell research.

The UK debate is presented in an epigrammatic yet sufficiently exhaustive manner, allowing the reader to better contextualise the present study. At a first level, a presentation of the various actors and their arguments will be made, concluding in the distinction of two focal standings, mainly concerning the human therapeutic applications of SCNT research: the pro-therapeutic and the anti-therapeutic cloning argumentation. At a second level, human SCNT research will be discussed in terms of its public reception, as indicated by relevant studies on its perception by different members of the UK public, its media coverage, and finally its regulation in the British context.

3.5.1 Actors in the UK debate: arguments and counter-arguments

Following Bauer and Gaskell’s (2002) suggested framework for the analysis of the relations between science, technology and society, three main distinctions regarding groups of actors can be made in relation to human SCNT research and its prospects.

Firstly, there are those with an interest in the creation and exploitation of cell nuclear replacement research and applications, also known as the scientific–industrial complex. These include research institutions, scientific societies, bankers, managers, marketing executives, stockholders, communicators, patent lawyers and a series of other actors. The scientific voice was expressed mainly through published reports and press releases, as well as by the numerous UK science-based organisations (like for example the Nuffield Council of Bioethics, the Royal Society, the Medical Research

Council, the British Medical Association, the Association of Medical Research Charities) and by the official representatives of the various public institutions where most of the UK's research activity takes place (Parry, 2003). While the reproductive applications of the technology were largely rejected, with the exception of some individual voices, it is the therapeutic potential of its application that took centre stage in their activities.

Secondly, there are those who saw opportunities in cell nuclear replacement research. Again, there has been little support for the use of cloning in human reproduction, albeit some individual ethicists and infertile couples. The majority of activities focused on the promotion of the therapeutic prospects of the technique in stem cell applications. Thus, with the support of some ethicists and the medical world, the major proponent of the technology was a strong patients' movement that vastly dominated the public debate in the form of clear-cut organisations. Some paradigmatic examples include the Alzheimer's Society, the British Heart Foundation, the Cancer Research Campaign, Diabetes UK, Huntington Disease Association and the Parkinson's Disease Society.

Thirdly, there are those who voiced concerns about both the therapeutic and reproductive applications of cell nuclear replacement. Albeit some individual cases, as per certain scientists and ethicists, this last type of actors was mostly represented in terms of self-referential groups like the Church, pro-life organisations (for example The Pro-Life Alliance, Life) and anti-abortion campaigners (like the Society for the Protection of the Unborn Child).

Taken together, the first two actors (scientific-industrial complex and patient groups) constituted the basic pro-therapeutic cloning front. While identifying a range of moral, deontological, as well as, practical difficulties raised by reproductive cloning, speakers advocating the creation of embryos through SCNT as a source of stem cells used seven main points of argumentation to promote such uses of the technology (Parry, 2003). Largely confined to scientific reasoning and drawing from prior debates on human embryo research, proponents of SCNT advocated for its nature as a mere continuation of prior research, already accepted and well-regulated in the British context. According to this line of argument, the creation of human embryos through SCNT held no new ethical dilemmas, for it followed long-established human embryo research practices, while essentially serving therapeutic goals. Indeed, and converging with moral and religious arguments, human therapeutic cloning advocates went on to articulate a more scientific conceptualisation of conception and concurrently of the human embryo *per se*. As such, the importance of conception in the creation of human life was undermined. Rather, conception was seen as one out of many conditions that contribute to the potentiality of a human embryo becoming a person. These include status provisions that are external to the embryo, such as the successful placement of the embryo into the womb, implantation, and a healthy pregnancy. Based on this perspective, all of these steps are sufficient conditions that should be met in order for an embryo to successfully develop into a human baby (Schroten, 2002). Coupled with this type of argumentation, a more utilitarian conceptualisation of the human, artificially created, embryo was proposed. Thus, a human embryo created by natural conception or in some cases by assisted reproductive technologies (ART) bears a different status than the embryo created by cell nuclear replacement for therapeutic purposes (or supernumerary embryos resulting through ART). In the former case, the anticipated result is gestation, leading to the birth of a new human being, while in the latter the goal is to treat an otherwise incurable condition, and in so doing save the life of a human being. This was taken as a sufficient reason to allow therapeutic cloning, as perceived alignment both with God's desire to heal the world and with issues of human dignity (Peters & Bennett, 2003; Kahn, 2002). Indeed, this last point was further substantiated by the identification of certain 'desperate' groups of ill people, advancing the naturalisation of stem cell cloning through embedding it within life's narrative sequence (Parry, 2003). Such reasoning provided grounds for pro-therapeutic cloning speakers to position themselves as both ethically and scientifically sound. As a result, the social and ethical cost associated with this type of research not being carried out and consequently depriving those suffering from particular diseases from the therapeutic prospects of SCNT, was seen as incommensurable. By implication, any delay in this type of research would account for a considerable delay in the overall fight against a number of degenerative diseases.

The above four lines of argumentation can be seen as a continuation of prior debates regarding the status of the human embryo and the role of scientific research in providing therapies and consequently in responding to already existing social demands (Parry, 2003). The following three points of reasoning, as advocated by those in favour of SCNT research for therapeutic purposes, present as being more inherent to this particular type of research issue. Hence, and once more, embedded in scientific reasoning, proponents of human SCNT promoted its therapeutic uses as bearing no alternative to other similar projects. Although acknowledging the importance of encouraging other analogous research, like that offered by adult stem cells or the exploitation of embryos left over from IVF treatments, supporters of therapeutic cloning highlighted organ compatibility as an advantage offered uniquely by CNR research. This was coupled with the argument as to the potential contribution of human cell nuclear replacement as a scientific technique in the further advancement of the understanding of the regulation and differentiation of cells. In the long run, they claimed, this knowledge could well make therapeutic cloning obsolete, since scientists would eventually possess the know-how to turn any cell in the human body into one sharing the same properties with embryonic stem cells (Maienschein, 2003). Accounting for the advancement in relevant research internationally, pro-therapeutic cloning arguments also developed within economic and political frames, emphasising the potential for the research to ameliorate the health care system and the financial growth of the UK, while further establishing the country's status as a potential leader in the worldwide medical field (Nippert, 2002; Parry 2003).

At the other end of the spectrum, polemicists of SCNT and its applications on humans, developed their rhetoric by combining religious, moral and scientific reasoning. In terms of the reproductive uses of this type of technology, a certain degree of parity can be traced between religious, pro-life and abortion organisations' rhetoric and their scientific and patient groups' counterviews both agreeing on the potential moral and safety risks offered by such an endeavour. However, it was their antithetical positioning, in terms of the therapeutic uses of CNR that epitomised the UK human cloning debate, forming challenges and counter-challenges. As a result, this last group of actors presents the anti-therapeutic cloning position. At the heart of their argumentation, one traces the archonic philosophical thesis, which assumes that the real nature of a thing is to be found in its beginning (Peters & Bennett, 2003). In accordance with this viewpoint, human life begins at conception, and as such, the right of the embryo to human dignity is unlimited. This type of argumentation was unfolded by the polemics of therapeutic cloning in two main forms.

The first form of argumentation emphasised matters of potentiality. In this line of argumentation, the embryo is treated as a potential human being, a person that comes into being and a call is made for the obligation to protect it. The second form of argumentation was an amalgamation of philosophical/theological positions and scientific facts. Personhood was defined as the outcome of the sperm, the egg and the soul. In this context, the act of conception is seen as resulting in the creation of a genuinely new human individual, subject to the right for life. By identifying the human embryo as a potential person, or as a person, both positions raised issues relevant to Kant and his dictum on human rights and dignity, which proposes that a person is to be treated as an end and not merely as a means, and deplores the instrumentalisation of human life (Peters & Bennett, 2003). As Parry (2003) observes these types of reservations against embryonic SCNT echo similar patterns of argumentation in prior debates about the status of the human embryo, while forming the base for the counter-challenge towards the pro-therapeutic cloning advocates. However, and further advancing their reasoning, polemicists of this type of research also have made use of scientific rhetoric and evidence that is more integral to SCNT.

Hence, opponents of therapeutic cloning gave evidence of relevant scientific studies pointing to the potentiality of adult stem cells to providing treatments for degenerative diseases. Indeed, research thus far had demonstrated, time and time again, the in-vivo malleability of these types of cells, such as umbilical cords and bone marrow, and their health-care benefits for many conditions. Further substantiating this claim, fears of a slippery slope towards reproductive cloning were also expressed based on the assumption that permission for therapeutic cloning studies would result in the perfection of the technique. In contrast, opponents pointed to a lack of appropriate scientific evidence over the ability of human embryonic stem cells to offer therapeutic breakthroughs at all (Parry, 2003). In such a vein, primacy should be given to policies that would improve the existing health care system rather than prioritise industrial capital and the pursuit of unknown therapies (Sexton, 2001).

The above actors and their respective argumentation and attitudes towards human SCNT research assisted in progressively focusing the UK public debate on the therapeutic potentiality of this type of research, while framing it in a complex scientific, ethical, economic and political reasoning. To conclude the presentation of main actors and their differing points of views, some additional studies regarding the communication style adopted by several representatives of the scientific community will be discussed for their perceived relevance to the present research.

As such, comparing the first UK reports of Dolly's birth to the story's coverage in the US press, Wilkie & Graham (2003) reveal a tendency for UK scientists to largely confine themselves to a discussion that is closely connected to the scientific context in which they were authority figures, dismissing the cultural meanings of cloning as addressed by the journalists. According to both scholars, most paradigmatic of this tendency was the management of the public announcement of Dolly's creation by the Roslin Institute, which, with the exception of a public relations company, failed to exhaust other possible channels of communication. Hence, Dolly was treated as a matter esoteric to science, i.e. by publishing the results in a credited journal and hiring a PR company to communicate with the media. Even the House of Commons Select Committee, which had visited the Roslin Institute two years earlier as part of its investigations into human genetics, was unaware of the experiments that were about to take place. Thus, when Dolly was made known and the public demanded scientists to account for social concerns, UK science found itself isolated, with few institutional allies (Wilkie & Graham, 2003). This exclusion of non-scientists is also evident in a media study by Einsiedel et al. (2002), where science is portrayed as being cut off from its social responsibilities. However, according to Wilkie and Graham (2003), this isolation should also be coupled with the tendency of the British press to provide partial scientific reporting. Such an absence has been mainly attributed to the limited number of science journalists in Britain. It has been estimated that there are more science journalists in the *New York Times* than in all the British broadsheet newspapers put together (*ibid*, 2003). Although this stands as a sufficient reason for the journalists to rely more heavily on scientific quotes, paradoxically, in the U.K the opposite prevails. Thus, scientists rarely feature as a source of information for science stories. With regard to the coverage of Dolly, only the scientists who participated in the project were cited, while information from other scientists was reported five days after the initial announcement.

In relation to the public representatives of scientists, after a two-year (1997-1998) analysis of British newspaper, television and Internet coverage of human reproductive cloning, Nerlich et al. (1999), identified four different scientific voices that contributed to the way the technology was largely framed.

First is the voice of *reason*, mainly represented by scientists who participated in the creation of Dolly. In an attempt to address public worries over the prospect of human reproductive cloning, these scientists assumed a comforting role, reassuring the public that scientists had no intention of using the technology to any such end. Moral standards and evidence on the usefulness of the application provided the backing to their arguments.

Next are discourses of *fantasy* intended to stimulate popular imagination by pairing cloning technology with mythical figures and cinematic characters. Dr Lee Silver, a molecular biologist at Princeton University, represented such type of argumentation.

Voices of *doom*, were also expressed by scientists such as Dr Dixon, a lecturer on gene technology at the University of Cambridge, who treated the possibility of using the technology for human reproduction as a *fait accompli*.

Lastly there is the voice of *hubris*, represented by scientists who, disregarding the overwhelming distaste of the public towards any use of cloning technology to produce a human being, expressed their intention to clone a human. The first of those who publicly verbalised such plans was Dr Richard Seed, an American physicist, who proposed to open the first cloning clinic in the United States. Following in his steps, other scientists like Dr Severino Antinori and Dr Panos Zavos also came forward. Indeed, and in the context of a wider project to assess the effects of media events in the public understanding of genetics (Nerlich et al., 2003; Nerlich & Clarke 2003), Nerlich & Clarke (*ibid*) report the profound implications of a 2001 press conference by Antinori and Zavos on the media, public and parliamentary receptions of SCNT research in Britain. More specifically, the two scientists announced their plans to clone humans at a press conference organised as part of an international workshop on human therapeutic cloning, taking place on March the 9th, 2001 in Rome. Nerlich & Clarke (*ibid*) report on how Antinori and Zavos' blurring of the boundaries between the different applications of human SCNT research (reproductive cloning was portrayed as 'therapeutic' in the context of addressing human infertility problems) and coupling this with the then recent announcement by the House of Lords to permit SCNT research in producing human embryonic stem cell lines, further heated up the British debate. Thus, the flourish of metaphors (like, 'clones are products' or 'clones are copies'), characters from literature (e.g. 'Frankenstein'), mythical themes and clichés (such as, 'scientists playing God' or 'going down a slippery slope') documented in the media reports following their announcement accentuated public fears and moral dilemmas, while additionally clouding the public's understanding of the differences between the various uses of SCNT technology. Nerlich & Clarke (2003) also demonstrate the ramifications of this announcement on the British government in its urgency to further clarify the legal status of both therapeutic and reproductive cloning and to produce a final regulatory framework for relevant research that addressed public fears, while making full use of the technology's therapeutic and economic potential.

3.5.2 Debating human cloning in the UK public sphere

The public debate on human CNR technology is presented based on a triangular image of the public sphere as comprised of three distinct yet related arenas. Thus, different modes and mediums of representation are considered: human cloning as covered by the mass media, as perceived and discussed in the context of large surveys and semi-structured interviews with representatives of the UK public (public perceptions), and in regulation. According to Bauer and Gaskell (2002), each arena serves different functions, with media and public perceptions constituting public opinion of human cloning, while regulation being its governance. It is at these three arenas that the activities of both advocates and opponents of human SCNT research and applications have been aimed, in an attempt to seal the future of this type of technology.

Media coverage of cloning

According to Einsiedel et al. (2002), the media coverage of Dolly the sheep constitutes the first real global and simultaneous news story on biotechnology. The first reports about Dolly emerged in the British press on Sunday, 23rd February 1997, when the *Observer* published news of a cloned sheep, lifting the embargo of *Nature's* exclusivity for having put out the story. Even though the coverage had begun by reporting the scientific announcement as a triumph for British science, it was sustained further by an emerging political and ethical controversy, involving mainly politicians, religious figures and scientists (Holliman, 2004). Thus, discussions were gradually moved from the application of the technique on animal breeding, to the first concerns about its prospects on humans, generating the conditions for the political and ethical controversy that displaced the scientific announcement. The coverage of Dolly moved from the news pages to commentary and opinion sections, exhausting metaphorical thinking with discussions about humans 'playing God', 'Brave New World', 'Frankenstein' and 'Boys from Brazil' scenarios (Einsiedel et. al, 2002). In the months that followed, British newspaper coverage continued to reflect mainly on economic and political developments, like the invitations by Jacques Chirac, the then

French president, and Jacques Santer, the then president of the European Commission, for a thorough examination of the developments by the respective ethics committees. Again, most media coverage was dominated by long discussions on human reproductive cloning that were further kindled by the first announcements of people willing to be cloned (Wilkie & Graham, 2003). When the Human Fertilisation and Embryology Authority (HFEA) gave evidence to the House of Commons Science and Technology Committee in March 1997, the first considerations of the potentially therapeutic applications of the technique emerged.

In the ensuing years cloning, as with other medical biotechnological applications, lost its news value as developments in GM food dominated public debates (Gaskell et al., 2001a). Following the Bovine Spongiform Encephalopathy (BSE) crisis, media coverage shifted from the ethical issues raised by SCNT research to a broad discussion about the risks of genetically modified organisms for humans and the environment. One of the latest studies on the media coverage of this type of technology reveals a steady but moderate interest by the British press, television and radio news (Hargreaves et al., 2002). Human CNR research was mainly discussed within the context of stem cell research, though not engaging wide discussion or high publicity. As was the case in the early reporting of cloning, a bifurcation in reporting was evident, with stories of great promise being outnumbered by stories of concern. The press was found to be less successful in explaining the scientific rationale behind SCNT and stem cell research, while TV and radio programmes were more likely to present the medical applications of the technology. Overall, however, television coverage was considerably low. For example, when the House of Lords Select Committee for Stem Cell Research announced its decision to permit the cloning of human embryos for research purposes (28th of February 2002), the story was given primacy on both ITV and BBC’s early evening news broadcast which, however, was not sustained over the next six months, where only sporadic references to the technology were featured.

In comparison to the first reactions to Dolly by newspapers in other EU countries, the British press stands out mainly for the primacy it gave to discussions about the health and economic repercussions of the technique, contextualised in a general feeling of national pride (Einsiedel et al., 2002). In the years succeeding Dolly’s creation and in relation to the U.S, relevant research reveals a distinctive tendency for British reporting of human SCNT to follow what is printed in the US press, mainly in terms of the intense political debate taking place on that side of the Atlantic (Wilkie & Graham, 2003).

Public perceptions of cloning

A considerable number of studies focusing on the conceptualisation of cloning among members of the UK public were conducted in the first most intense years of the human SCNT debate. It is these studies that will inform our discussion on the public perception of the technology, and which have probably also informed scientists' representations of public opinion. Thus, the findings of Eurobarometer surveys, which took place from 1996 to 2000, suggested that British people were not averse to the idea of CNR *per se*. Rather, it was the uses and the different applications of the technology that determined the reactions towards it (Gaskell, et al., 2001a). The same conclusion was also drawn by the Wellcome Trust's study and the Human Genetics Advisory Commission (HGAC) and HFEA's report, which were all conducted within the context of a public consultation exercise in 1998.

Hence, animal cloning for medical purposes was the focus of moral worries and concerns regarding health risks and the conditions of experimental practices undertaken on animals. The prospect of applying cell nuclear replacement on humans reflected a bifurcation already observed in the media coverage of the technology. Thus, reproductive cloning was paralleled to eugenic practices and associated with images of automated production-line facilities and fictional characters (Gaskell, et al, 2001a; Wellcome Trust, 1998). Concerns were frequently expressed with regard to the diminishing role of men in reproduction, the psychological status of the human clone and the dangers of cloning to personal identity. By and large, all relevant studies revealed the unwillingness of the public to support practices leading to reproductive cloning.

The first attempts to study the public perception of human therapeutic cloning suggested that people were apprehensive about the purposes served by the technology. This was reflected in the findings of the HGAC and HFEA's reports (1998b), which concluded that although people seemed supportive of the technology being applied to humans for medical purposes, they were also concerned with matters relating to its financial management and the degree of its accessibility by members of the public.

Subsequent studies revealed a steady increase in public support for research involving cloned human embryos. Thus, the findings of the Eurobarometer survey suggested that people in the UK were more willing to encourage the medical uses of cloning on the basis of its potential therapeutic benefits (Gaskell et. al, 2001a; Hargreaves et al., 2002). However, a study undertaken by the Economic and Social Research Council (ESRC) in 2002, revealed a low public understanding of the science involved. Two surveys were conducted in April and October of 2002 in order to assess public knowledge, opinion, and understanding of science-related issues as reported in the media, with a focus on developments in climate change research, the MMR controversy and cloning/genetic medical research (Hargreaves et al., 2002). Of these, cloning and genetic medical research were found to be the most esoterically conceptualised by the UK public; meaning that people were less interested in the coverage of these stories, while at the same time they were more likely to admit that they were not very well informed about SCNT. The surveys also revealed that, by and large, people were not informed about issues relating to the regulation of the technology, with only 25 per cent being aware that the cloning of human embryos for research purposes was permitted in the U.K. The studies suggested that despite an awareness of the benefits of therapeutic cloning, issues relevant to regulatory practices and ethics arouse public anxiety (*ibid*, 2002). According to the researchers, this was highly relevant to the dichotomous type of media coverage human SCNT research had received, where reports focusing on the medical benefits of cloning had been outnumbered by alarming stories.

To further illuminate the parameters that determined public anxiety on issues of human SCNT policy, there is a need to situate the discussion within the context of public attitudes towards science policy in general. Public attitudes towards science regulation seem to stem from three important factors: the established model of decision-making in the UK; events demonstrating the aptitude of government to handle scientific crises; and the public image of scientists.

It is only recently that the UK model of decision-making has been extended to include the voices of the public, mainly in the form of public consultation exercises and public discussion forums. Thus, there was a sense that public opinion was excluded from regulatory discussions of scientific developments and that decision making was taking place behind closed doors (Wellcome Trust, 1998). These concerns were further reinforced in the way the BSE crisis was handled by the UK government. As a result, people felt that important negative information with regard to CNR technology was being withheld from them. They also expressed worries regarding the implementation and enforcement of the law, exemplified by 'conspiracy theories' of the government secretly conducting human reproductive cloning experiments (Wellcome Trust, 1998). Trust in the UK government after the BSE crisis, declined relative to independent bodies, such as consumer organisations and environmental groups**;** overall trust in science also suffered after the same event (Gaskell et al., 2001a; Hargreaves et al., 2002). In general, the scientific community was perceived as esoteric and rigid. Though scientists were regarded as competent in their relative fields of interest, they were seen as lacking in social skills. They were perceived as driven by personal vanity and commercial motives and thus unwilling to address the social worries relevant to human SCNT research (Wellcome Trust, 1998). However, people seemed to differentiate between types of scientists, relying more on information given by university researchers, while finding scientists working in private business to be less trustworthy (Hargreaves et al., 2002).

The findings of studies on UK public perception of SCNT seem to be in agreement with results from other EU countries. Thus, overall approval of the use of cloning technology for medical purposes across Europe was reported, while animal cloning received very little support. With regard to issues of trust in science policy, it seems that in countries such as the UK, Ireland, Greece and Italy, where the political system is oriented towards a pattern of conflicting political parties, people reported some of the lowest levels of trust in government, in contrast to democracies, such as those of Finland, Germany, Denmark and the Netherlands, where a more consensus-oriented political system has resulted in greater confidence in the decision makers (Gaskell et. al, 2001b). In general, it was again actors independent of government bodies, such as, consumer groups, environmental organisations and medical doctors, which the European public found most trustworthy.

Regulation of cloning

The news of Dolly and the alarming public reaction and media coverage alike, over the prospect of using the technique to assist human reproduction resulted in an acute response by the regulators. Although surprised at first, the regulatory wheel seems to have gradually moved at a great pace, even faster than scientific experimentation (Tardu, 2002).

The UK was a pioneer in the regulation of human cloning, outlawing reproductive cloning while permitting the use of cell nuclear replacement for research purposes. The political governance of human CNR was largely influenced by the then existing regulation on human embryo research, both in terms of the themes discussed and the actors involved. As a novel scientific advancement, it was treated in the context of the case-by-case approach implemented in the U.K over the regulation of all biotechnology developments, in contrast to past activities, however, it was handled with an unusual transparency. This is mainly due to the reformation of the regulatory framework of biotechnology in 1998, and the establishment of the Human Genetics Commission that further promoted public engagement in the regulation of biotechnology in general (Gaskell et. al, 2001a).

The creation of Dolly by using cell nuclear replacement presented a challenge to the HFE Act, passed in 1990, which explicitly prohibited any research involving the replacement of a nucleus of a human embryo with a nucleus taken from a cell of any person, embryo or subsequent development of an embryo. However, the then existing definition of the human embryo (section 1 (1) a) raised the possibility that embryos created by cell nuclear replacement fell outside the scope of the Act (Morgan & Ford, 2003). With the legal status of the technology being unclear, the HFEA and the HGAC joined together as a working group to clarify whether the language of the Act needed to be amended to explicitly prohibit reproductive cloning (Bonnicksen, 2002). Thus, a consultation document was produced, which was distributed to members of the public from January to April 1998. The document drew a sharp distinction between reproductive and therapeutic cloning, presenting in depth the possible and diverse applications of CNR technology (HGAC & HFEA, 1998a). The final report was also enriched by a qualitative study conducted by the Wellcome Trust in the spring of 1998 (Wellcome Trust, 1998). In December of the same year the HFEA and the HGAC produced another joint report (Cloning Issues in Human Reproduction), arguing in favour of a purposive rather than a literal interpretation of section 1 (1) a. However, due to the implications of the technology, it was suggested that further action had to be taken in the form of an explicit ban (HGAC & HFEA, 1998b).

Soon after, The Science and Technology Committee of the House of Commons argued in favour of a law prohibiting reproductive CNR, which was followed by a similar recommendation by the Royal Society that denounced reproductive cloning on the basis of morality (Royal Society, 2002). Despite the recommendations to amend the HFE Act to specifically outlaw human reproductive cloning, the government chose, until mid-2001, to not apply any legal prohibition explicitly addressing the technology.

Alongside the political developments on reproductive cloning went policy issues associated with the therapeutic uses of CNR. The HFE Act, which addressed research involving human embryos, allowed experimentation for the enhancement of knowledge on infertility, miscarriage, contraception, congenital disorders and preimplantation genetic diagnosis. The developments in CNR technology and the isolation of the first human embryonic stem cell lines in 1998 raised another matter, that of the legal treatment of therapeutic cloning. It was in 1999 that an expert group (Expert Advisory Group on Therapeutic Cloning) chaired by the Chief Medical Officer, Liam Donaldson, was appointed by the government to consider whether the HFE Act should be expanded to allow the creation of human embryos for research involving CNR and embryonic stem cells technology. At the same time, a report was issued by the Nuffield Council on Bioethics favouring an amendment of the Act to allow therapeutic cloning and embryonic stem cells research to proceed (Nuffield Council on Bioethics, 2000). The report was delivered to the expert group, which also received a scientific advisory document from the Royal Society, and in mid-2000 issued its recommendations (UK Department of Health, 2000). The Expert Advisory Group on Therapeutic Cloning invited the government to expand the HFE Act so as to permit research on embryos less than 14 days old for medical purposes, the use of CNR to produce embryonic stem cells, and egg cell nuclear transfer to address mitochondrial diseases. Endorsing the expert group’s recommendations in August 2000, the government requested Parliament to amend the HFE Act so as to permit research on human embryos, expanding knowledge on human embryo development and on serious diseases, as well as enabling any such knowledge to be used for the treatment of serious diseases (Bonnicksen, 2002).

On 19th December 2000, the House of Commons, and after a free vote, accepted the recommendations, further establishing the legal status of therapeutic cloning research. Along the same lines, following an intense debate involving representatives of the Church, anti-abortion groups, pro-life organisations and representatives of scientific societies and patient groups, the House of Lords voted on January 22 2001, in favour of the amendment. In response to the Archbishop of Canterbury, and as a means to further strengthen the changes, the House of Lords set up a review committee, The House of Lords Select Committee for Stem Cell Research. In

February 2002, the committee issued its report supporting embryonic stem cell research and therapeutic cloning after a consideration of the medical benefits of the technologies. Additionally, the committee reiterated its total opposition to any attempt towards reproductive cloning (House of Lords Select Committee, 2002).

In the meantime, further research on therapeutic cloning and embryonic stem cells was put on hold after ProLife Alliance, a group opposing both abortion and cloning, appealed to the court arguing for a literal interpretation of the HFE Act. According to the group, the HFE Act referred only to embryos created by fertilisation of an egg by a spermatozoon and not embryos created through CNR (Bonnicksen, 2002). In November 2001, the High Court of Justice judged in favour of ProLife Alliance, while the government rushed to endorse a bill specifically outlawing reproductive cloning (December 2001). In January 2002, the Court of Appeal overturned the decision, thus, ending a long and heated political debate. On 1st March 2002, the first licenses on human embryonic stem cell research were granted to the University of Edinburgh and Guy's Hospital in London. Although the initial research involved the use of human embryos left over from IVF treatments, in the longer term scientists could make use of CNR technology as a means of producing human embryonic stem cells. In September 2002, The Medical Research Council established the UK Stem Cell Bank, the first of its kind in the world, while in December 2002 the government announced the provision of 40 million pounds to support stem cell research as part of that year's spending review. The money was issued via a new Cross-Council Coordinating Committee of the five major research councils.

The UK was the first member of the EU to provide a clear and comprehensive regulatory framework on human reproductive and therapeutic cloning and the first country in the world to permit cell nuclear replacement research for therapeutic purposes. Although criticised by many for its permissive regulation of therapeutic cloning, current law is thought to present but an amalgam of ethical, social, economic and political reasoning, history and tradition. Hence, in a more reflective tone, various scholars have pondered on the regulation of human SCNT research as being but the mixed product of: the overall moral-philosophical standing in the UK; the prior relevant scientific developments and their policy; and the more recent advances, such as, the GM food or the BSE crises, and the public debates that ensued. Thus, scholars like Hauskeller (2004), Kahn (2002), and Sexton (2000) discuss the utilitarian and pragmatic ethical reasoning as paradigmatic of Britain's tendency to prioritise issues regarding individual rights, autonomy and choice over more intrinsical or deontological concepts. More specifically, by equating human rights with individual rights, as an issue of individual rather than governmentally imposed choices, importance is directed to the use of science in further promoting and substantiating personal health and relief issues. It was such an ethical reasoning that also framed prior relevant research, resulting in a continuum between human embryo and human reproduction research with human SCNT and stem cell scientific developments. Such a continuation, though, is not only reflected in the themes and actors mobilised, but also in the various already established institutions and their traditional practices. As a result, a web of institutions existing in the UK during the last 30 years, like the Human Genetics Commission, the Nuffield Foundation, the Wellcome Trust or the HFEA, provide procedures of ethical approval and commentary which allow for relatively quick judgments of any particular subject in the field of embryonic research (Hauskeller, 2004). At the same time, more recent biotechnological developments, such as, GM food with its intense UK public debate, and instances of scientific crisis, like the BSE, developing alongside human SCNT research, demonstrated the need for tacit public acceptance of relevant techno-scientific accomplishments (Sexton, 2000).

Scholars further point to the ramifications of the above considerations in UK parliamentary discussions and actions. As a result, narratives on the potential benefits of the technology in terms of both social and economic matters, overshadowed reflections on the wider commercial considerations and the intersection between commercial and ethical issues, which were largely omitted from regulatory debates (Sexton, 2000; Parry, 2003). Indeed it was in the UK where most of the major scientific breakthroughs, pre-conditional for SCNT and stem cell research, have taken place, resulting in the country’s overall pro-scientific attitude (Hauskeller, 2004). And while specific regulatory actions reflected the primacy of confining relevant discussions to representatives of the scientific and medical expertise (for example, Sexton (2000) comments on the composition of Liam Donaldson’s Expert Advisory Group on Therapeutic Cloning as over-representing scientists), a consideration of other voices in the debate were also regarded (such as, consultation of the public or taking account of anti-reproductive cloning lines of argumentation).

A consideration of relevant comparative studies with regard to the regulation of human SCNT research in countries outside the UK, reveals similar patterns of social, ethical, historical, political and economic intersections. Thus, the disparity between federal and private legislation of human SCNT research in the US, reflects similar points of convergence with prior science policy traditions and a utilitarian treatment of scientific developments, as that experienced in related UK policy. In contrast, where specific uses of science have resulted in the trauma of national narratives and memories, as for example, in Germany during the Second World War, the prospects of human SCNT research have been outlawed, revealing an emphasis on the perceived social function of the state in respecting and protecting issues of human dignity, life and death (Gottweis, 2002). And while the Nazis' eugenics have also been a significant point of reference in the formation of national, cultural and religious identities in Israel, stem cell research and human cloning have not been met with analogous ethical or moral reservations on either religious or political grounds (Prainsack, 2006). Overall, UK regulation of human SCNT research offers one of the most permissive environments for conducting human embryonic stem cell research, while being in line with most international developments in outlawing reproductive cloning.

3.6 Conclusion

In tracing the history of CNR research, the creation of Dolly the sheep can be seen as a scientific breakthrough in a series of experiments for the understanding and exploitation of cell development and differentiation. However, it was the potential applications of the technology on humans that caught the attention of different actors, the regulators and public opinion in the UK, as well as in other countries. The subsequent debate covered the ethical, social, economic and political repercussions of SCNT research within the context of prior scientific developments, such as, human embryo research, new scientific advances, like the derivation of the first human embryonic stem cell line, as well as scientific crises, like the BSE and GM food. Initially treated by the UK representatives of research as a matter esoteric to science, cell nuclear replacement immediately surpassed the confined environment of the laboratory having a profound cultural resonance.

The conception of human cloning technology as a movement comprised of different actors, publics, challenges and counterchallenges is expressed in the context of a more elaborate discussion over the relationship between science and the public sphere. It is this last point that motivated the present study to be conducted. Although a considerable amount of research has attempted to address this point through studies in the public sphere, only recently has there been an interest in the scientific point of view. Society and its relationship to science as perceived by scientists themselves forms the background of this study, the rationale of which is discussed in the pages that follow.

Chapter 4

Designing the research: corpus construction and analysis

The present chapter deals with the description of the research design adopted and the presentation of the methodological route followed for the elicitation and subsequent analysis of the data. To begin with, the rationale behind the design of the study is discussed and emphasis is given to the concept of triangulation, its importance when studying social representations, and the way it is employed in this context. This is followed by a description of the data collected and the methods of analysis used. In each case, deliberation is given to the reasons guiding the choice of particular types of data and methods of analysis. At the same time, the chapter should also be treated as an extension of the discussions in preceding parts of the thesis. Thus, Moscovici's social representations as both a theory of knowledge and a phenomenon to be investigated formed the basis for the conceptualisation of research questions and their investigation around the assumption of knowledge as a representation process expressing, at one and the same time, subjective, intersubjective, and objective worlds (Chapter 1). Research conducted so far on the way different scientific experts conceptualise a variety of non-scientists and its relevant findings, provided a useful resource enhancing the understanding of the phenomenon currently studied, as well as, pointing to possible conceptual, methodological, and empirical lacunae (Chapter 2). Lastly, the presentation of the human SCNT research and the debate it ensued in the UK from 1997-2005 as a movement, informed the present study, not only on the main issues of concern but also on the different actors and interlocutors mobilised and their positioning in the debate, offering a clear identification of appropriate social segments for the study of relevant social representations (Chapter 3).

4.1 Social representations as a phenomenon under investigation: the rationale of triangulation

Contrary to the idea of knowledge as a cognitive mental construction which people achieve by detaching themselves from emotional, social or historical links, Moscovici (1984) calls the attention of the researcher to the tripartite architecture of the representations that produce it. Thus, every representation of something is always a representation by someone at a specific place and time. Moreover, and in opposition to those who treat knowledge in a hierarchic way, elevating the status of certain types of knowledge while downplaying the importance of others, as well as, to relativistic approaches that treat knowledge as a mere epiphenomenon, Moscovici's discussion of social representation re-directs relevant research questions in identifying the logic and the function behind meanings and ideas, linking cognitive and social processes. As a result, to select information, to categorise or to render the invisible visible are taken as intrinsically linked to the formation, preservation and transformation of group identities, selves and worldviews (Gervais et al., 1999). Significations, themes, meanings, in one word, contents of representations are linked to their conditions of genesis and multiple functions. In such a vein, empathy in documenting, listening or observing phenomena under investigation is a necessity.

Thus, researching social representations becomes a quest of typifying contents, that is, anchors and objectifications, as they are embedded in different modes and mediums, while linking them back to those who hold them, debunking their possible structures and functions (Bauer & Gaskell, 1999). Instead of studying phenomena in the confining conditions of a laboratory environment, forming *a-priori* hypotheses and testing them in relation to a control group, social exploration expands its quest in more naturalistic settings, making analytical induction an issue of the data *per se*. More specifically, it is by staring the data in the face, so to speak, and identifying what is there that forms the basis of empirical interpretation. However, soon one is faced with a problem: 'does unidentified necessarily mean absent?' (Gervais, et al., 1999). Indeed, time and time again, social representations research has shown the importance of accounting for presences, as well as, absences in the data investigated. For example, work by Jodelet (1991) on the social representations of madness in a family colony in rural France, where local inhabitants acted as foster parents to some psychiatric patients, revealed how absences of knowledge of the 'mad' in the interview narratives with the locals, fully made their presence in their habitual practices and every-day interactions with the patients. Thus, empirically unidentified does not always mean non-existent. With this in mind, how, then, is one to design the study of *a priori* unknown phenomena?

To tackle such an issue, social representations researchers have, over the years, prioritised and incorporated triangulation as an integral pre-requisite in their studies (Bauer & Gaskell, 1999; Duveen & Lloyd, 1990; Flick, 1992a; 1992b; Farr, 1993; Gervais et al., 1999; Sotirakopoulou & Breakwell, 1992). The history of triangulation dates back to more than thirty years, originating in navigation and military strategies that use multiple reference points to locate an object's exact position (Flick, 1992a). Initially, the idea was adopted as a methodological principle in social research, in order to address non-reactive measurement. Soon, it was introduced by Denzin (1978) in the realm of qualitative research as a means of securing the high validity of the results of a piece of study. Denzin (1978) drew a distinction between *data triangulation*: the combination of different sources of data; *investigator triangulation*: the employment of different researchers; *theory triangulation*: the implementation of different theoretical perspectives; and *methodological triangulation*: the combination of different methodological approaches in the investigation of a phenomenon.

As has been argued, the idea of triangulation has lately assumed a central role in the design of studies on social representations, for it is the complexity of the phenomenon that calls for a combination of sensitive methods of research, of sources of data, of theories, and even of researchers. However, triangulation is not implemented as a way to enhance the validity of the results but rather as a means of helping the researcher in providing a fuller interpretative account of the phenomenon under study. According to Gervais and her colleagues (1999), triangulation is more productive when it combines methods that tap into different aspects of representations, namely sociogenesis, ontogenesis, and microgenesis (Duveen & Lloyd, 1990). In brief, sociogenesis is the process through which social representations are generated at the collective level. Ontogenesis is the process through which the representations of a community are re-constructed by the individual, resulting in the development of social identity. Lastly, microgenesis takes place in social interaction where representations are ex-changed, negotiated and re-constructed. Triangulation, then, is a form of comparative analysis that explores similarities and differences between different milieus, over time, or between different modes and mediums of communication through the mix of methods of data collection and analysis. At the same time, and in an exploration for clear guidance for the design of research on social representations, triangulation has become the building block of the present study. It is to its rationale that we now turn our attention.

4.2 The public sphere according to UK experts in SCNT research: a triangulation of formal and informal settings of communication

From its inception the present study has been preoccupied with the relation between different forms of knowledge and their holders, that is, the scientific and non-scientific, scientists and non scientists. And while the epistemic relationship between science and non-science has always been a subject of intense philosophical debates through the centuries, the question here arises for an empirical investigation in the exploration of relevant representations by a specific group of scientific experts. Current debates over the public's understanding of science and scientist's understanding of the public and their interrelationship, render such an investigation topical. This is, indeed, a highly underdeveloped area, with the exception of a number of limited studies, explored in Chapter 2. However, the vast majority of such studies have, either, treated scientists' conceptualisation of the public as mere linguistic repertoires, undermining the links between meanings and their possible social functions, or approached the phenomenon of interest from a remedial agenda, identifying certain fallacies and rectifying them, further promoting political and business consultancy logics. The present study comes from a more socio-psychological framework arguing for the constituted and constitutive nature of representing, at the same time as approaching it in a disinterested attitude (Bauer & Gaskell, 1999). Moscovici's theory of social representations, as discussed in chapter 1, provided a solid basis for such an endeavour.

It is in social milieus, that is, groups of people bound together in a common project where social representations are formed and transformed. Bauer and Gaskell's (2002) proposed model for the study of the relationship between science and non-science, as discussed in Chapter 3, forms a useful resource in identifying appropriate segments for the elaboration of analogous studies. Thus, the purpose of the present study is the exploration of social representations of the public sphere, that is, public perceptions, media coverage and regulation, by UK experts in SCNT research. More specifically, an attempt is made to provide a final typification of meanings, their interrelationship and their possible functions. Relevant questions include: 'How do UK stem cell scientists anchor and objectify the public sphere?' (or the 'what' of representation as per Jovchelovitch, 2007), 'what types of communication and interaction between science and the public sphere do these meanings prioritise? (the 'how' of the representation), 'what are the possible functions of these meanings?' (the ‘why’ and ‘what for’ of the representation). At the same time, the meanings are linked to the people who hold them, in relation to their standing, in a specific debate, regarding not only the status of SCNT research but the overall relationship between science and non-science. Indeed, knowledge of something by someone is constructed through the employment of different symbolic processes. However, knowledge of something by someone, and in our case knowledge of the public sphere, is a resource in debates about the legitimation and reification of certain scientific developments. Moreover, and more to the point of public opinion studies, much theorising takes place, either at the macro-structural level (e.g. models documenting the relationship between mass opinion, mass communication, and policy making) or at the micro-individual level (e.g. experimentation in political cognition). The adopted operational definition of the public sphere mediates between these two levels by pointing to the way the voices studied conceptualise how public perceptions relate to public policy and media coverage or how media coverage relates to public perceptions and policy, and finally, how policy is related to media coverage and public perceptions (Herbst, 1998; Bauer & Gaskell, 2002). In a nutshell, the research illuminates, at one and the same time, objective (how the world is), as well as, subjective (who am I), and intersubjective (who the other is) elements of representing.

In an attempt to maximise its interpretative power, as per social representations research tradition, the present study employs triangulation in a threefold manner: in terms of theory, types of data documented, and methods of analysis.

Triangulation of theoretical backgrounds. The choice of a certain theoretical framework holds grave importance for the conceptualisation of the phenomenon under study, highlighting some aspects of it while ignoring others (Gervais et al., 1999). Social representations theory offers an alternative to more individualistic approaches that have dominated social psychological research for years (Farr, 1993; 1996). Suffice it to say that the theory surpasses the notion of the ‘unthinking mind’, linking object with subject, the social with the individual, the past with the present and the future. Social representations are always representations of something by someone at a specific place and time. Concurrently, they provide the symbolic material for the elaboration of a variety of functions, either mythical or ideological, forming identities or enabling resistance (Bauer & Gaskell, 1999). To further enrich the main theoretical framework, while assisting in the operationalisation of the processes generating social representations, namely anchoring and objectifying, metaphor theory, as per Lakoff and Johnson (1980), and argumentation theory, as per Toulmin (1958) and Billig (1996), were also employed. Liakopoulos' (2000) research on the social representations of biotechnology in Britain constituted the point of departure, with the intention of further extending this perspective (see Chapter 1). The relationship between theory and method has always been an important topic of debate, exemplified mostly with the distinction between the rationalists and the empiricists. However, I tend to agree with Farr (1993) that theory can help guide the design of a research so as to better account for the phenomenon under study.

Triangulation of different types of data. Social representations tradition identifies a series of modes and mediums in which meanings and significations over a particular object are to be located. In an effort to provide a paradigm for relevant research, Bauer and Gaskell (1999) identify habitual behaviour, individual cognition, formal and informal settings of communication, as the four modes of representations, while bodily movement, words, visual images or non-linguistic sounds as the four mediums of representations. Metaphors and arguments, that is, words, regarding the public perceptions, media coverage and regulation of SCNT research constitute the medium under focus in the exploration of the social representations of the public sphere among UK stem cell researchers. However, other crucial questions arise: in which types of modes are those mediums to be explored? And how is one to select such modes so as to minimise the possibility of empirical absences as a consequence of methodological shortcomings? (Gervais et al., 1999). In order to tackle these issues, the present research employs triangulation of data from formal (elite media) and informal (individual, semi-structured interviews with scientists working in areas relevant to SCNT research) settings of communication that make reference to the public sphere, linking in this way, media and individual (individual cognition) representations. On the whole, it is sociogenetic and ontogenetic aspects of representations that are comparatively analysed.

More specifically, there have been a variety of approaches in the study of media material, each illuminating specific aspects of media coverage. Thus, news items can be seen as an individual product reflecting the values and aspirations of a particular journalist, as an organisational product shaped by the modus operandi of a particular profession, as an activity aiming at influencing and shaping public opinion, or as a canvas where larger societal problems and values are portrayed (Einsiedel &

Coughlan, 1993). The adoption of each approach separately or in combination raises different questions that need to be tackled.

From the social representations perspective, analysis of media coverage is based on the assumption that one needs to account for the 'environment' or 'culture' in association with cognition and individual opinions (Farr, 1993). Numerous studies, among which Moscovici's (1961/1976) seminal work on the social representations of psychoanalysis in French society, Gaskell and Bauer's (2001) work on the social representations of biotechnology across EU countries, and Gervais' (1997) thesis on the representations of nature in Shetland, have employed the analysis of printed press material. However, even though Moscovici's initial work was born out of a 'diffusionist' or 'agenda-setting' conviction of the power of the press as a producer and disseminator of social representations prior to them being part of individual representations, recent work has moved in a different direction (Gervais, 1997). Thus, informed by current developments in media analysis, most notably constructivist accounts that stress the complex relationship between media stories and different social groups, and consequently the dynamics of the different denotational and connotational meanings of a social object, current social representations research seeks to illuminate the dynamics of the interaction between media and individual representations (Bauer, 2000). As Gamson and Modigliani (1989, p. 2) assert "media discourse is part of the process by which individuals construct meaning, and public opinion is part of the process by which journalists and other cultural entrepreneurs develop and crystallise meaning in public discourse."

That stated, a specific type of media coverage is at the focus of the present research that of highly specialised scientific journals. It is the characteristics of the empirical problem at stake that guided the selection of scientific journals as sources of data. Firstly, scientific journals constitute an integral component in human SCNT research as a science in the making. They are a source of legitimation and credibility of both scientific ideas and scientific research groups that construct these ideas (Latour & Woolgar, 1986). They play a crucial role in the dissemination of scientific developments overcoming spatial constraints and giving a sense of belonging to a global scientific community. Secondly, they are a forum of discussion and communication among researchers of the main technical and public issues regarding a given scientific development. Thus, scientific journals are a means of exchanging technical information with regard to the latest advances in scientific research, and, depending on the journal, following major developments in public perceptions, media coverage and regulation of science and technology. Lastly, an overview of the relevant literature pointed to a lack of empirical consideration of this type of media by prior research, further influencing such a choice.

The analysis of material from scientific journals is thought to provide access to the sociogenetic process of social representations. The design adopts a longitudinal approach and incorporates the analysis of the scientific coverage of the debate from 1997 to 2005, for it is at a time of controversy that social representations are best explored (Moscovici, 1984). Therefore, the study of scientific journals will illuminate the historical aspects of the representations of the public sphere assisting in the identification of possible changes in their structure and functions across the years (Duveen and Lloyd, 1990; Bauer & Gaskell, 1999). Moreover, the non-reactive nature of these data helps to ensure that the social representations which emerge from the analysis, do not change by virtue of being investigated (Farr, 1993). The accumulation of data from scientific journals is thought to further assist in the next stage of the research, that of selecting interviewees and of forming the interview topic guide, by providing information about the main actors and issues discussed at a collective level. More importantly though, their analysis is thought to further enrich the interpretative power of the present research by offering an alternative for comparison to the data that emerges from individual interviews. Is there parity with regard to metaphors and arguments about the public sphere in relation to human SCNT research in both formal and informal settings of communication or are specific presences and absences reported? If the latter is the case, how are those differences to be accounted for? Are they understandable in terms of time or spatial constraints or both? That is, are specific meanings and themes prioritised in specific years or countries? Such considerations are mostly topical in the study of social representations, where one cannot anticipate *a priori* what is to be found. Overall, no causal relationship is adopted, rather, representations in scientific journals are seen as being engaged in dialogue with individual representations, the one feeding the other (Gervais, 1997).

The following table provides a schematic presentation of the operating principles in terms of modus operandi, main achievements and functions of scientific journals.

Table 4.1 The operating principles of scientific journals

Modus operandi	Agenda: driven by an ethos of contribution to scientific progress Process: rigid, peer-review process People: highly expert and well-connected personnel
Achievements	Dissemination Education Mobilisation Agenda setting
Functions	Legitimation Credibility Communication Information Sense of membership Linking different domains of scientific action

An extensive discussion on the use and interpretation of interview data has, over the years, been taking place. Some of the most frequently debated issues are 1) the relation between interviewees' accounts and the world they describe, and 2) the relation between interviewee and interviewer (Silverman, 1993). Both issues have important ramifications, not only on interview procedure but also on the interpretation of data derived. Thus, from a positivistic point of view, interview data are treated as 'facts' about the world. The belief in a reality 'out there' calls for unbiased and structured methods in an attempt to objectively bring out information about this reality. The social representations perspective takes a more constructivist stand. Here, the task of the analyst is to be aware of her/his dual role as both an observer and a participant and to treat interview data not as facts about the world but rather as socially constructed versions of reality (Farr, 1993). As a result, there is a preference for less structured interviews in an attempt to avoid imposing the researcher's own representations on the persons being interviewed. The interviewer is allowed to explore from a list of predetermined themes, at the same time as, the interviewee enjoys the freedom of raising important issues not contained in the schedule (Silverman, 1993). While Herzlich (1973, p. 13) argued for open interviews as the ‘only technique suitable for the collection of data’, social representations researchers often couple the method with other less reactive methodological approaches, as does the present study.

Individual interviews with UK stem cell scientists are considered to provide access to the ontogenetic process of social representations, and more specifically, to how they become psychologically active for individuals (Duveen & Lloyd, 1990). These kind of data, however, are not to be treated as a way of individualising social representations, depriving them of their social nature, for knowledge at all levels is, first and foremost, social and historical (Gervais, 1997).

That stated, social sciences textbooks are by and large preoccupied with extending the logic of representative sampling, where the researcher is interested in the description of the distribution of already known attributes in social space. However, the rationale of qualitative research, and indeed research on social representations, goes along different lines, where the task is to provide a typification of unknown attributes in the phenomenon of study (Bauer & Aarts, 2000). It is this difference that renders the use of the representative sampling rationale as inappropriate in the present and other research situations. Identifying this inconsistency, Bauer and Aarts (2000) have retrieved the idea of ‘corpus construction’ from the field of linguistics, offering an interesting alternative for qualitative research. Although the term is not as yet widely used in social sciences methodology, it was found to be a useful tool guiding the selection of data in the present study.

Thus, the sources of investigation were selected in such a way so as to maximise the varieties of the phenomenon under study. In each case, the characterisation of formal and informal contexts of communication and their varieties preceded any other activity. However, I tried to keep an open mind by considering other sources of data not accounted for initially. This will be made explicit in the next section. Overall, a stepwise procedure was followed: selecting preliminary data, analysing the variety and extending the corpus of data until no additional variety could be detected (Bauer and Aarts, 2000).

Although no attempt was made to systematically account for possible microgenetic aspects of social representations, it needs to be stated that in the course of the study, I had the opportunity to attend several public meetings held in London, between 2003 and 2005. These were events organised by the scientific community (mainly the Science Museum and the British Association for the Advancement of

Science) whose purpose was to provide a setting where members of the public could directly discuss and debate with experts (such as biologists, geneticists, ethicists, science journalists) the ethical, economic, and scientific ramifications of research developments, either generally in biotechnology or more specifically in human embryology. In some cases, these events granted me access to interviewees, while overall, they served as a useful place where I myself, could discuss and exchange information about important developments in the human SCNT debate. However, since the events were not systematically explored, mainly due to time and budget constraints, any observations made are left in the background and will not be accounted for.

Triangulation of different types of methods. The overall design of analysis follows a 'typification' logic, so far as it tries to reduce the phenomenon under study to a manageable set of data. Thus, classical content analysis is employed so as to analyse those data from the elite media that highlight important dimensions of the public debate relating to its salience as a topic for discussion, and structure. Metaphor and argumentation analyses are used for the study of data derived from formal and informal settings of communication and cognition. They both follow a typification rationale, identifying different types and qualities of metaphors and arguments used to talk about the public sphere in the scientific journals and in the individual interviews. Analysis is further assisted by the application of two software packages: SPSS and Atlas/ti.

Table 4.2 gives an overview of the rationale of triangulation. In the investigation of the public sphere among SCNT experts, data referencing the public sphere are analysed in such a way so as to provide a final typification of anchoring and objectification processes at both the collective and the individual level. At a later stage, results are merged together in order to identify the social representations of the public sphere among UK stem cell researchers, in terms of their contents, possible structures and functions (see also Chapter 1).

Table 4.2 Investigating the public sphere among experts

	Formal Communication	**Informal Communication**
Data	Scientific articles	Individual interviews
Methods of analysis	Content analysis Metaphor analysis Argumentation analysis	Metaphor analysis Argumentation analysis
Rationale	Typification of contents at the collective level Sociogenetic aspects of representation Comparison and final integration with data from informal communication	Typification of contents at the individual level Ontogenetic aspects of representation Comparison and final integration with data from formal communication

4.3 Selection of scientific journals

Social representations are not the product of an individual mind, isolated in its own privacy, but rather the cumulative outcome of a constant process of communication, exchange, and interaction between members of a certain community and among different milieus. As a result, the analysis of metaphors and arguments about the public perceptions, media coverage and regulation of SCNT research in scientific articles constitutes an important counterpart to the data derived from individual interviews with scientists, further adding to the overall interpretative power of the present study. Thus, their consideration assists in the identification and typification of main anchors and objectifications of the public sphere existing at the collective level, at the same time as it offers a safe comparison with data from informal settings of communication, accounting for any possible discrepancies or similarities. At a second level, and while linking contents to people who share them, they further contribute to the identification of different interlocutors and their various positioning vis-à-vis other interlocutors illuminating the reasons guiding the choice of certain metaphors and arguments, thus linking meanings to their functions. Lastly, they provide an indispensable resource in the clarification of the historic aspects of representations, by assisting in the identification of possible shifts across years and countries.

However, where is one to look for what is yet unknown? Indeed, in an exploration for relevant symbolic spaces, a long list of scientific journals was produced. Some of them preserved a unique focus on SCNT and associated research (like for example '*Cloning and Stem Cells*' or '*Stem cells and Development*' or '*Tissue Engineering*'), while others had a more paramount interest in that they covered developments in specific scientific fields (like for example '*Cell*' or '*Journal of Cell Biology*') or across domains (like for example, '*Nature*' or '*Science*'). Bauer and Aarts' (2000) idea of 'corpus construction' constituted a useful resource guiding relevant choices. Thus, selection was made in such a way so as to be both specific and general; that is, technical enough for the purposes of the present study (elite media), yet exhaustive enough so as to maximise the possible varieties of the phenomenon under study in terms of meanings, as well as, voices reported.

Two scientific journals constitute the focus of the present analysis, *Nature* and *Science. Nature* is a UK based journal, published by the Nature Publishing Group since 1869. It comes out every Thursday with the exception of the last Thursday in December. It is a journal of international status publishing papers from any area of research with great impact potential. While implementing the idea of triangulating relevant data from both formal and informal settings of communication, the choice of a non-UK publication was also considered vital. Hence, although the scope of the present research limits its focus to the UK context, as exemplified also by the selection of UK-based interviewees, science meets no temporal or geographical constraints. As a result one should keep in mind that scientists are likely to receive information from a number of resources far exceeding their geographical location. Thus, *Science*, a US based journal established in 1880 by Thomas A. Edison and currently published by the American Association for the Advancement of Science, was chosen. It, also, is published weekly, every Friday, and as is the case with *Nature*, has an interest in research from any scientific discipline whose importance extends well beyond the confines of its specialised field.

The choice of *Nature* and *Science* as representatives of a long list of scientific journals was dictated by several reasons.

Firstly, both are considered as the most prestigious multidisciplinary science journals. Their importance stems from their circulation figures and the calculation of their impact factor. The impact factor is a statistical formula that indicates a journal's relative importance compared to other journals in the field, by calculating the frequency with which the 'average article' in a journal has been cited in a particular year. Thus, the most recent research conducted in 2002 by BPA Worldwide indicated that the average circulation of *Nature* was 64,361, comprising 13,246 institutional and 49,676 personal subscribers (Nature, 2003). The overall worldwide receivership of the journal for that year, along with the number of Internet users having visited Nature's website came to a total of 683,516. In the same year, the average circulation of *Science* was reported by BPA Worldwide as 143,569 including 127,132 individual subscribers and 15,524 institutional subscribers (Science, 2003). Tables 4.3 and 4.4 present some additional information with regard to *Nature* and *Science* readers' profiles. As it is shown, life scientists (including molecular biologists, cell biologists and biotechnologists) constitute an important part of the overall readership of both journals. In terms of the impact factor, it was found that for 2002 *Nature* recorded its highest ever impact of 30.4 points, placing it ahead of *Science* by almost 4 points.

The second reason that prompted the choice of these two journals is related to their structure. Both journals contain news, commentary, correspondence and editorial sections providing a forum for discussion of technical issues, as well as, issues pertinent to the public sphere. The similarity in structure affords a safe condition for any relevant comparisons between the two journals.

Thirdly, they have both played an important role in the human SCNT debate, for it was through their pages that news about the birth of Dolly in 1997 (published in *Nature*, Wilmut et al., 1997), and the first isolation of human embryonic stem cells in 1998 (published in *Science*, Thomson et al., 1998), reached specialist audiences and media reports.

Overall, both journals constitute appropriate symbolic spaces from which to draw comparative data to the study interviews. While being highly popular among life scientists, they are also relevant enough to SCNT and associated research, yet sufficiently general, offering the possibility to maximise the varieties of the phenomenon under study in terms of voices reported and their corresponding positioning regarding the relationship between science and the public sphere. In this way, the criteria of 'corpus construction' of qualitative research, as specified by Bauer and Aarts (2000), is thought to be met.

Table 4.3 *Nature's* worldwide reader profile for 2002

Frequency %	Reader area of research
6%	Agriculture
4%	Astronomy
30%	Biochemistry/biophysics
15%	Bioinformatics
23%	Biotechnology
17%	Cancer/oncology
28%	Cell biology/development
13%	Chemistry
10%	Clinical medicine
12%	Computer science
10%	Earth science
13%	Ecology/evolutionary biology
16%	Education
12%	Environmental science
24%	Genetics
14%	Immunology
4%	Legal and financial
6%	Materials science
7%	Mathematics
13%	Microbiology/Virology/Infectious disease
38%	Molecular biology
17%	Neuroscience
6%	Oceanography
4%	Other biology
10%	Pharmacology
11%	Physics
5%	Plant science
13%	Other

(Source, *Nature*, 2003, the percentage total is more than 100% due to multiple choices)

Table 4.4 *Science* circulation figures for 2002

Frequency (%)	Reader's profile
88%	Individual subscribers
80%	U.S. subscribers
58%	Individual paid life science subscribers
49%	Research/research & development subscribers
20%	Non-U.S. subscribers
15%	Baccalaureate and Master's degree subscribers
11%	Library and institutional subscribers
4%	Postdoctoral subscribers

(Based on *Science*, 2003, the percentages' total is more than 100% due to multiple choices)

4.3.1 Material selection by keywords

The search of articles was conducted on-line by making use of the relevant archive search services available on each journal's webpage. The search words and phrases were: *cloning, clone, clones, cloned, cell nuclear replacement, somatic cell nuclear transfer, stem cells*. The focus of the search was placed on articles published in the sections of 'Editorial', 'News', 'News in brief', 'News features', 'Correspondence', 'Commentary', 'Words' and 'Books and Arts' for *Nature*; and 'Editorial', 'News of the Week', 'News Focus', 'Letters', 'Books et al.', 'Random Samples', 'Science Scope' and 'Policy Forum' for *Science*. It is in these sections where scientific developments are discussed in relation to major technical, economic, political and social issues. Most of the news sections are covered by *Nature* and *Science* in-house writers, while the correspondence and commentary sections are a space for the journals' readers to express their own views on a given issue. Overall, the search covered 9 years of reporting from 1st February 1997 to 30th of October 2005. This is to identify overall trends and patterns of the scientific coverage of the public debate that occurred after the announcement of the birth of Dolly in February 1997 until the time of the conduction of the individual interviews with scientists. Having collected the articles a first 'read through' of the text was needed to deselect articles that came up containing the search words without however being relevant to SCNT technology. For instance there were articles referring to nuclear power or cell regulation that were irrelevant to CNR research. Articles containing the search word ‘stem cells’ without however referring to SCNT were likewise excluded. A second reading followed identifying articles discussing public perceptions, media coverage and the regulation of CNR. A decision was also made to retain those articles discussing public developments relevant to animal cloning not only as a way to further extend the corpus of data accounting for the maximum of possible varieties, but also because it was soon realised that relevant discussions and arguments unfolded in parallel. In the same frame of mind and chronologically matching the period of the interviews, the second step was performed resulting in the identification of an overall **461** articles having at least one reference to public perceptions and/or media coverage and/or public policy of SCNT research from February 1997 to October 2005 (226 *Science* articles and 235 *Nature* articles).

4.3.2 Methods of analysis

As already stated, the analysis of the material is based on a typification logic. While classical content analysis is employed in order to document important information about the salience and the structure of the debate as covered by the two journals, argumentation analysis and metaphor analysis are performed so as to identify different types of metaphors and arguments used to anchor and objectify the public sphere.

4.3.2.1 Content analysis

Content analysis can be seen as situated at the crossroads of statistical formalism and qualitative analysis (Bauer, 2000). While providing a means for numerical descriptions of several features of the text corpus, at the same time, it invites the researcher to reflect upon ‘kinds’, ‘qualities’ and ‘distinctions’ in the text prior to quantification. According to Farr (1993), the domination of the individualistic tradition of social psychology resulted in socio-psychological research being confined to the laboratory and the consequent undervaluing of content analysis as a method of analysing socio-cognitive phenomena. Recently, and with the advent of social representations theory, importance has been reinstated in this form of analysis.

In the present study content analysis of the articles is performed so as to document issues relating to: 1) basic information about the article (item number, name of journal, date); 2) salience of the public sphere (size, journal section, news format, author,); 3) identification of the public sphere (public themes, focus, location and type of cloning); 4) arguing about the public sphere (claimant[5], public arena claimed, location of public arena claimed). The use of metaphorical concepts is also documented (string code), while information regarding the metaphor user and the arena to which the metaphor applies are likewise coded. The coding frame underwent several transformations and was piloted before devising the one used on the full corpus (Appendix 5).

4.3.2.2 Metaphor analysis

Metaphors employed to describe public perceptions, media coverage and regulation of SCNT constitute the focus of analysis. The procedure is unfolded in two steps and it draws heavily from Liakopoulos (2000):

1) *Identification of metaphors*

The basis for the identification of metaphors in the text lies in the definition of non-literal speech as a form of wording intended to mean something other than what is exactly said. However, analysis of relevant literature indicated that there are other tropes of non-literal speech, from which metaphor needs to be carefully distinguished. The purpose thus, is to provide definitions and examples of these related tropes in an effort to secure a reliable process of identification, after Liakopoulos (2000):

- **Irony**: an utterance used to express the very opposite of what is said. For example, to say ‘what lovely weather’ to refer to a dark and rainy day is ironic. The difference between metaphor and irony is the way non-literal meanings are used. Thus, although ‘what lovely weather’ expresses something else than what is said, it echoes a probable reality under other circumstances, something that cannot be said for metaphor. Hence, to say that somebody is a ‘lion’, or ‘regulation is battle’ can never assume a literal meaning.
- **Hyperbole**: an utterance that contains exaggeration beyond what is really possible. For example, to say ‘I told you a thousand times’ is a

[5] In cases where the claimant or the user of metaphor was a scientist, a string code documented his/her specialisation

hyperbole for it is impossible to believe that someone has repeated the same word a thousand times.

- **Dead metaphor**: figures of speech, which, although deriving from metaphorical concepts, have lost their value as metaphors. For example, 'the law endangers current research' is an instance of a dead metaphor. A law is not a living entity able to 'endanger' anything. Although originating from metaphorical concepts, it is not perceived as a metaphor for it is quite common to use active verbs in association with immaterial concepts.
- **Simile**: an utterance describing similarities between different entities. For example, to say that somebody 'sits on his chair like a king on his throne' is an instance of simile. Simile is different to metaphor for it describes literal similarity between two entities (in the example actual posture observed and that of a familiar photograph or a painting). Metaphors, on the other hand, offer similarities between concepts (a man and a lion). A useful way to distinguish simile from metaphors is the use of words such as 'as' or 'like' in expressions of the former.
- **Metonymy**: while metaphor is used so as to understand a concept in terms of another, metonymy uses one entity to stand for another. For example, to say 'I bought a Picasso' is to refer to the qualities of a painting by reference to the painter.

At the completion of this step, and after having demarcated metaphor from other tropes of non-literal speech in the text analysed, a list of **269** metaphors, used to refer to the three arenas of public sphere, was produced (as has been already mentioned, metaphorical concepts were documented in the form of a string variable).

2) Identification of superordinate categories

Following the identification of metaphors, the next step is to detect similarities between the metaphors found so as to classify them under a common superordinate category. This provides a way of understanding and explaining the intrinsic associations that metaphors create. In this way, light is shed on the categorisation function of anchoring.

4.3.2.3Argumentation analysis

The analysis of arguments was conducted by employing Toulmin's theory of argumentation. As it has already been discussed in Chapter 1, Toulmin's (1958) theory of argumentation is one of the most important in the tradition of informal logic for it is the only who has managed so far to offer a workable definition of the argument and its premises, providing a clear methodological approach for the analysis of everyday discourse (Brockriede & Ehninger, 1960; Liakopoulos, 2000). As such, it has been adopted in a variety of research projects, among which in studies for the analysis of science argumentation (Ball, 1994), the analysis of children's argumentation (Bernardi & Antolini, 1996), of arguments in organisational settings (Putnam & Geist, 1985; Simosi, 1997), of media effects (Chambliss & Garner, 1996), and the analysis of argumentation in formal debates (Vári, 1991; Liakopoulos, 2000).

In the present research, argumentation is explored in articles from scientific journals, which focus on public perceptions, media coverage and regulation of SCNT. The analysis follows a two step-procedure (for a more elaborate description of the procedure followed, please see Appendix 7):

1) *Identification of argumentation structure*

The first step employs the reconstruction of arguments as identified in the articles. That is, identify those elements of the argument that function as a claim, data, warrant, backing, or rebuttal, based on what is explicitly said. In doing so, a small summary of the main points of argumentation is produced enabling the identification of the argumentation structure. Many scholars employing Toulmin's model have criticised him for failing to successfully demarcate backings from warrants and data from warrants making it difficult for the analyst to distinguish the role of relevant statements (Hample, 1992; van Eemeren et at., 1987). In order to clarify this point, and based on Toulmin's notion of context-effects, other scholars have found it appropriate to contextualise their argumentation by devising their own definitions of the argument parts (Bernardi & Antolini, 1996; Simosi, 1997, Liakopoulos, 2000). This was found to be a helpful way in clearly identifying the structure of the arguments while increasing the reliability of the analysis.

In the present research, argumentation develops in the context of a formalised debate in which participants offer clear and articulate backings for their claims about public perception, media coverage and the regulation of CNR technology. The argumentative parts are defined as follows:

Claim (*So*): The organising theme, the conclusion, the point of view that the claimant tries to make about people, media, regulation. This is the outcome of the argument. The purpose is to account for all the claims made in a given article concerning the three arenas of the public sphere. Some claims come as a form of evaluation of the public sphere; others stress a mode of relation with the public to be adopted, while others still, express the effect of public engagement with science on science. Examples of claims include:

'People do not understand reproductive cloning and what it really is.'

'Scientists and those who are interested in the ethical consequences of advances in science must strive to point public debate toward what is practical and possible as well as what is plausibly moral.'

'It is important that the current confusion about these issues does not lead to a ban on the production of certain types of human cells growing in Petri dishes.'

Data: An utterance which constitutes the evidence at the claimant's disposal. It may refer to past events or current situations, actions or opinions. Examples of data are:

'*Much confusion has arisen in the public, in that cloning seems to have become almost synonymous with somatic cell nuclear transfer.'*

'*Some companies are touting the current feasibility and safety of cloning people, and are moving ahead with volunteers.*'

'*Widely publicized examples of scientific dishonesty, like the Schön case, or unacceptable scientific practice, like the Lomborg affair or repeated unverified claims of human cloning, are not only misleading but seriously erode the public's trust in science.*'

Warrant (*because*): It is the operational name Toulmin gives to that part of an argument which authorises the mental 'leap' involved in advancing from data to claim. The distinction between data and warrants of a particular argument can only be achieved by examining how the particular claimant has chosen to use the information which s/he has included in her/his argument. If a statement is used as part of the definition of the situation at hand (presentation of current public concerns, media coverage, regulation, current science communication), the statement is considered to be part of the data of this particular argument. On the contrary, if the claimant has used it as a means to support her/his main claim (i.e. evaluation or mode of action), then this statement has taken the role of the warrant in the particular argument. The purpose is to focus on the intention of the arguer, how she/he wanted to use this information. Examples of warrants are:

'*Science-based regulatory agencies have learned that stakeholder consultation makes all the work going better.*'

'People have a right to know what they consume and have a right to choice.'

'It takes a focused effort to explain to the average citizen that therapeutic cloning does not entail making a copy of another person and that what many find abhorrent (including ourselves) is reproductive cloning.'

Backing (*since*): An utterance which refers to an additional assumption, used as a means of further supporting the warrant in the argument. Backings could be claims of their own. They usually present deeper ideas and values about science, the public, media and regulation. Backings include statements such as:

> *'It is not the job of scientists to decide what research should follow, but it is the job of society to decide what scientists should be permitted to do.'*
>
> *'We do believe that accurate language will result in clearer debates and will not so routinely mislead the uninformed.'*
>
> *'As science encroaches more closely on heavily value-laden issues, members of*

the public are claiming a stronger role in both regulation of science and the shaping of its research agenda.'

Rebuttal (*unless*): Rebuttals indicate conditions under which the general authority of the warrant is to be set aside. These are statements that 'cancel out' the argument and are stated explicitly by 'unless'. For example:

'Unless they are devoted followers of a religion which has a very specific view on the matter.'

Another hurdle associated with Toulmin's model is the dilemma the analyst faces with the treatment of the implicit parts of the argument. Relevant work has shown that in everyday argumentation it is the warrant and, most frequently, the backing that is unexpressed (Simosi, 1997). Scholars like Freeman (1991), alert the analyst to the dangers of imposing their own thoughts and values on the phenomenon of research by trying to fit Toulmin's model on the research data. In this approach it is only what is explicitly stated that is taken as part of the argument. However, it is in the warrants and backings where, according to Toulmin, the deepest values and thoughts of a community are to be found. Social representations research has also argued for the need to account for the crucial role of empirical absence, often thought to reveal 'taken for granted' dimensions of the phenomenon under study (Gervais et al. 1999). Early on in the analysis of the data, I too was faced with this dilemma. In order to avoid a strongly subjective reading of the data, it was decided to follow a third less 'rigid' approach. The missing elements were inferred (I kept a list of all the 'missing' statements) whenever they were safely deduced from the expressed elements (data or warrants). In cases where the content of the missing element was less obvious to identify, making the danger evident of imposing my thoughts and values, I refrained from this procedure.

The completion of this first step of the analysis concluded in the identification of a total of **410** arguments made about public perceptions, media coverage and the regulation of SCNT technology in the *Nature* and *Science* articles analysed. Information regarding the structure of each argument was also generated.

2) Classification in argumentative types

The last step involves the identification of different types of arguments based on the claims and their supportive elements. The notion of type of argumentation originates from the fact that every debate is structured around some general points which guide and organise the thinking process (Liakopoulos, 2000). Each argument is grouped under its corresponding type.

The data from argumentation analysis were later integrated with those relating to the source of each argument and to the arena to which each argument was addressed, as coded in content analysis.

4.3.2.4 Reliability of content and argumentation analysis of formal communication data

Reliability estimates are one means researchers have at their disposal to assess the overall quality of the various measuring instruments employed in their studies. The core idea of reliability could be summed up by the word ‘consistency’. Across time researchers have conceptualised consistency in many forms depending on the question of interest. Thus, in some studies reliability measurements are employed to evaluate consistency across repeated testings, or to assess internal consistency of inventory items, or still in others to estimate the degree of agreement among different raters. It is in this latter context that the idea of reliability has been used here (Huck, 2000).

Hence, a second coder was employed so as to estimate the degree of interrater consistency of the coding schemes used for both content and argumentation analysis. The second coder was an academic with experience in media studies. A careful procedure was followed in order to familiarise her with the rationale of the study as well as the coding frames adopted and their application in the analysis of the relevant data. Consequently, the second coder received information regarding the underlying principles of the study and its interest in providing a typification of elite media coverage of cloning related public developments by triangulating data concerning patterns of coverage, metaphors and arguments used. Extensive material was also provided in relation to SCNT research; its technicalities and different applications. The coder was also familiarised with Bauer and Gaskell’s (2002) proposed framework for conducting similar social research projects and the operationalisation of the public sphere as public perceptions, media coverage and regulation.

With regard to the content analysis procedure, the second coder was given enough time to acquaint herself with the coding frame and its rational while any difficulties met were thoroughly discussed. A basic set of instructions was provided to enhance the understanding of the coding frame devised and its use (see Appendix 13). Careful training in the logic of argumentation analysis also took place. At first, the coder was introduced to Toulmin's proposed model for argumentation analysis and his respective definition of the argument's parts. Considering the various difficulties met by researchers so far in the implementation of Toulmin's approach, as aforementioned, and in order to better clarify the coding scheme adopted in the present study, the second coder was familiarised with the definition of argumentative premises, as described in the above section. Thus, the coder received clear information as to the way of identifying and differentiating between data, warrants, backing, claims and rebuttals in the context of the present research topic. Regarding cases in which specific parts of the argument were missing, the coder was asked to deduce them only when they could be easily inferred by what was explicitly stated in the text. Thus, a list of inferred items was produced. This was mainly done to enhance the next step of the analysis, which related to the identification of the overall type of the argument.

Overall, inter-coder reliability of content and argumentation analysis of formal communication data was assessed on the basis of a sample of 10 per cent of the material coded (i.e. 46 articles). The criterion for the estimation of the inter-coder reliability adopted was that of percentage agreement. Percent agreement is one of the most popular coefficients used for the estimation of interrater reliability (Neuendorf, 2002). Its conceptual formula could be represented as:

$$\mathrm{PAo} = \mathrm{A}/n$$

where PAo stands for the 'proportion agreement observed', A is the number of agreements between two coders and *n* is the total number of units coded by the two coders (*ibid*, p.149).

For content analysis, the average reliability between the two coders measured as percentage agreement was 0.86, ranging from 0.61 to 0.99. The overall interrater reliability value for the identification of argument parts was estimated as 0.89 with individual part's values fluctuating between 0.72 and 0.96. Moreover, the percentage agreement in the coding of the 'argumentation type' was 0.86.

The above results add force to the quality of the coding schemes and procedures adopted pointing to acceptable values of consistency among the coders.

Especially regarding argumentation analysis, this is in accordance with prior studies that have also implemented Toulmin's model in their analysis of argumentative material (Liakopoulos, 2000; Simosi, 1997). Both scholars argue for the importance of introducing the second coder to a) the rational of the study, b) the phenomenon of interest, c) the definition of research concepts and d) the coding strategy followed. Appendix 14 provides clear and fuller information regarding the reliability measures of content and argumentation analysis of articles.

4.4 Selection of interviewees

From the beginning of its conception, the present thesis set to study one specific group of people, scientists involved in human SCNT research and their representations regarding the public sphere. Although highly selective, such a focus was thought to offer an opportunity to investigate the interplay between the scientific and the non-scientific in the context of a technoscience in the making. That stated, this conceptualisation does not mean to propose that experience in different scientific projects relates to different representations of the public sphere. This question and its answer exceed the purpose of the present thesis. Rather, this choice mainly reflects an attempt to investigate one group of scientists working in a controversial arena, while ensuing that the relevant data is contained at a manageable size. Taking into account the lacuna in relevant social representations research, such an attempt was considered topical. However, a crucial question soon arose: considering new social movements, pressure groups, advisory committees and all these different hybrids, where is one to draw the line before falling into the simplistic dichotomy of lay versus expert, which was the original intent of this investigation? (Burningham et. al, 2007; Irwin & Michael, 2003; Latour, 1993). Although such a distinction assisted in the further clarification of who constitutes an expert and who does not, nevertheless it could not be surpassed. Still, it was largely treated as unproblematic by the interviewees, as will be shown later.

Who then is an 'expert'? As aforementioned, the logic guiding qualitative research is not that of representativeness but of typification, that is, to identify the variations of the phenomenon under study. In this context, the task of the researcher is to maximise the possible varieties of the phenomenon investigated by maximising the criteria guiding the selection of her/his interviewees. While some observations regarding the criteria of selection were made *a priori*, they were continually updated throughout the study. In general, differences amongst subjects were thought to vary according to the degree of relevance to human SCNT research, the degree of experience in the field, the type of institution, and gender[6].

A variety of scientists whose work is relevant to human CNR research and applications was identified, generally comprising three broad groups of people: 1) those directly involved in somatic cell nuclear transfer (SCNT) research for the purposes of extracting human embryonic stem cells; 2) those engaged in human embryonic stem cell research by using other methods; and 3) those involved in animal SCNT research for the purposes of advancing the efficiency of the technique for both animal and human applications. It was hypothesised that these different ways of relating to CNR research were connected with different experiences of being under 'siege' and possibly resulting in different perspectives of the relationship between science and the public sphere. During the course of the investigation, and following the logic of triangulation, it was decided to include a fourth group of scientists engaged in other projects unconnected to SCNT research. The decision was made so as to further enhance the interpretative power of the present research, for it was thought to assist in better understanding possible absences and presences in the discourse of the interest three groups.

Prior research has indicated that seniority, research institution, and gender are all factors that have a considerable impact in the way scientists think about science and its relation to public perceptions, media coverage and regulation. Thus, in a qualitative study by Waterton and her colleagues (2001), structural shifts in science identified by older and younger UK scientists were associated with different degrees of reflection between these two groups regarding uncertainty, responsibility, accountability and precaution. In a similar way, research conducted by MORI (2000) detected significant differences between senior and junior UK scientists regarding

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6 An additional criterion first considered was that of the participant's role in science communication. It soon became apparent though that it was quite difficult to control for it, since some scientists had often several different kinds of relationships with people and/or media and/or regulation, while their participation in science communication seemed to be strongly determined by their respective working experience in the field. Thus it was thought to account for it with the criterion of seniority.

their participation and attitude to science communication activities. While the Waterton study (2001) identified no variations amongst UK scientists working in different institutional settings, it did detect differences between men and women scientists, with women adopting a more responsible position regarding science and its relevance to society. In an earlier survey, by Rabino (1994), with US scientists engaged in recombinant DNA research, differences were detected amongst researchers working in private industry, government research institutions and academe across a set of questions enquiring about the impact of public attention, political advocacy and litigation of their work. Overall, scientists in academe had a more favourable view of the impact of public engagement with science on their work.

While the above variables guided the selection of interviewees, various sources of information were considered in order to further familiarise myself with research groups and institutions in the U.K. Thus, an extensive Internet search was carried out in order to identify possible settings where relevant research was conducted (for example, the HFEA webpage provides a list of all the institutions currently holding a license to perform human embryonic stem cell research). Information gathered through out the analysis of *Nature* and *Science* contents proved most helpful. I also got in touch with a biologist working in the Sociology Department at the LSE to whom I am greatly indebted for granting me access to her rich stem cell archive and most importantly for our fruitful discussions.

A combination of ways was used in order to contact the interviewees. Initially, and with the help of my supervisor, I got in touch with a member of the HFEA. Through her acquaintances I was successfully secured access to two institutions engaged in human embryonic stem cell research. After that it was thanks to the participants' enthusiasm that I accessed other academic institutions were similar work was being conducted. In other instances, interviews were arranged after public meetings, mostly organised by the British Association for the Advancement of Science or through e-mails and without the use of a liaison. All interviewees were approached applying the following two-step procedure. They first received an e-mail drawing their attention to the research and informing them about the research interest, the researcher, the procedure and issues of confidentiality (Appendix 8). After a week, the scientists were again approached. With the exception of a few cases, where the contacted people did not respond, most of the scientists made prompt replies either expressing their interest to participate or not. The most frequently met obstacle was scientists' heavy schedule, a factor also having important ramifications on the conduct and duration of the interviews. Approximately, one in three people contacted agreed to collaborate.

While the majority of participants were receptive about the research, there was one case where my supervisor was asked to provide additional clarification about the research and myself. This was justified as part of the institution's policy in hosting 'outsiders' and it did add further breadth to my understanding of the modes of interaction with the public.

Overall, 18 people were interviewed over a period of 9 months, from February to October 2002. Three of the participants were directly involved in SCNT research for the purposes of extracting human embryonic stem cells, seven were engaged in human embryonic stem cell research by using other methods, five participated in research groups with an interest in animal SCNT research, while three were biologists working in areas not relevant to SCNT and human embryonic stem cell research. In terms of working experience in the field, eleven of the interviewees were senior and seven were junior scientists (Ph.D. and postdoctoral students). Since at the time of the study most of the work in animal SCNT, human SCNT and human embryonic stem cell research was undertaken in academic research institutions, there is an overrepresentation of scientists working in the public sector. While some institutions held links to the commercial sector, by and large, research was supported by governmental funding through the research councils and the Wellcome Trust. Thus, fourteen of the interviewees worked in academic institutions, and the other four in government research institutions[7]. Regarding gender, eleven of the participants were male and seven were female. It is clear that authoritative claims over the representativeness of the sample cannot be made and relevant results are to be treated in this frame of mind. This does not, however, undermine its richness, further enhanced by the consideration of some additional, uncontrolled variables. Hence, eleven of the participants had one or more experiences in formal science communication activities, either in the form of talking to the press, on television or at discussions organised by relevant bodies. Notably, two of them are amongst the most

[7] I refrain from presenting a fuller and more detailed account of the relevant institutions for this is a small and easily identifiable community. Commitment to confidentiality as was assured to the interviewees remains my first priority.

recognised science-spokespersons in the U.K. Also, at the time of the interview two held links to regulatory authorities of SCNT research, being members of respective scientific advisory groups.

4.4.1 Conducting interviews

Most of the interviews were conducted in the interviewees' office spaces provided by the institution they worked for (one was held in a hospital waiting room, one in a university cafeteria and one was conducted over the phone due to the interviewee's tight schedule). The duration of the interviews varied between 10 and 77 minutes, depending on the interviewee's time availability, with a mean of 45 minutes. All interviews were conducted individually, with the exception of one where two interviewees participated in the conversation [8] and they were all organised according to a three-phase sequence: the initiation phase, the questioning phase, and closure.

The purpose of the initiation phase was to introduce myself to the interviewee, describe the topic of my research, and to explain the principles of the conversation (i.e., the interviewee was invited to discuss about personal experiences and opinions regarding the public's engagement with and understanding of somatic cell nuclear transfer research and its human applications). Opportunity was given to the interviewee to pose any preliminary questions, while permission was requested for the use of a tape recorder acting as an *aid mémoire*. Interviewees were also reassured about issues of confidentiality. In order to establish rapport and give the participant some time to become comfortable with the situation, the discussion started by inviting each interviewee to present her/his research interests and current working projects. Next, the interviewee was invited to recall any instance of public communication of her/his work. This was proved to be a useful and non-directive way of initiating the conversation around the topic of interest while enabling me to take notes and prepare for the questioning phase.

During the next phase, and following the participant's narration, I was able to explore in more depth specific themes occurring during the narration using the interviewee's vocabulary and to expand the conversation by prompting descriptions,

[8] While the interview had already been scheduled with one of the participants, when I arrived at the interviewee's workplace I was told that one of his junior colleagues 'had offered to help me' as well. He was invited by the interviewee to join the discussion.

opinions and explanations about the ‘public’, the ‘media’ and the ‘regulatory authorities’. In each case, by following the flow of the conversation, I tried to avoid directing the interviewee, so as not to trigger rationalisations (‘this is very interesting’, ‘earlier you said that… would you mind telling me a little bit more about that?’, ‘from what you say it seems that you think that…. Am I right?’ and ‘what do you think about …?’).

In the last phase and while the conversation approached its closure I reminded the interviewees of a specific event (Switzerland’s latest referendum on stem cells, for it constituted a recent example of direct public participation in science policy) inviting their opinion about similar events. This primarily was done to bring to the surface any unexplored themes and/or to close the conversation. It soon proved to ignite fruitful discussions about the role of public opinion and its relation to formal decision-making. The interviews were closed by enquiring about any last thoughts and comments. In most cases, the conversation was over as soon as the tape-recorder was switched off, due to the interviewees’ time constrains. In the cases were ‘small- talk’ did occur, it was later documented and used in the interpretation of the formal part of the interview.

The accumulation of data from the scientific journals before the conduction of the interviews assisted to familiarise me not only with the main themes and arguments relevant to the public perceptions, media coverage and regulation of human CNR technology but also with the language used by experts (for example, I tried avoiding the term ‘cloning’ by using the scientific equivalent ‘somatic cell nuclear transfer’ prompting expressions of satisfaction by the interviewees. This was also a point considered in the latter phases of interpretation). Generally, the interview topic guide (Appendix 9) served more as a reminder of a list of general areas to cover and less as a way of structuring the conversation. In many interviews the above sequence was deviated from for the purposes of the discussion. In some cases, the interviewee was in full command of the conversation by bringing up topics, offering explanations and justifications, in others I had to stimulate the conversation in a more direct way, while still in others the interviewee’s tight schedule enabled me to cover the main topics of interest in a less exhaustive manner.

After the completion of the interview each participant was asked to fill in a form providing additional information about her/his current profession, total number of years of working experience, research interests, total number of years of science communication experience, and age (Appendix 10). All this information was documented in a separate sheet for each interview together with some personal notes about the interview, mostly in the form of advice regarding the conduct of the interviews, interesting moments before or after the formal interview, and some preliminary observations about the interpretation of data (Appendix 11).

My different roles as an LSE Ph.D. student, a non-scientist, a woman, a foreigner, and first and foremost a member of the public came to form a fascinating amalgam of reactions prompting questions about my background, my motives in doing this research, my personal thoughts and opinions about human SCNT research, its applications and its actors. While most of them originated from a genuine curiosity, I was challenged (on some occasions directly) for my social sciences background and my lack of any formal biology training. This interesting inter-play between being an observer and at the same time a participant, served in a dual way. Firstly, it further encouraged me to assume a disinterested research attitude, as specified by Bauer & Gaskell (1999), avoiding confrontation and taking a more passive stance; especially in cases where the interviewee persisted in finding out my thoughts on the ethics of human SCNT and the public debate. In such circumstances I replied that when doing research in social sciences one is obliged to be as less attached emotionally to her/his object of study as possible. Secondly, and in the interpretation phase, these moments of interaction proved to be a useful resource further illuminating my object of study. Overall, I was welcomed by the interviewees, most of whom were enthusiastic about my research, and while I did encounter some initial defensive manners, they were soon overcome in the course of the discussion. Some of the participants kept contact with me long after the completion of the interviews, not only enquiring about the progress of my research but also sending me papers of their work either to inform me about the latest developments or to ask me for a commentary. These expressions of trust and appreciation accompanied me all the way through this journey. Table 4.5 gives a general description of the people interviewed together with details regarding the location and the time of the interview.

Table 4.5 The interviewees: Who-where-when

Interviewee	Type of research	Degree of experience	Gender	Institution	Location	Date	Duration *minutes*
No1	Other	Senior	Male	Academic	Office	04/02/2005	77 min.
No2	hES[1]	Senior	Male	Academic	Office	18/02/2005	70 min.
No3	hES	Junior	Male	Academic	Office	18/02/2005	70 min.
No4	aSCNT[2]	Senior	Female	Academic	Hospital waiting room	09/03/2005	50 min.
No5	hES	Senior	Male	Academic	Office	14/03/2005	45 min.
No6	hES	Senior	Male	Academic	Office	20/03/2005	50 min.
No7	hSCNT[3]	Senior	Male	Academic	Office	29/03/2005	40 min.
No8	hES	Senior	Female	Academic	Phone interview	30/03/2005	20 min.
No9	aSCNT	Junior	Female	Governm. research institution	Office	04/04/2005	20 min.
No10	aSCNT	Junior	Male	Governm. research institution	Office	04/04/2005	40 min.
No11	aSCNT	Junior	Female	Governm. research institution	Office	04/04/2005	33 min.
No12	aSCNT	Junior	Female	Governm. research institution	Office	04/04/2005	30 min.
No13	hSCNT	Junior	Female	Academic	Office	14/04/2005	50 min.
No14	hES	Senior	Female	Academic	Office	19/04/2005	10 min.
No15	hES	Senior	Male	Academic	Office	16/06/2005	56 min.
No16	hSCNT	Senior	Male	Academic	Office	16/06/2005	62 min.
No17	Other	Junior	Male	Academic	Cafeteria	11/10/2005	59 min.
No18	Other	Senior	Male	Academic	Office	25/10/2005	23 min.

[1]human embryonic stem cells
[2]animal somatic cell nuclear transfer research
[3]human somatic cell nuclear transfer research

4.4.2 Analysis of interview data

Metaphor and argumentation analysis were employed for the identification and analysis of metaphors and arguments used by the interviewees while discussing about the public sphere and SCNT. Once again, it is metaphors and arguments on public perceptions, media coverage and the regulation of CNR that are under analysis. While the procedure unfolded in the exact same way as for the analysis of metaphors and arguments in the scientific articles (that is, identification and classification), there were some differences, most notably in argumentation. Thus, from an analytical perspective, it was less difficult to infer missing warrants and backings as most of them were spread out in the course of the discussion (for example, the same warrant could be used to support different claims). This is thought to relate to the fact that interviewees had enough time to spontaneously provide descriptions, explanations and justifications in the less formalised, more flexible setting of individual interviews (for an example of argumentation analysis of interview data please see Appendix 12). Overall the analysis concluded in the identification of **402** metaphors and **363** arguments employed in the discussions with scientists.

The same coder employed to assess the inter-coder reliability of the coding schemes adopted for the content and argumentation analysis of articles was also used to assess relevant interrater measures for the identification of the structure and the overall type of interviewees' arguments. A similar procedure was also followed, assessed on a sample of 10 per cent of the overall coded material (i.e. 2 interviews). Once again, clear and thorough instructions were included (see Appendix 13). Percentage agreement of the overall reliability between coders for the identification of argument parts provided an estimated value of 0.79 (ranging from 0.61 to 0.95) while the value of inter-coder consistency for the identification of the argumentation type was 0.88 (see Appendix 14).

To conclude, a summary presentation of the data analysed in both formal and informal settings of communication is given below.

Table 4.6 Summary of research data

Formal communication	***Informal communication***
Total No of articles: 461 *Nature* articles: 235 *Science* articles: 226	Total No of interviews: 18
Metaphor analysis	*Metaphor analysis*
Total No of metaphors: 269 *Nature* metaphors: 117 *Science* metaphors: 152	Total No of metaphors: 402
Argumentation analysis	*Argumentation analysis*
Total No of arguments: 410 *Nature* arguments: 191 *Science* arguments: 219	Total No of arguments: 363

4.5 Conclusion

Jovchelovitch (1995) argues for the need to be explicit regarding methodological procedures not only as a way to meet the demands of scientific rigour but also as a means to circumvent any uncritical treatment of the assumptions they entail. With that in mind, and based on theoretical elaboration, I have sought to offer a detailed presentation of the data collected and the methods employed in their analysis. Thus, discourses on the three arenas of the public sphere are studied through the analysis of scientific journals in an attempt to shed light on the historical aspects of social representations, reflecting both the structure of the public debate and the main issues of concern at the collective level. Individual interviews with experts are thought to provide access to the ontogenetic process of social representations where collective meanings are transformed for the appropriation of individual identities. Overall, two modes, formal and informal settings of communication, and one medium, words, of social representations were studied. The triangulation of different methods of analysis was performed in such a manner so as to capture both structural aspects and essential elements of meaning of the phenomenon under study (Flick, 1992a).

Chapter 5

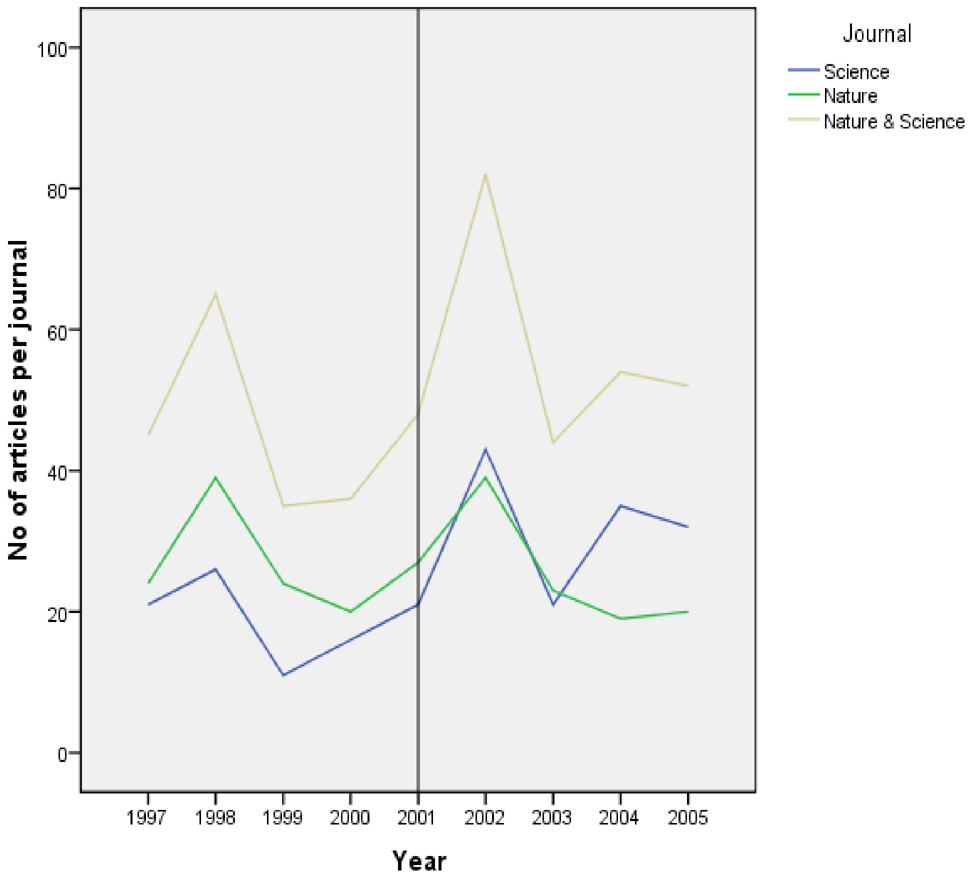
The public sphere according to *Nature* and *Science*

The first journals about science were published in the early nineteenth century in the spirit of 'popularisation' when the distinctions between popular practices of science, academic science and public perceptions of science were largely blurred. However, the gradual 'professionalisation' of scientific work and the resulting social division between scientists and non-scientists also brought about a distinction between popular and academic scientific journals (Bensaude-Vincent, 2001). While the scope of the former is to disseminate scientific facts to a non-specialist audience, processes like peer-review have contributed to the establishment of the role of the latter as a qualifier of distinction between 'science' and 'pseudoscience' further restricting its purposes to a small minority of experts. In the context of social representations theory and research, formal settings of communication are seen as an active forum of construction and communication of ideas and opinions regarding the main aspects of collective life in a given community. In this vein, the choice of scientific journals as a specific type of medium of representations is thought to provide access to highly specialised forums of discussion of the relationship between science and non-science. Whilst illuminating patterns of reporting, their analysis assists in identifying the intensity of coverage of non-scientific activities, the salience of 'different public spheres', the salience of different 'public arenas' and actors and the mapping of representations of public life contained therein. The coverage of almost 9 years of reporting (1997-2005) further brings forth the possibility for variations and shifts casting light to the historical aspects of representations. As already noted, media reports are treated in parallel to individual constructs of meaning, for they are seen as feeding one another. In this chapter I aim to present the results of the content analysis of *Science* and *Nature* and to account for the metaphors and arguments employed in the reporting of public developments relating to SCNT research. As this chapter ensues, the content of the news in both scientific journals investigated bears a clear connection to discussions with the individual scientists interviewed in this study. It should also be noted that an absence of any empirical consideration of the academic media by similar studies renders such an analysis topical.

5.1 SCNT news coverage in *Nature* and *Science*

Figure 5.1 shows the intensity of coverage of SCNT related public developments in the period analysed. From 1997 to 1998 there appears to be a growth in both *Nature* and *Science* articles covering initial public national and international reactions to the announcement of the creation of Dolly and the extraction of the first human embryonic stem cell lines.

Figure 5.1 Intensity of articles in scientific journals, 1997-2005



A decline in interest between 1999 and 2001, a time during which the U.K passed its first legislation banning reproductive cloning, is followed by a considerable peak in 2002. This was a year of great interest both in terms of related research as well as regulatory developments. Thus, the U.S federal government was about to vote on a bill banning therapeutic cloning at the same time that in the U.K the Court of Appeal, overturning an earlier verdict, permitted the government to grant the first licenses for the creation of human embryonic stem cell lines while approving research into therapeutic cloning. In Asia, countries such as, Singapore were finalising their legal framework and in the UN opinions on how to approach CNR research differed respectively. This was also the time when Antinori announced the pregnancy of one of his patients with a cloned human embryo and Chinese researchers claimed to have extracted embryonic stem cells from cloned embryos created by fusing human cells with rabbit eggs. In the period from 2003 to 2005 in most of the countries, and with the exception of the U.S and the difference between federally and privately funded research, relevant public debates had been settled. In the U.K, the first licenses to create human embryos by SCNT for research were granted and until the time of the completion of the present study South Korean researchers had claimed to have created the first human embryonic stem cell lines through SCNT[9]. However, this disparity between the US and the UK public interest in SCNT is thought to be reflected in the reporting of relevant articles by the two journals analysed. Thus, whereas attention of the UK based *Nature* in public developments around CNR technology progressively declines, the number of articles covering similar developments in the North American *Science* increases.

To match changes and shifts in the public debate following the creation of Dolly, results of the analysis will be presented in a two-phase time frame permitting relevant comparisons. The years from 1997 to 2001 represent the opening of the international public debate on human and animal SCNT when the first intense discussions over the ethics and the regulation of related research occurred. The last four years of the period covered correspond to later phases when the clarification of legal frameworks in most countries marked an initial closure of pertinent disputes.

Thus, a comparison of the interest of the two journals in SCNT related public developments between the two chronological phases investigated reveals significant differences (see Appendix 15). Whereas 59% of the total corpus of articles analysed from the period 1997 to 2001 appeared in *Nature*, relevant *Nature* articles appearing in the later period of the debate decreased to a total of 41%. This again is thought to echo general trends of interest in CNR as they developed in their respective countries of publication over the time frame investigated.

[9] The scandal, that later followed, exceeded the time-frame of the present thesis.

5.2 Salience of the public sphere

For each article, information was coded regarding its size, format, the section it appeared in, and its author. These are all variables thought to assist in the identification of the importance of a given issue reported in the media outlets. Although the format and structure of scientific journals is different in comparison to other mass media communication, since their primary scope is to publish the latest scientific findings, they can nevertheless expose styles of reporting and possible shifts across years. Table 5.1 gives a comparative view of reporting between the two chronological phases. Overall, there do not appear to be any significant differences (see Appendix15). With an average of 51 articles per year, public developments relevant to SCNT research received considerable attention. The majority of articles were of small size and tended to provide information about the latest main news in brief. Most of the stories were reported by in-house *Nature* and *Science* writers. University scientists represented the majority of 'outside' voices, contributing considerably to pertinent discussions, especially during the later phase of the coverage analysed.

Table 5.1 Salience of the public sphere in scientific journals 1997-2005 (*threshold for inclusion 5%*)

Phase [1]	***1997-2001***		***2001-2005***	
Frequency (%)	50		50	
Size (%)	**Small**	**48**	**Small**	**57**
	Medium	37	Medium	33
	Large	15	Large	10
Section (%)	**News**	**79**	**News**	**74**
	Editorial	9	Editorial	9
	Commentary	5	Correspondence	8
			Book reviews	6
Format (%)	**Latest news**	**76**	**Latest news**	**74**
	Commentary	21	Commentary	21
			Response	5
Author (%)	**In-house**	**81**	**In-house**	**80**
	University	9	University	14

1 Percentage of corpus; total *n* = 461

5.3 Identifying 'public developments'

Significant shifts in the public themes reported can be identified across the time period analysed, as shown in Table 5.2 (see Appendix 16). Changes appear to follow public developments as they occurred over the years. During the early phase of coverage, focus was placed on the initial science policy reactions and debates over the regulation of SCNT research. Attention was also given to issues of interest to public perceptions and mass media coverage with articles providing information and opinions of non-scientific views and treatment of human and animal CNR, most often within a pro-scientific frame. U.S, U.K and generally international developments monopolised reporting while other individual countries were less frequently mentioned.

Table 5.2 Public developments covered in scientific journals, 1997-2005 (*threshold for inclusion 5%*)

Phase	**1997-2001**		**2002-2005**	
Frequency (%)[1]	***50***		***50***	
Public Developments[2] (%)				
	Proposal/Draft	**39**	**Proposal/Draft**	**30**
	People	13	Science Policy	14
	Other	10	'People'	13
	Public funding	9	Public funding	10
	Science Policy	8	Public hearing	7
	Media	5	Other	7
			Law	6
			Media	5
Cloning (%)	**Human**	**82**	**Human**	**95**
	Animal	18	Animal	5
Human Cloning (%)	**Reproductive**	**52**	**Therapeutic**	**60**
	Therapeutic	48	Reproductive	40
Focus (%)	**Main**	**52**	**Reference**	**53**
	Reference	48	Main	47
Controversy (%)	**Imbalanced**	**61**	**Imbalanced**	**62**
	Balanced	39	Balanced	38
Location (%)	**US**	**41**	**US**	**58**
	UK	16	Asia	11
	International	16	International	8
	Other Europe	13	Other Europe	8
	Asia	13	UK	8
			Other	7

[1] Percentage of corpus; total n = 461
[2] Multiple codings (more than one variable may be coded per article)

During the later phase, science policy issues remained of high news value prioritising the reporting of developments relevant to therapeutic cloning and stem cell research. A main focus on public matters was sustained with U.S activities, and the tension between federally funded and private research regulation, dominating discussions. Interest in the U.K seemed to drop following the clarification of the legal framework and the permission to carry out human SCNT research, while importance was given to developments coming from the East and the rise of stem cell research and related policy there. Overall, the regular sections of the scientific journals, such as, ‘Policy forum’ for *Science* and ‘News’ for *Nature* point to the institutionalisation of science policy as a matter of routine coverage (Einsiedel & Coughlan, 1993).

5.4 Metaphors in formal communication

5.4.1 Metaphors

In the context of discursive communication, the use of metaphors is thought to cast light on the symbolic and contextual resources interlocutors have at their disposal to familiarize new objects, ideas and beliefs. Classification of one thing in terms of something else is what metaphor does, permitting for the identification of anchors. In the context of formal communication, approximately 33% of the total number of articles discussing the public dimensions of SCNT technology contained 269 metaphors, anchoring public perceptions, media coverage and the regulation of CNR. Metaphors were identified on the basis of certain criteria, as discussed in Chapter 4, that differentiated them from other linguistic tropes. Following, they were classified into superordinate categories according to conceptual similarities between target and source domain. Before presenting the underlying associations between the source concept and the public sphere for each superordinate category, it is essential to provide some basic information regarding the different actors identified as using metaphors, as well as the public arenas classified in this way. As presented in Table 5.3, a large proportion of the metaphors identified were found to be employed by the in-house writers of the two scientific journals. Anchors by other actors are less often quoted with the exception of the metaphors used by representatives of the scientific community. With regard to the three arenas of the public sphere (regulation-popular media coverage-public perceptions) there is only a limited reference to metaphors utilised directly by representatives of national regulatory authorities in discussions relevant to developments in the regulation, media coverage and public perceptions of SCNT research.

Table 5.3 Users of metaphors in scientific journals, 1997- 2005

Type of actor	**Representatives**	**Number of Metaphors**	**Total**
Interest Groups	Pro-life antiabortion groups	1	**5**
	Church/ religious groups	1	
	Anti-cloning groups	3	
In- House authors	In-house writers	198	**198**
Regulatory Authorities	Upper House	2	
	Lower House	1	
	Research funding agency	1	**9**
	Specific member state/ country	1	
	Ethics committee	1	
	Scientific advisory group	1	
	Univ. scient/ethics committee member	1	
	Univ. scientist/ member of scientif. advisory group	1	
Scientific-industrial complex	Biotechnology company	1	
	Biotechnology organisation	7	
	University scientists	28	**48**
	Scientists in private lab	1	
	Scientists in government institution	1	
	Scientists in museum	2	
	Scientific organisation	7	
	Scientists in general	1	
Other	Other	9	**9**
		Total	**269**

Table 5.4 offers a schematic presentation of the public arenas classified by the identified metaphors. Categorisation processes by metaphor appear to be monopolised by an interest in national regulatory arenas. When metaphors are employed to refer to media or public perceptions of SCNT there seems to be a tendency for generalisation. Although classification of regulatory developments seems to be actor specific, categorising a number of different regulatory representatives, differentiations among representatives of media or people are almost absent. In contrast, most of the metaphors employed are used to associate relevant source domains to broad concepts of ‘media in general’, or ‘people in general’.

Table 5.4 Public arenas classified in scientific journals, 1997 - 2005

Type of public arena	**Representatives**	**Number of Metaphors**	**Total**
Regulatory Authorities	Upper House	64	
	Lower House	16	
	Legislature	33	
	Government	17	
	Health agency	5	
	Research funding agency	3	**206**
	National patent office	2	
	Specific member state/ country	7	
	Ethics committee	21	
	Scientific advisory panel	1	
	Policy makers (general)	6	
	EU Commission	1	
	EU Parliament	8	
	EU Council	8	
	UN Organisations	14	
Media	Newspaper	1	**35**
	Radio programme	1	
	Media (general)	33	
Public perceptions	People, public (general)	25	**25**
Not identified		3	**3**
		Total	**269**

Table 5.5 offers a comparative view of metaphor users, arenas anchored and locations of arenas across the two phases of reporting covered. Analysis indicates an equal distribution of relevant variables between the two periods regarding the users of metaphors (see Appendix 17). However, significant differences were detected in relation to the public arenas anchored and their respective locations. An initial effort to anchor relevant developments as they took place in all three arenas of the public sphere were followed by a strong preoccupation with the classification of regulatory developments in later years. Whereas in the first phase interest was placed in both U.S and other countries' regulatory developments, later discussions and relevant metaphors employed focused mainly on the public debate still strong and on-going in North America.

Table 5.5 Metaphors employed in scientific journals, 1997-2005 (*threshold for inclusion: 5%*)

Phase	***1997-2001***		***2002-2005***	
Frequency (%)[1]	**47**		**53**	
Metaphor user (%)	**In- house**	**72**	**In- house**	**75**
	Scientific Industrial Complex	19	Scientific Industrial Complex	17
Public arena anchored[2] (%)	**Regulatory Authorities**	**72**	**Regulatory Authorities**	**83**
	Media	18	'People'	8.5
	'People'	10	Media	8.5
Location of arena[3] (%)	**US**	**51**	**US**	**72**
	International	22	International	13
	UK	17	UK	5
	Other Europe	5		
	Asia	5		

[1] Percentage of metaphors; total *n* = 269
[2] Missing values excluded; total *n* = 266
[3] Missing values excluded; total *n* = 244

Following, each superordinate category of metaphor is described in terms of the underlying associations and images it creates, while some paradigmatic examples are offered. Overall, fourteen major superordinate categories were identified: War, Arts/Entertainment, Nature, Economy, Psychopathology, Journey, Sports, Cloning, Chemistry, Engineering, Religion, History, Container and Popular metaphors. The order in which they are presented does not denote their frequency, nor is it considered of vital importance, since a rare appearance today, might be a common occurrence tomorrow, provided there is fertile ground for its development (Liakopoulos, 2000). Rather, the main interest of the present research lies in the identification of the symbolic resources used to anchor the three arenas of the public sphere, namely public perceptions, media coverage and the regulation of SCNT research.

5.4.2 Superordinate categories

War

Metaphors that fall under this category were largely identified in articles discussing research regulatory developments relevant to SCNT at both national and international levels. With ‘War’ constituting the source domain, the various metaphors in this category produce ominous images of the political arena. Science policy is portrayed as a ‘battle’ where different assemblies of interest groups, scientists and politicians ‘clash’ in an attempt to legitimate their standings (anti or pro-SCNT) determining, thus, the legal future of SCNT research and its applications (permission or banning of certain applications). The structure of the metaphor can be presented as: (1) argumentation is war, (2) words are weapons, (3) interlocutors are enemies, and (4) there are winners and losers.

‘*The decision marks the latest stage in an intensive 9-year* ***battle*** *between industry, which foresees economic and health advantages to a uniform biopatent policy, and a* ***coalition*** *of consumer, environmental, and religious groups, which object to many biotech patents on safety or ethical grounds*’ (*Science*, 5.12.1997)

‘The ***battle lines*** *are already drawn: Opposition Member of Parliament (MP) Liam Fox, a physician who serves as the Conservative Party's "shadow" health secretary, has come out against therapeutic cloning.’* (*Science*, 25.08.2000)

‘*In a* ***warning shot in the battle on human cloning,*** *a conservative Republican has introduced a bill banning federal payments….*’ (*Nature*, 18.2.1999)

Different ‘camps’ use different ‘strategies’ and ‘weapons’ to succeed. The ultimate goal is to win, and ‘allies’ seem to determine the outcome of the ‘battle’.

‘Says Tipton: "We've ***dodged the first bullet****."*’ (*Science*, 20.02.1998)

‘*The comments* ***drew darts*** *from numerous scientists in the audience.*’ (*Science*, 23.06.2000)

‘Tackling the legal and ethical **minefield** *associated with human embryonic stem-cell research…..*’ (*Nature*, 8.9. 2005)

‘*…he and others suggest that the state would have sufficient* **ammunition** *to argue convincingly…’* (*Nature*, 15.1.1998)

‘There is going to be a sort of ***guerrilla campaign*** *now," says Nigel Cameron of the Council for Biotechnology Policy, a conservative think tank in Reston, Virginia.*’ (*Science*, 21.6. 2002)

‘*The United States and its European* ***allies are once again on a collision course*** *over an international agreement.’* (*Nature*, 7.03.2002)

‘*Scientists have worked with advocates for patients…to* ***fight*** *attempts to outlaw therapeutic cloning.’* (*Nature*, 7.11.2002)

‘*Missouri scientists who favour human embryonic stem cell research found an unlikely political* ***ally****… to help* ***kill*** *a bill that would have outlawed somatic cell nuclear transfer…that decision made him a* **hero** *on the floor..’* (*Science*, 22.4.2005)

As in any war there are those who lose and those who win. At times, science seems to be one of the ‘victims’.

‘*The American Society for Cell Biology dubbed it the "****Friday Afternoon Massacre****."*’ (*Science*, 5.3. 2004)

‘*The result led both sides of the debate to claim* **victory***, but it will probably not have a great impact on research.’* (*Nature*, 17.3.2005)

‘Stanford University Nobelist Paul Berg warned that Americans' "health is being held ***hostage****" by the anticloners*.’ (*Science*, 15.3.2002)

‘*When Rivers proposed an amendment to restore the ban to one on the use of cloning for ‘creation of a human being’, it was* **soundly defeated***.’* (*Nature*, 7.8.1997)

As Lakoff and Johnson (1980) have pointed out, while allowing us to comprehend one aspect of a concept in terms of another, metaphor necessarily hides other aspects of it. That stated, the choice of ‘war’ as a concept with which to anchor the regulatory arena appears to hinder the consensual nature of public dialogue. Interlocutors are more preoccupied with domination rather than appreciating the cooperative aspects of public debates. Such a metaphor departs from the Habermasian (1999) notion of the public sphere, where agreement is reached on the basis of the ‘goodness’ of an argument. Rather, conflict is pervasive in social and political life and inherent validity does not determine the power of the argument; it is the allies, the weapons and the strategies that do so.

Art/Entertainment

Metaphors relating the public sphere to the concept of arts and entertainment were also found in articles covering the latest developments in the regulation of human SCNT research. Largely following relevant discussions as they took place in various US deliberations at the federal level, public decision making is categorised as a public show to which people are protagonists in an attempt to entertain a certain audience. Such an anchoring of the public sphere downplays the importance of knowledge production and information circulation. Public debates are spectacles with a view to produce excitement and surprise. Some examples of relative metaphors include:

‘*And although the **cast** has changed, lawmakers seem to be **replaying last year's drama**, which ended in stalemate.*’ (*Science*, 7.2. 2003)

‘*..when two important **protagonists** in the debate presented strongly conflicting views of appropriate rule of cloning*.’ (*Nature*, 24.1.2002)

*‘Cloning ban **waits in the wings***’ (*Science*, 29.8.1997)

Billig (1996) has pondered extensively on the dramaturgical metaphor and its use by social researchers’ theories to account for the public sphere. He notes the tendency of the metaphor to underline the notion of actors, roles and scripts. Social life is a staged drama, in which, actors enact their roles in the presence of an audience. One of the central features of metaphors in this category is that they emphasise the smoothness of public debates. By pointing to social regularities and the coordination of script performances, they undermine the importance of conflict found in the previous superordinate category. The image of the public actor as a mere follower of pre-given rules seems to prevail. This leads to another interesting aspect of the metaphors, that of public performance. By familiarising the public sphere in terms of art and entertainment, a primacy is given to developments taking place on stage rather than backstage. However, as Billig (1996) argues, everything important happens backstage, for it is there that scripts and roles are produced. That stated, the employment of such metaphors seems to implicitly contrast public life to that of science. Public debates are 'performed' with a view to excite the audience. The force of the argument is to be found in its ability to produce sentiments and arouse feelings. Science on the other hand, is not about entertainment nor is it about feelings, but rather it is a realm where rigorous and objective processes take place for the elaboration of facts. Most evident of such a contrast is the use of relevant metaphors by scientists to refer to specific actors in the human SCNT debate and their engagement in public communication.

After the announcement of Dolly's creation, and throughout the period covered, particular scientists, frequently termed by the scientific press studied as 'cloners', monopolised the human SCNT debate both at national, as well as, international levels. These include Zavos, Antinori, Seed, and a religious cult, Clonaid, all of whom had raised prospects of human reproductive cloning experimentation, even claiming success in the creation of human clones. However, and until the completion of the present study, all of them had failed to provide analogous scientific evidence in support of their alleged successes. It is in reference to their research and its media coverage that several metaphors in this category were detected. They were used in the context of discussions concerning: a) the scientific credentials of the above researchers and their work, b) the risks and ethical dilemmas relating to human reproduction and cloning, and c) the dangers posed by such claims on the regulation of human therapeutic cloning and stem cells research.

'*The current* ***media circus*** *might be entertaining were it not for the potentially destructive consequences for nascent research in human reproduction and developmental biomedicine.*' (*Science*, 17.1. 2003)

‘*This time, it seems likely to have been a bizarre **publicity stunt**.’* (*Nature*, 16.1.2003)

A relevant metaphor was also detected in relation to another ‘actor’, Jeremy Rifkin, a well-known anti-biotechnology activist. In response to his accusations, expressed at a public forum in Switzerland, against several genetic engineering and SCNT researchers of having lost their objectivity at the expense of public good, due to their ties with the biotechnology industry, a Bern University biologist was reported as saying:

*"This is **theater**, not science.*" (*Science*, 23.6.2000)

Such a choice of metaphors with which to anchor other actors in the debate, performs a dual role. At a first level, and by categorising them in the sphere of fantasy and entertainment, it permits the demarcation between reality and fiction, thus, perpetuating the distinction between legitimate and illegitimate scientists. It is the commitment to international standard rules of scientific conduct, including the provision of sufficient evidence in support of one’s claims and the reverence of ethical rules, that becomes a criterion for distinguishing between science and non-science. Following that, and at a second level, such an anchoring assists in the restoration of the public image of the scientists as responsible and accountable to public disquiet regarding SCNT research. Driven by an interest in objective truth, and in contrast to those motivated by a need to manipulate the public sentiment, legitimate scientists emerge as the gatekeepers of ethical and safety standards, as the credited spokespeople of nature, as qualified public servants.

Nature

In the context of public developments, either in the national and international regulatory arenas or in the media coverage of SCNT research, a number of metaphors familiarising the public sphere to nature and natural phenomena were detected. However, how is one to understand nature? As Liakopoulos (2000) also discusses, the concept of nature is an arduous subject in itself. Moscovici’s (1977) tripartite typology (organic, mechanistic and cybernetic) of the different states of nature and its uses across centuries marks a series of changes in its relationship to society. At times, nature emerges as a superb entity (mother-nature) detached from any human activity, at other times, nature appears as a resource for the betterment of human kind, while still at others, it emerges as its product. Any of the above accounts contains an implicit set of values and modes of interaction with nature, whereas all seem to prevail in one way or another in contemporary notions and understandings of nature (Gervais, 1997). Metaphors under this category seem to favour an almost super-natural view of nature. The associated images they create, relate to natural phenomena such as rain, hurricanes and storms, where human rules do not apply. In this light, the public sphere is seen as an unpredictable almost supernatural realm. Public debates are natural phenomena beyond the control of the observer. Indeed, in cases where the metaphors were directly used by the in-house writers of the two journals studied, they could be read almost as weather reports, informing the interested reader, while guiding future actions in a prescriptive and cautioning manner.

'*The **global storm** will continue to gather over human cloning and related stem cell research.*' (*Science,* 3.01.2003)

'*The vote has precipitated a **storm of protest**.*' (*Nature*, 17.4.2003)

'*There is also a concern that the **tidal wave** of the media coverage blurred the distinction between therapeutic- which many scientists support-and reproductive cloning.*' (*Nature*, 16.8.2001)

'*The **media snowball** began rolling after NPR sent out press releases…*' (*Science*, 16.1.1998)

'*Indeed, Senator Arlen Specter (R-PA), who strongly supports therapeutic cloning, **further muddied the waters** by predicting…*' (*Science*, 15.03.2002)

The above metaphors illuminate the catastrophic and unpredictable aspects of nature. Their choice, out of a possible stock, needs to be accounted for within the context of their use and production. In this vein, they seem to favour an image of the public sphere as a hostile and capricious environment. Metaphors such as '*storm*' contrast images of light and dark, hope and desperation. Implied also is the concept of distortion. These menacing associations leave the future of SCNT technology vague and unclear.

Economy

The next category contains metaphors derived from the concept of economics. They were largely found in articles covering deliberations in the regulation of therapeutic cloning, in the form of national laws or international measures considered. Anchoring science in the world of business, relevant research emerges as a manufacturing product to be sold to customers. Its driving force is money and demand. It is promoted by advertising and scientists are portrayed as entrepreneurs trying to find a niche. As such, SCNT is associated to its profit-generating aspects, depicting it as a potential resource for development. In this light, the public sphere appears, either as a possible partner or a hurdle in the realisation of gain. By promoting CNR technology's prospects for profit, science is detached from any moral or ethical code: science is only there to be sold.

"*It would make us the **center of the world**" for stem cell research.*' (*Science*, 16.01.2004)

'*Now it looks like the Senate may follow suit, thus **robbing** scientists of a chance to pursue a technology that some believe is vital to realize the promise of embryonic stem (ES) cell research.*' (*Science*, 10.08. 2001)

'*..the world's **scientific superpower** has so far failed to deliver a satisfactory **contract** between researchers and its citizens at large on this issue.'* (*Nature*, 23.07.1998)

Psychopathology

This set of metaphors was mainly identified in discussions about the birth of Dolly the sheep and its subsequent reception by the national and international media, regulators and the general public. The public sphere's reaction to the idea of SCNT as solely a technique to produce humans, is undermined as having been reached under states of 'shock' and not that it involved a careful consideration of its actual contribution to scientific knowledge *per se*. Relevant metaphors were, also, reported in a generally alarming context over the potential influence of media and public concerns in the regulation of what is seen as useful applications of the technology. Overall, such categorisations seem to perform a contrast between science, as the realm of logic, and the public sphere, as the realm of emotions.

'*The latest* ***aftershock*** *came on Sunday, 19 October, when the Sunday Times.……whether the technologies that have stirred public fears will ever become a reality is hard to say* ' (*Science*, 31.10.1997)

'*And even though animal scientists have been cloning sheep and cattle from embryos for a decade, the media* ***went wild*** *over Dolly, the first animal ever cloned from an adult cell….But even as the* ***media frenzy*** *continues, researchers say it's still unclear how practical cloning of animals, let alone humans, will be.*' (*Science*, 7.03. 1997)

'*Cloned sheep such as Dolly, who set off the* ***cloning frenzy*** *in 1997 (*Science, *7 March 1997, p. 1415), are impressive scientifically and hold the potential to become bioreactors that produce human proteins for medicine*' (*Science*, 18.08.2000)

'*The announcement last year of the cloning of Dolly the lamb led to an international response unprecedented in medical ethics… The wrong issue for a* ***moral panic.*** *If there is an area of medical ethics in need of international regulation it is not cloning but xenotransplantation…'*(*Nature*, 22.01.1998)

The idea of the public sphere as the sphere of emotionality and abnormality is not new. Jovchelovitch (2007) astutely points to how from its birth, Social Psychology itself, associated the social with psychopathology, exemplified in the name of the first journal of the discipline *Journal of Abnormal and Social Psychology*. From Le Bon to Freud, life in groups has been tied to images of irrationality and emotional uncontrollability. Here, metaphors categorise the public sphere as being in the reign of neurosis. Lacking the necessary mechanisms to cope with anxiety, people fall into states of 'shock' and 'panic'. Thus, a picture of an unthinking, psychologically unstable society emerges. Underlying these images is the Cartesian dictum 'I think therefore I am'. However, thought is disentangled from its social and emotive context restricted only in mind and cognition. Thought is *logos* (*λογική*) and in order for a person to think s/he needs to disengage from the social and also from the self. This aspect of the metaphor has important ramifications for public decision-making. Sanity and insanity become the criteria for participation: only those who can think logically are entitled to enter. Indeed, in an article discussing the repercussions of the media coverage of two non-reviewed and non-reproduced claims, of having created a kidney from a cloned cow embryo and of growing differentiated cells from adult stem cells, on the deliberations of a US Senate judiciary committee on SCNT research, concerns were raised over both the media's responsibility in producing accurate reporting, as well as, the regulators ability to fully understand and distinguish legitimate from illegitimate science:

'*cloning agenda 'skewed' by **media frenzy**...this raises the question, researchers say, of whether policy makers know-or want to know- the difference between a claimed result and a peer-reviewed scientific finding'* (*Nature*, 14.02.1997)

Journey

This next superordinate category of metaphors was detected in the context of articles covering regulatory debates over SCNT research in specific countries, as well as, international arenas. The associations created under this category classify political debates in the concept of journey. The structure of the argument could be identified as: (a) argument is a journey, (b) words are vehicles, (c) strategies of argumentation are paths, and (c) discussions have destinations. Here, metaphors emphasise the goal of the argument, the fact that it must have a beginning and proceed in a linear fashion towards an objective (Lakoff & Johnson, 1980).

'*The [anticloning] regulatory **train is coming down the rails**…*' (*Science* 24.04. 1998)

'*So it would **speed through** the conference committee.*' (*Nature*, 9.05.2002)

However, reaching a destination is not always characterised by smoothness. Arguments and debates can at times 'arrive' at 'dead ends' or 'hit a speed bump'.

‘*Biomedical groups* ***derail fast-track*** *anticloning bill*’ (*Science*, 20.02.1998)

‘*Australia's quest for national legislation regulating human embryonic stem cell research has* ***hit another speed bump***.’ (*Science,* 6.09.2002)

Images are also created associating public modus operandi with traffic regulations.

‘California ***flashes a green light***.’ (*Science*, 27.9.2002)

‘*Parliament* ***gives green light*** *to stem-cell research.’* (*Nature*, 4.01. 2001)

‘*Singapore* ***opens door*** *to stem-cell research.*’ (*Nature*, 9.9.2004)

‘*The Korean group…. has got the* ***green light*** *to resume its research.*’ (*Nature*, 21.01.2005)

Lakoff and Johnson (1980) have demonstrated the propensity of such metaphors to distinguish between the form and the content of an argument. Thus, the path corresponds to the form of the argument and the ground covered to its content. In arguing, metaphors like ‘going in circles’ indicate that although there is a long path not much ground has been covered, signifying that the argument lacks content. By categorising public debates as journeys, a purposeful and goal-oriented conception of life is entailed (Lakoff, 1993). Things cannot go backwards but only forwards. Seen in the context of their use, at times, the metaphors seem to imply a progressive image of science. Thus, science is conceived as a moving object that goes forwards. Such a classification appears to be in line with most Western ways of thinking about the past. What distinguishes the ‘moderns’ from the ‘pre-moderns’ is the ‘invention of ‘Science’ in Latour’s (1993) terms. In a world constituted on the basis of beliefs in progress and development, science seems to be a prerequisite for further advancement:

‘***Full speed ahead****.’* (*Science*, 7.06.2002)

Sports

The world of sports is the world of games. Games are played among groups of people or between individuals. Although fun can be part of the game, the use of sports metaphors in the context of political decision-making over human therapeutic SCNT technology appears to place more of an emphasis on the bipolar loss-win situation associated with sports. Thus, different teams or individuals (pro-therapeutic or anti-therapeutic cloning groups) compete with each other for the acquisition of a trophy (permission or ban of relevant research). Such a categorisation of the public sphere throws light on its competitive nature: (a) public life is a game; (b) teams compete with each other; and (c) there are winners and losers. Some examples of relative metaphors under this category include:

'*He should get credit for appointing a group that has **wrestled** honestly with the issue.*' (*Science*, 19.07.2002)

'*In its 90-day analytical **sprint**…*' (*Science,* 13.06.1997)

*'Back in the **race**…'* (*Nature*, 2.06.2005)

'*New **players**, same debate in congress.*' (*Science*, 7.02.2003)

'*...amid the **media scrum** that has surrounded her work...*' (*Nature*, 26.09.2002)

Billig (1996) has commented on the masculine dimension of the metaphor. Traditionally, it is men who wrestle and box. Such a classification of *politics* as a 'men's thing' finds its genesis in the context of the Athenian *polis*, where the exclusion of women from public matters was part of the modus operandi, ensuring participation only to a privileged minority. Although partial, to fully appreciate the importance of the metaphor, Billig also discusses its associative image of the social actor. Thus, the social actor is pictured as a follower of a predetermined set of rules. It is the rules that render the game possible. Although points of views are pitted against each other with the purpose of wining, the rules always remain the same. People argue on subjects not on how to argue. According to Billig, such a conceptualisation of the public sphere fails to capture the controversial nature of rules, for they too, under certain circumstances, can become the object of an argument.

Cloning

'*Arthur Caplan, a University of Pennsylvania bioethicist, referred to it as **'a council of clones'**…*' (*Science*, 19.07.2002)

The above extract originates from an article published in a section of the latest news in *Science* in 2002. The article discusses the deliberations of President Bush's council on bioethics. Commenting on the membership and staff of the council, the university bioethicist calls it a 'council of clones'. This metaphor is of profound importance, for two reasons. Firstly, it is one of the few occasions where cloning itself becomes the paradigmatic source domain to understand public developments. Although the appearance of the metaphor is a unique instance, future research may reveal analogous classifications. Secondly, it seems to originate from popular understandings of cloning, where it has been conceptualised as a way of replicating identical copies of a certain prototype undermining individual differentiations. Such an understanding of cloning has repeatedly been refuted by scientists themselves, who argue that although cloning may in the future succeed in producing identical organisms, personalities are not determined solely on the basis of genes.

Chemistry

'*Created by a 1988 law aimed at making U.S. companies more competitive in global markets by funding innovative research with potentially high payoffs, ATP for the last decade has been a $1.5 billion political* **litmus test** *for whether the government should subsidize corporate research.*' (*Science*, 5.5.2000)

The above metaphor has been used by a *Science* in-house writer to report, at the time, the latest developments over science funding schemes and SCNT research governmental grants in the United States. The concept of litmus, a chemical used to differentiate between acid and alkali, is used to make sense of regulatory developments. While employed to denote the intentions of the government, it is an instance of scientific resources utilised to render non-scientific activities familiar.

Engineering

'*Scientists are still struggling over how best to make the distinction clear in **the minds of the public and politicians** between cloning to make babies (bad) and cloning for research and developing new treatments (good).*' (*Science*, 5.07.2002)

Public understanding of SCNT research and its various applications has been at the centre of scientific interest ever since the birth of Dolly the sheep. A number of articles, as will also be discussed in a later section, covered international scientific meetings in which various researchers pondered on the necessity of clarity in terming the different applications of SCNT technology, as a sufficient enough reason in securing politicians' and the general public's support in therapeutic cloning and relevant stem cell research. The above metaphor was identified in reportage of a similar scientific meeting, where scientists considered the use of a number of possible terms with which to distinguish the various uses of SCNT. The article concluded in inviting its readers to send analogous propositions directly to the journal. Such a metaphor establishes the idea of a unified public mind, the disposition of which towards a specific object, and in this case SCNT research and its applications, is determined solely on the basis of naming. In light of public disquiet regarding SCNT, scientists are established as being a sort of engineer in the face of a technical hurdle that has to be fixed by the use of highly sophisticated gear. SCNT is pictured as an objectified fact, as a set of equations one needs to learn by heart to make sense of it. Moscovici (1984) traces such an understanding of perception in the Cartesian notion of an external objective world which humans are to make sense of through processes of replication. It is largely based on the image of the human mind as a machine or black box that has, for centuries, pervaded socio-psychological understandings of human perception. However, more recent relevant research has indicated that the understandings and attitudes towards a certain object are not solely determined on the basis of its name but rather through a complex and highly creative interplay between individual and collective memories, personal and social identities, emotions, values and beliefs, to name but a few.

Religion

'*Can a state on its financial uppers become a **mecca** for stem cell research?*' (*Science*, 16.01.2004)

The above metaphor, used in the context of a report about California's regulation of stem cell research by a *Science* in-house writer, produces sacred images of science. Science is a religion; there are pilgrims and scientific 'holy places'. Those who believe in science will be saved. Such a categorisation has been the subject of intense consideration by philosophers and sociologists of science. The secularisation of Christianity in the seventeenth century, largely a result of the emergence of the European nation-states, marked the descending of religion as the main repository for hopes of salvation in the Western world (Fuller, 2000). Based on historical and philosophical considerations of the role of systematic knowledge in society, Comte was the first to announce science as the new religion of the post-Christian world. He was convinced that the natural sciences could replace the institution of the Church as a source of authoritative knowledge and political power (*ibid*, 2000). The philosophical debate between science as a doctrine of belief, replacing religion, and science as the accumulation of objectivity through successive tests can be seen as an exemplification of this tension over the essence of science and its, if any, social functions. The associative images of this metaphor seem to favour a dogmatic understanding of science overcoming barriers between knowledge, belief, and ideology.

History

'*The Brownback bill ...will drive scientists to countries that are not going back into the **Dark Ages**.*' (*Science*, 15.03.2002)

'*Politicians have been only ready to make populist condemnations of a practice that still remains many years from realisation…what appears at times to be virtually a **witch-hunt**…*' (*Nature*, 7.8.1997)

'*Driven by ignorance, conservative thinking and fear of the unknown, our political leaders have undertaken to make laws that suppress this type of research… I believe our country risks being **thrown into a dark age** of medical research.'* (*Nature*, 27.9.2001)

In the above extracts, discussing national and international proposed bans regarding human therapeutic SCNT research, science policy is anchored in science's historical past. The choice of medieval metaphors arouses traumatic memories regarding the relationship between science and non-science and especially religion. These were the times when Giordano Bruno was burned for supporting the Copernican view of the solar system and Galileo was presented with the Inquisition's torture instruments for popularising it (Gregory & Miller, 1998). This was also the world of myth and magic; the era of superstition, usually contrasted to the Enlightenment and the proliferation of the sciences. Metaphors in this category undermine the ability of the public sphere to disassociate from practices of the past constituting an alarm warning in order to avoid repeating past mistakes. Once more, the public realm emerges as a menacing place for science, where bias and errors reign.

Container

The following extracts formed part of articles covering the latest, at the time, scientific crises, like the BSE scandal, or announcements of the birth of human clones and their repercussions on both the public's trust in SCNT and stem cells researchers in particular, as well as, people's overall confidence in science *per se*. Accounting for science's pervasive role in the lives of everyday people, and in contrast to past efforts that engaged the public solely through educational efforts, the following metaphors present a strategy of 'opening up'.

'*…and above all, **be open** and publish all advice…these admitted and awkward costs of wide and **open** consultation, and of **open** admission of uncertainty, are outweighed by their trust-promoting benefits.*' (*Science*, 11.05.2001)

'*We need to engage the public in a more **open** and honest bidirectional dialogue… Science-based regulatory agencies have learned that stakeholder consultation makes all the work go better.*' (*Science*, 14.02.2003)

'*Scientists, too, have a responsibility to **open up**.. their confidence that an informed public is a responsible public is welcome.*' (*Nature*, 23.10.1997)

Originating from the experience of the human body as a container, bounded and set apart from the rest of the world by the surface of the human skin, the above metaphors perform analogous categorisations (Lakoff & Johsnon, 1980). Thus, science is anchored as a physical being with a bounding surface and an in-out orientation. This is not, however, performed with a view to sustain demarcation but rather as a way to transcend existing boundaries and establish novel channels of communication and interaction. Such an anchoring permits the re-establishment of public trust in science, while sustaining future research. Hellström and Jacob (2000) comment on a recent shift from the 'scientification' of politics to 'politicisation' of science. Whereas in the past, scientific knowledge was considered an important resource for public policy, public funding of scientific research has placed the social and political utility of science under scrutiny. The idea that public spending on science has to be justified, entitles society to pose previously unasked questions, like 'who is entitled to do what, to what ends, for whose benefit?' and so on. As a result, scientists turn into politicians - public orators - seeking to refine their rhetorical strategies to ensure public legitimation for their actions.

Popular metaphors

The next and final superordinate category contains metaphors used mainly by anti-cloning groups and the Church, linking regulatory developments and science to a moral and ethics code. The idea of classifying them under the name 'popular' is based on the findings of prior research by Liakopoulos (2000) on anchors of biotechnology in the British press from the 1970s to the 1990s. He identified a set of metaphors, used mainly by environmentalists to produce Evangelical images of doom and disaster, linking science to the concept of hubris. Scientists are depicted as cunning and arrogant creatures, exaggerating their abilities by comparing themselves to God. The divinity of human creation as a product of God's wisdom prevails, where the foetus is a living organism and life is sacred; God will take revenge by destroying the sinners. Implied is the image of public regulation as a safeguard. Regulators are God's angels with the duty to protect society from scientists' moral degradation.

'*Opponents in Britain and elsewhere in Europe have called the 19 December vote a step down* ***a slippery slope*** *toward human cloning*.' (*Science*, 5.01.2001)

'*...it will produce "government-sanctioned '****human fetus farms****.'* (*Science*, 9.01.2004)

'*I fear that if we proceed as we are doing, we* ***will open the floodgates***.' (*Science*, 5.01.2001)

5.4.3. Classifying and naming about classifying and naming

Like every newly introduced technology, SCNT research and its human reproductive and therapeutic prospects has been associated with both images of prosperity and doom, as identified by relevant public opinion and mass media coverage research (Durant et al., 1998). The analysis of articles in the two scientific journals reveals an interesting instance of another debate, as it took place within the confines of the academic media per se. In an attempt to control relevant classificatory processes of non-scientists to anchor and make sense of CNR technology, representatives of the scientific community were found to be engaged in an almost de-anchoring procedure. An integral feature of the procedure involved the choice of the 'right' terms and 'right' names for the different human applications of the technology, as well as, the destruction of popular metaphors like 'Brave New World' and 'scientists playing God'. Discussions over the production and choice of different alternatives with which to communicate their doings, point to efforts to de-contextualise human SCNT research from the moral and ethical frame in which it was received in the public realm, restricting it to technical matters where scientists appear as the sole experts. In this way, terms and names produced by rival groups, such as Pro-life and the Church, lose in validity and credibility for they are treated as stereotypical misunderstandings of scientific research. Some examples of such discussions include:

'I do not think that anyone has a license to ***play God****.'* (*Nature*, 3.07.2003)

'*The International Society for Stem cell research is asking its members to use the phrase 'nuclear transfer' instead of 'therapeutic cloning' in future papers and in communications with the public and press.*' (*Nature*, 1.07.2004)

'*Researchers have stopped using the term "therapeutic cloning" to avoid being tarred by the widespread criticism of efforts to clone human beings. Instead, they call the creation of a cloned embryo solely for research purposes "somatic cell nuclear transfer*"' (*Science*, 15.02.2002)

5.4.4. Recapitulating the results of metaphor analysis

The analysis of metaphors in the two scientific journals studied indicates the employment of an amalgam of symbolic resources with which to anchor the public perceptions, media coverage and regulation of SCNT technology. Overall, the public sphere is incorporated in a rich and highly diversified pre-established network of 14 superordinate categories. By assigning a name, each category succeeds in categorising the public sphere in an already existing set of contents, accentuating some of its properties, while hiding others.

Thus, the use of 'war' and 'sports' metaphors in making sense of the deliberations between different interest groups, scientists and politicians in public decision-making processes over the legal status of the various applications of SCNT research, highlights the competitive nature of public life. At times, specific regulators, the media or people become the 'enemy', whereas at others, they prove to be an indispensable 'ally' in securing 'wins'. In this light, action is coordinated towards the design of sophisticated strategies for the accumulation of supporters and like-minded 'players' to ensure domination. As a result, other, more cooperative aspects of public life are largely left in the background.

Categories such as 'Art/entertainment', 'Psychopathology' and 'Engineering' seem to cast a set of distinct demarcations. More specifically, the use of 'Art/ Entertainment' metaphors with which to anchor regulatory arenas and the media coverage of other actors in the debate, though pointing to the consensual character of public decision-making, present a dual tension. On the one hand, the allocation of regulatory processes in the sphere of the arts and entertainment produces a stark contrast with the sphere of science. While the production of spectacles with the purpose of arousing the world becomes the scope of the former, the latter is differentiated as the sphere of objectivity and *logos* with the intention of explaining the world through the production of fact-making claims. On the other hand, these same metaphors are also employed to distinguish between real and fake scientists, restoring a responsible public image to science, while securing participation in the relevant debates to only a handful of legitimate researchers. The employment of 'Psychopathology' metaphors with which to anchor public understanding, media coverage and regulation of SCNT technology is another instance of demarcation. The engagement of concepts of normality and mental health further accentuates the distinction between an emotional public sphere and a logical scientific realm, ensuring decision-making status on the basis of sanity and insanity. Lastly, 'Engineering' metaphors produce a mechanistic understanding of human perception, treating any discrepancies between scientific knowledge and its non-scientific reception as calling for rectifying actions.

In contrast to the above, a blurring of the boundaries between the public sphere and science occurs with metaphors in the categories of 'Container', 'Economy' and 'Religion'. Traditional demarcations are abandoned, assigning new meanings to both science and the public sphere. An opening up takes place, expanding existing channels of communication, while establishing novel roles and patterns of interaction in a more reflexive tone.

Categories like 'History', 'Chemistry', 'Popular metaphors' and 'Cloning' constitute another pool of symbolic resources with which public perceptions, media coverage and regulation of SCNT research are anchored. They are but demonstrations of the way a group's common stock of experiences and memory are stimulated to make sense of a novel debate. Thus, prior or more recent science related debates, as well as, expert forms of knowledge constitute an already familiar context with which to appreciate the current public interest in SCNT research. A certain continuation with the past is performed, sustaining group identities, while coordinating action.

Lastly, while 'Nature' metaphors highlight the unpredictability of the regulatory arena, metaphors in the category of 'Journey' perform another classification, putting forward more cooperative and purposeful meanings of public decision-making.

Statistical analysis regarding the identification of possible variations in the types of superordinate categories used between scientific journals, as well as, among different representatives of science did not reveal any significant differences[10] (see Appendix17). However, an investigation on the distribution of the most frequently identified superordinate categories between 1997/2001 and 2002/2005 resulted in some interesting findings, as shown in Table 5.6.

[10] Associations between superordinate category/ phase, superordinate category/metaphor user and superordinate category/location of arena anchored could not be performed due to the small number of frequencies in the cells.

Table 5.6 Superordinate categories in scientific journals, 1997-2005
(*threshold for inclusion: 5%*)

Phase	***1997-2001***		***2002-2005***	
Frequency (%)[1]	**48**		**52**	
Superordinate category (%)	**'War'**	**48**	**'War'**	**66**
	'Psychopathology'	17	'Journey'	11
	'Journey'	17	'Nature'	8
	'Nature'	10	'Arts'	8
	'Popular metaphors'	8	'Popular metaphors'	7

[1] Percentage of metaphors, total n = 230

The employment of 'Psychopathology', evident only in the first phase covered points to the classification of the initial public, media and policy reactions in the realm of emotions. The image of the public sphere as being in the reign of pathology and uncontrollability, reveals an early need to identify who is eligible and who is not to enter and contribute to the public debate about CNR research. Overall, and largely referring to regulatory developments in the U.S (see Table 5.5), there is parity in the superordinate categories dominating scientific reporting across the years with images of competition coupled by associations, emphasising the consensual character of public life.

5.5 Arguments in formal communication

Billig (1996), drawing from the philosophy of sophists, conceptualises the argument as a thesis with the purpose of persuasion through criticism of a counter-position. Further extending on his view, in the context of the present phenomenon under study the choice of an argument about the public sphere is not only conceived as taking a stance in relation to it but also as a reproduction of ideas on how the interlocutor, that is the public sphere, is perceived to be. Claiming for the need to expand educational initiatives or for public accountability are not only two different persuasive ways to support one's opinion but also illuminate two completely different objectifications of the public sphere. Thus, argumentation analysis is thought to provide access to objectification processes as they take place in a discursive context. Following Toulmin's approach, mostly as a tool enhancing the identification of the argument and its parts, the analysis proceeded in two steps: accounting for the structure of the argument and its content and overall argumentative type (see Chapter 4). From a total of 461 articles discussing public developments of CNR technology 224 were found to contain argumentative parts (110 *Nature* articles and 114 *Science* articles). The rest were articles mainly of an informative nature, containing news about the latest public developments. It should also be stated that each article might contain one or more arguments, reflecting the tendency of the scientific press to account for a number of different actors and their claims in the debate. Overall the analysis identified 410 arguments discussing public perceptions, media coverage and the regulation of SCNT technology. Tables 5.7 and 5.8 contain information about the different claimants as well as the different public arenas for which arguments were expressed. Relative results indicate a bifurcation in terms of the voices reported in the scientific press. Arguments expressed by the scientific/industrial complex and various regulatory actors are overrepresented. In contrast, the argumentation of interest groups is less often reported, while there seems to be an overwhelming absence of public opinion (media coverage and public perceptions) and related views on public developments on CNR research. Taking into account the nature of the scientific press to cover the latest developments regarding scientific research and relevant social events as well as their character as a forum of further reflection upon them, it could be suggested that inclusion of certain points of view is indicative of their perceived legitimation. The tendency to confine discussions largely between regulatory and scientific experts reveals the propensity of scientific journals to prioritise elite forms of knowledge and opinion over others, the importance of which may be considered as less central.

Table 5.7 Claimants reported in scientific journals, 1997-2005

Type of actor	**Representatives**	**No of arguments**	**Total**
Interest Groups	Pro-life antiabortion groups	3	**29**
	Church/ religious groups	7	
	Anti-cloning groups	9	
	Environmental groups	2	
	Patients groups	5	
	Pro-cloning groups	3	
Journalists	In-house writers	59	**59**
Regulatory Authorities	Upper House	9	**114**
	Lower House	5	
	Legislature	3	
	Government	13	
	Health agency	1	
	Research funding agency	5	
	Specific member state/ country	30	
	Ethics committee	11	
	Scientific advisory group	5	
	Policy makers (general)	3	
	EU Parliament	3	
	UN Organisations	1	
	Univ. scientist/ ethics committee member	15	
	Univ. scientist/ member of scientific advisory group	7	
	Government research institution-ethics committee member	3	
Media	Radio programme	1	**2**
	Media (general)	1	
Scientists	University scientists	92	**184**
	University scientist-scientific organisation member	2	
	Scientists in hospital	1	
	Scientists in private lab	2	
	Scientists in government institution	10	
	Scientists in government research institution/ scient. org. member	1	
	Scientific organisation	43	
	Scientists in general	11	
	Biotechnology company	6	
	Biotechnology organisation	16	
Other	Other	22	**22**
		Total	**410**

Table 5.8 Public arenas argued for in scientific journals, 1997-2005

Type of actor	Representatives	No of Arguments	Total
Regulatory Authorities	Upper House	48	
	Lower House	24	
	Legislature	92	
	Government	28	
	Health agency	6	
	Research funding agency	7	**339**
	National patent office	3	
	Industry agency	2	
	Specific member state/ country	16	
	Ethics committee	40	
	Scientific advisory group	4	
	Policy makers (general)	20	
	EU Parliament	8	
	EU Council	6	
	EU Patent office	1	
	UN Organisations	34	
Media	Media (general)	11	**13**
	Newspapers	2	
Public perceptions 'People'	People, public (general)	58	**58**
		Total	**410**

Table 5.8 offers a schematic depiction of the various arenas constituting the focus of argumentation processes. It is apparent that regulatory developments, both at the national and international levels monopolise relevant discussions. As was the case in metaphor analysis, here too, it seems that although there appears to be a degree of differentiation among different regulatory arenas, overall, arguments about the media and public perceptions assume a more general standpoint. A comparative analysis between the two chronological phases presents an overwhelmingly similar picture in terms of frequency of arguments, claimants, and arenas claimed across the years (see Appendix 18). Once more, significant differences were detected regarding the salience of different national developments. Thus, an initial focus on the state of public policies across a variety of different locations was later restricted to regulatory activities in the U.S.

Table 5.9 Arguments developed in scientific journals, 1997-2005 (*threshold for inclusion 5%*)

Phase	***1997-2001***		***2002-2005***	
Frequency (%)[1]	53		47	
Claimant (%)	**Scientific/ Industrial Complex**	**45**	**Scientific/ Industrial Complex**	**45**
	Regulatory Authorities	28	Regulatory Authorities	28
	In-house	13	In-house	16
	Interest Groups	8	Interest Groups	6
	Other[2]	6	Other	5
Public arena claimed (%)	**Regulatory Authorities**	**83**	**Regulatory Authorities**	**83**
	'People'	15	'People'	13
Location of claimed arena[3] **(%)**	**US**	**52**	**US**	**61**
	International	18	International	20
	UK	13	Asia	8
	Asia	10		
	Other Europe	5		

[1] Percentage of arguments; total $n = 410$
[2] 'Other' and 'Media' have been merged for the purposes of analysis
[3] Missing values excluded; total $n = 374$

5.5.1 Structure of argumentation

In only 35 out of the 410 arguments identified, data, warrants, backings and claims were directly expressed in the text. The most frequently missing premises were data and backings, while claims were openly reported in all of the cases. In an attempt to account for the missing elements, I tried to stay as close as possible to the text, deducing inferences on the basis of the reported parts. Given that warrants were directly reported in almost one third of the arguments, some of the missing backings were easily inferred (see Appendix 7). In cases where there was a danger of imposing my own thoughts and values on the phenomenon of research attempting to account for Toulmin's model, only evident premises were coded.

According to Govier (1987) missing premises reveal either gaps in the deductive reasoning of the argument or universal truths in the particular context in which the argument takes place. It would be unrealistic to attempt such an assumption in the present context without risking misinterpretation, considering that most of the articles containing argumentative parts were of an informative nature, updating readers on the latest developments. While presenting news, reportage focused on covering the main points of view (claims) of associated actors in a rigorous and superficial manner. I would suggest that this is more indicative of the tendency of scientific reporting to provide a brief overview of relevant issues in a few paragraphs rather than being expressive of taken-for-granted information or any other dimension. It should also be noted that arguments expressing the author's personal opinions in editorial and correspondence sections contained all the main argumentative parts. However, the absence of any rebuttals in the reported arguments could be seen as indicative of their authoritative nature. Table 5.10 gives an overview of the basic structure of the arguments analysed.

Table 5.10 Expressed, inferred and missing premises of the 410 arguments identified

	Data	Warrant	Backing	Claim	Rebuttal
Reported	96	163	47	410	0
Inferred	12	5	124	0	0
Missing	302	242	239	0	0

5.5.2 Argumentative types

Having selected all the relative arguments, an attempt was made to typify them according to their expressive meanings. Such a classification was also assisted by taking into account the overall context of their production, that is, each thesis was categorised by a consideration of its counter-thesis. This mode of proceeding resulted in the identification of two main types of argumentation: the technocratic (218 arguments), and the strategic (149 arguments), shortly to be presented. That stated, 43 claims contained mainly in articles reporting news were unable to be categorised into argumentative types. These were mainly premises claiming lack of clarity in political decision-making. The fact that any supporting elements were missing made it difficult to assess the overall type of argumentation. A consideration of the context of their reporting and possible counter-argumentation also failed to draw any informative conclusions. Thus, and in order to do justice to the data, it was preferred to code them as 'not identified'.

5.5.2.1 Technocratic argumentation

The term 'technocratic' has been used to capture the tendency of the arguments under this type to prioritise expertise over other forms of knowledge. More specifically, scientific knowledge as fact-based and public opinion as emotive and biased are demarcated. In this way, science policy is placed in the minds and hands of those who have access to 'true' facts. A one-linear model of communication between science and the public is assumed with people envisaged as the final receptors of a *fait-accompli*.

Claims

A large portion of the claims under this type of argumentation ponders on the effects that science policy has on SCNT research. In a rather alarmist tone, they point to the potential of regulation to put what is seen as important research (human therapeutic cloning and animal cloning) in jeopardy. In contrast, permissive regulatory developments are treated with enthusiasm.

'*The bill would prohibit all researchers in public and private universities and in private companies from performing important research*' (*Science*, 14.03.1999)

'*Outlawing research would set a dangerous precedent*' (*Science*, 20.02.1998)

'*This bill will stop important research*' (*Science*, 22.10.2004)

'The bill proposes draconian measures that could deter legitimate research' (*Nature*, 3.07.1997)

‘*Such restrictions send a strong signal to the next generation of researchers that unfettered and responsible scientific investigation is not welcome in the United States*’ (*Nature*, 18.04.2002)

‘*The bill as passed could jeopardize broad classes of research such as the growth of lines of nerve, liver or kidney cells*’ (*Nature,* 7.08.1997)

‘*I think it is a very reasonable bill*’ (*Science,* 8.12.2000)

‘*The new law is very reassuring*’ (*Science,* 19.03.2004)

‘*It is a huge step forward*’ (*Nature*, 10.03.2005)

Accounting for scientific research from an international perspective, other claims focus on issues of national competitiveness. Conclusions are drawn over the prospect of possible regulatory measures to constrain or reinforce research affecting national economies respectively.

‘*We are not in a leadership position*’ (*Nature*, 15.01.98)

‘*The country is working hard to build up its biotechnology industry and it seems that the business will grow in the wake of this legislation*’ (*Nature*, 9.09.2004)

‘*The bill would leave the US in a conservative position compared with countries such as Britain and South Korea*’ (*Nature*, 2.06.2005)

‘*Talent and resources will flow to countries with the most permissive laws*’ (*Science,* 4.01.2002)

‘*Political decisions in the United States may carry real penalties for its own scientific enterprise*’ (*Science*, 12.03. 2004)

‘*Governments around the world must invest significantly in the basic science*’ (*Science*, 29.08.2002)

Claims are also addressed to regulators proposing alternative SCNT policies. Invitations to national and international regulatory bodies are made pointing to the need for further reflection before the enactment of bans on relevant research.

‘*Deliberate and considerate reflection is needed*’ (*Nature,* 15.01.1998)

‘*Ethical consideration is essential, but the character of ethical arguments, and how to respond to them, merits reflection*’ (*Nature*, 24.01.2002)

‘*A federal ban at this time would be premature*’ (*Science*, 14.03.2003)

‘*Human cloning should not be banned*’ (*Nature*, 13.11.1997)

‘*Research cloning should not be banned*’ (*Science*, 29.06.2001)

‘*Sensitive and flexible guidelines overseen by an interagency regulatory body, including the Food and Drug Administration, NIH, and representatives of the general public, would be better than legislation.*’ (*Science*, 16.10.1998)

The next set of claims entails a demarcation between scientific and public knowledge. The dissemination of scientific facts into the public realm produces misunderstandings and arouses negative feelings. Media coverage of science is also criticised for failing to objectively account for the facts. In this light, scientific expertise is called to remedy the wrongs and educate the ill informed over the ‘true’ state of affairs.

‘*The prohibition ignores a distinction obvious to most biologists, that between sexual and asexual reproduction*’ (*Science*, 01.09.2000)

‘*This may be the lowest level of knowledge I've seen for a significant piece of legislation*’ (*Science*, 10.08.2001)

‘*All of Dolly's other popularizers have misunderstood her importance*’ (*Science*, 25.02.2000)

‘*Some of the common fears about cloning are little more than science fiction at present*’ (*Nature*, 25.03.1999)

‘*Debates over the ethics of such approaches, as well as their potential scientific and clinical merit, should be separated from the fantasy currently occupying news reports*’ (*Science*, 17.01.2003)

‘*Science and scientists would be better served by choosing other words to explain advances in developmental biotechnology to the public*’ (*Nature*, 05.07.2001)

‘*Members of the public who would like to understand what the debate on human cloning is all about should read this book*’ (*Nature*, 22.04.2004)

‘*Scientists and those who are interested in the ethical consequences of advances in science must strive to point public debate toward what is practical and possible as well as what is plausibly moral*’ (*Science*, 28.11.1997)

‘*Federal departments and agencies concerned with science should cooperate in seeking out and supporting opportunities to provide information and education to the public in the area of genetics and about other developments in the biomedical sciences*’ (*Science*, 11.07.1997)

Data

Data are utterances in the form of evidence that strengthen the claim by constituting a ‘hard’ base on which conclusions are drawn. They are of an informative nature, referring to past or current events or to unproblematic statements. A large part of the utterances used to build a solid foundation to the claims made reference to developments in the regulatory arena. Some examples include:

‘*We believe the danger is very real that research with enormous potential benefits may be suppressed*’ (*Science*, 30.05.1997)

‘*Public reaction to human cloning failures could hinder research in embryonic stem cells for the repair of organs and tissues*’ (*Science*, 30.03.2001)

‘*Congress is now pondering a bill that would ban research on human cloning, subjecting scientists to criminal as well as civil penalties*’ (*Science*, 26.10.2002)

‘*Therapeutic cloning might become legal in Singapore*’ (Nature, 27.06.2002)

Other forms of data provided give information about public opinion in relation to SCNT research. The majority of them focus on the ethical concerns surrounding relevant research and they are employed in such a way so as to later point to their fallacies. The use of statements about public apathy or public misunderstandings as data is indicative of their treatment as inherent and permanent characteristics of public opinion formation.

‘*Apathy about science and technology seems especially rampant among my fellow Americans, among whom indifference toward scientific understanding is almost considered a badge of honor.*’ (*Science*, 13.03.1998)

‘*The appearance of Dolly, the first cloned mammal made from DNA of an adult cell, set of a flurry of ethical concern about the pace with which cloning technology could be applied to human beings*’ (*Science*, 10.12. 1999)

‘*I think people have a tendency to think that scientists in China just push research wherever they want it to go*’ (*Nature*, 26.09. 2002)

‘*The page-one headlines heralding Dolly’s creation ignited worldwide concerns about the potential of this approach for cloning people*’ (*Science*, 7.03.1997)

‘*SCNT has inappropriately been lumped into the general category of ‘cloning’ and so may be subject to regulation that is aimed mainly at preventing reproductive cloning*’ *(Nature*, 24.04.2003)

‘*We must accept that democratic debate on cloning is bereft of any meaning*’ (*Nature*, 5. 07. 2001)

'*Enhanced polarization has emerged in the human cloning debate, encouraging a reflex response that demands sweeping bans rather than the determined reflection that the issue deserves*' (*Nature*, 15.01.1998)

Evidence is also drawn from the present or past of relevant scientific research. References are made to activities by specific scientists, identified as 'cloners', in an attempt to assess the effects of their doings on public perceptions, media coverage and science policy. As would be later exemplified, these kinds of data are largely employed with the purpose of defining 'real' expertise.

'*Twenty-five years ago, the discovery of techniques for cloning and manipulating DNA molecules (the use of recombinant DNA) presented comparable concerns, while promising to advance the life and biomedical sciences*' (*Science,* 16.10.1998)

'*Stanford University last week announced the formation of a new, privately funded institute to marry research on stem cells and cancer in a search for new therapies*' (*Science,* 20.12.2002)

'*Human cloners were invited to speak to the National Academy of Sciences (NAS), the U.S. Senate, and the media*' (*Science*, 17.01.2001)

Warrants

Warrants are explanatory statements in that they explain how things are. Their role is to enhance the legitimacy of the data in support of a claim. Warrants used in technocratic argumentation can be largely grouped into two broad categories. In the first set explanations are of a more internal nature in the sense that they are largely drawn from scientific expertise (assuming that the point of reference in technocratic argumentation is science). Thus, a majority of them originates from technical knowledge with regard to SCNT research. They are presented as 'factual' knowledge informing about the way things 'work' in CNR. Issues of financial growth are also employed linking cloning research to the world of business. SCNT is a way of making money. Health and research benefits of associated research are another way of asserting the strength of relevant claims. Such explanations dissociate SCNT from the ethical and moral context in which it was received in the public realm. Even if there are fallacies they are quickly reduced to matters of risk and safety, implying the assumption that eventually they will be understood and accounted for by relevant scientific research. Examples of such internal explanations include:

'*'Nuclear transfer'... involves inserting a nucleus from one cell into an egg stripped of its own genetic material*' (*Nature*, 22.04.2004)

'*In scientific parlance, cloning is a broadly used, shorthand term that refers to producing a copy of some biological entity--a gene, an organism, a cell--an objective that, in many cases, can be achieved by means other than the technique known as somatic cell nuclear transfer*' (*Science*, 15.02.2002)

'[Because of] *current rates of interest*' (*Nature*, 9.6.2005)

'*Research cloning is likely to give insights into the processes that underlie a host of debilitating diseases*' (*Nature*, 9.05.2002)

'*The technique shows promise to overcome the anticipated problem of immune rejection in stem cell-based therapies to replace a patient's diseased or damaged tissue while offering an unprecedented opportunity to study genetic disorders as they unfold during cellular development*' (*Science*, 15.02.2002)

'*From safety considerations alone, human reproductive cloning is unwarranted because animal cloning so far results in high rates of abortions and neonatal losses*' (Science, 17.01.2003)

'*The success rate in animals is between 3% and 5%*' (*Nature*, 5 April 2001)

External explanations refer to statements used to describe the modus operandi of public opinion formation and public policy. Technocratic argumentation prioritises explanations of social influence over critical thinking. This is mainly exemplified by a tendency to account for public perceptions as mere reproductions of media opinion. Certain groups like the Church or the 'cloners' are also singled out as agents of public influence. People misunderstand because of what they read in the media, because of what the Church or the 'cloners' claim. In a sense, public opinion reflects the opinion of major actors in the debate. Such explanations direct any attempts to account for responsibility outside the scientific/industrial complex. Science policy is also described as operating under the principles of politicisation. Relevant regulation reflects political rather than rational motives.

'*Antinori's activities will generate public anxiety about cloning*' (*Nature* 11.04.2002)

'*…after Seeds claims to the media declaring his intention to produce a human baby clone…*' (Science, 16. 01.1998)

'[because] *the public is woefully ignorant about genetics*' (*Science*, 23.05.1997)

'*...to avoid a public debate on the issue in the run-up to next year's presidential elections...*' (*Nature*, 21.06.2001)

'*It provides an avenue for politically based regulation of research*' (*Nature*, 20.03.1997)

'*Advocates of supernatural or spiritual agendas may be trying to railroad governments into banning biological research*' (*Science*, 30.05.1997)

Backings

According to Toulmin (1958) backings reveal wider beliefs and values shared in a large community. Relevant research has indicated that these premises are frequently alluded to or left to be assumed by the reader of the argument (Govier, 1987). Warrants referring to the economic and research benefits of cloning technology appear to imply two different sets of backings. The first set promotes sociobiological explanations of science, in the sense that scientific conduct is portrayed as an inherently competitive activity. Different scientific groups compete amongst each other over the accumulation of knowledge and professional credibility.

‘*We need to conceal the birth of cloned animals until publication in scientific journals*’ (*Nature*, 30.07.1998)

The second set of inferred backings draws heavily from economics describing science within the context of a capitalist economy. Competition is also stressed here but this time involves different stakeholders. Another kind of backings not explicitly stated appears to be inferred in warrants discussing the health benefits of CNR research. These types of explanations seem to reveal the humanitarian nature of science per se. Inherent in them is the idea that an important function of science and scientific research is to promote general well being by offering solutions to problems devastating humanity.

Still, others attempt to draw a demarcation between scientific conduct and politics revealing a growing unease about the increased politicisation of science. Beliefs in scientific freedom and its strictly factual nature are situated here. As was the case with warrants, technical knowledge is also employed as a further means to differentiate between what is seen as reality and as fantasy.

‘*There is a balance between the protection of human rights and scientific freedom*’ (*Nature*, 7.08.1997)

‘*A federal ban would constitute an unprecedented intrusion of the U.S. government into the freedom of scientific inquiry in the United States*’ (*Science*, 14.03.2003)

‘*The real cloning technology might only lead to the birth of a unique and unpredictable child who had the same DNA sequence as someone else*’ (*Nature*, 5.07.2001)

‘*Even Dolly is not an exact replica of the ewe used to clone her, because she did not develop in that ewe's uterus nor receive its genes in the cellular organelles called mitochondria*’ (*Science*, 19.12.1997)

Normative statements were likewise used to base relevant claims. These were utterances referring mainly to ideas on how things should be, and taken together they constitute the majority of backings under technocratic argumentation. Overall, they assign primacy to expertise knowledge implying the meritocratic assumption that science communication and policy should be restricted to those with direct access to ‘hard’ facts. ‘Right’ knowledge becomes the criterion for the exclusion and inclusion of different actors in associated debates. Those who act under the influence of emotions or any non-experts are to be prohibited from decision-making for rationality is the basis of ‘valid’ opinion. In the same light, specific scientists, namely the ‘cloners’, are also excluded, for they do not appear to operate within the context of scientific rules and standards.

‘*Scientific knowledge is essential for all citizens to participate in a full and informed fashion in the governance of our complex society*’ (*Science*, 11.07.1997)

‘*I believe we will realize that the answers to many of the problems that still confront us will need to be solved by scientists and engineers who understand the complexities of the societal problems their work impacts*’ (*Science*, 13.03.1998)

‘*There is a heavy responsibility* [for accuracy] *on those who frame the public debate*’ (*Nature*, 28.01.1999)

‘*Legitimate scientists submit evidence, sufficiently substantial to withstand rigorous expert review, to be considered for publication in reputable journals*’ (*Science*, 17.01.2003)

5.5.2.2 Strategic argumentation

Several names were considered preceding the final choice of the term ‘strategic’, including ‘protective’, ‘social’ and ‘democratic’ argumentation. Although the term ‘protective’ was thought to reflect some of the most basic features of this type of argumentation, it failed to capture the active role assigned to representatives of the public realm. The term ‘social’ was considered problematic for it implied yet again a ‘science versus society’ explanation. Finally, an overview of relevant literature on political theory confirmed that the term ‘democracy’ has been used to refer to different regulatory and policy practices across years and countries. Even technocracy has been associated with a specific type of democracy, further to be discussed in following chapters. The final choice of the term 'strategic' was thought to best reflect the participatory role assigned to members of the public sphere. In contrast to the previous type of argumentation, here people, the media and regulators are given voice; voice of a certain weight and status. Thus, instead of being treated as a bad caricature of scientific knowledge, public opinion is perceived in the wider context of its production. People and the media are portrayed as playing a central role in the legitimation of scientific practices, while decision-making is based on the idea of civil rights and their protection. Overall, argumentation proceeds in the wider background of ethics regarding not only SCNT research but that of science and humanity too.

Claims

All of the claims made and addressed to regulatory authorities originate from the idea of regulation as a gatekeeper of ethical and moral standards. Some of the most frequently expressed are calls made to either permit or ban relevant research. In a similar manner invitations are made to further reflect on matters at stake or to clarify relevant points. In what follows some examples of such claims are presented:

'*We need to enact banning legislation*' (*Nature*, 15.01.1998)

'*We should ban this technique from being applied on humans*' (*Nature*, 20.03.1997)

'*This promising line of biomedical research should be permitted to continue, not banned by an act of Congress*' (*Science*, 27.06.2003)

'*So, this is a decision no president should make alone*' (*Science*, 27.06.1997)

'*We need to proceed carefully*' (*Nature*, 1.07.1999)

'*An information protection law should be set up, with an authoritative body to oversee genetic and embryo research for at the moment the CST is too weak*' (*Nature*, 1.04.1999)

A different set of claims argues for the effects of science policy on SCNT research. Although similar claims are also found in the technocratic type of argumentation, these seem to originate mainly from the idea of science as proceeding in the service of the greater public good.

'*A sweeping cloning ban would have grave implications for future advances in medical research and human healing*' (*Science*, 10.08.2001)

'*Health is being held hostage*' (*Science*, 15.03.2002)

The last set of claims presented is only evident under this type of argumentation. They include conclusions regarding the inability of regulation to protect the rights of human life, as well as references to a more participatory model of communication with the wider public. As such, calls are addressed to the scientific community to engage in public discussion and dialogue, implying the assumption that public opinion is valid opinion.

'*Issuing a patent that can be applied to create genetically engineered human embryos poses both ethical and legal problems*' (*Science*, 03.03.2000)

'*The experiment might be used by countries to accelerate research*' (*Nature*, 26.05.2005)

'*We need to respect the public's perspective and concerns even when we do not fully share them, and we need to develop a partnership that can respond to them*' (*Science*, 14.02. 2003)

'*We should integrate public concern into a viable science policy*' (*Nature*, 16.10.1997)

'*We should adopt a more inclusive approach that engages other communities assertively discussing the meaning and usefulness of our work. Let's try diplomacy and discussion and see how that goes for a change*' (*Science*, 11.02.2005)

‘*More can still be done to engage the public directly in regulating the impacts of modern science*’ (*Nature*, 23.01.1997)

‘*The purpose is to create a dialog with the larger society*’ (*Science*, 12.09.2003)

Data

Evidence in support of strategic claims is largely similar to those employed in technocratic argumentation. Thus, references to regulatory developments and to the benefits of SCNT research are also being made. Information about public ethical concerns over the use of CNR technology is coupled with the personal concerns of claimants in an attempt to account for their authenticity. Examples of scientific misconducts relating either to the communication style adopted or to the breaking of ethical codes are put forward as well.

‘*The president has announced his support for a bill sponsored by Senator Sam Brownback (R-KS)*’ (*Science*, 10.05.2005)

‘*One country where human cloning is in principal legal is the US*’ (*Nature*, 23.07.1998)

‘*Cloning research for therapeutic purposes has potential to treat diseases*’ (*Science*, 29.07.1999)

‘*Some members of the public are finding certain lines of scientific research and their outcomes disquieting, like therapeutic or research cloning and stem cell research. Although many understand the benefits of the research they are also troubled about scientists working so close to what they see as the essence and origins of human life*’ (*Science*, 11.02.2005)

‘*We would regard cloning a human being as an unethical and reprehensible act*’ (*Nature*, 25.09.1997)

‘*Human cloning raises ethical and moral issues that go well beyond questions of safety.*’ (*Science*, 4.12.1998)

'*The suggestion made by some that cloned human embryos will provide otherwise unobtainable cells for disease research misleads the public.*' (*Nature*, 22.05.2003)

'*Widely publicized examples of scientific dishonesty like the Schön case, or unacceptable scientific practice, like the Lomborg affair or repeated unverified claims of human cloning.*' (*Science*, 14.02.2003)

Warrants

A large part of the explanatory statements offered to further support data in strategic argumentation reflect ethical worries and questions regarding SCNT research. Scientific practice is put under scrutiny. At the same time, warrants referring to the benefits of CNR are largely expressed in the context of public health and healing.

'*The cloning of human beings is not socially acceptable*' (*Nature*, 3.07.1997)

'*The fundamental genetic material in every person is the common heritage of humanity and shall not give rise to financial gains*' (*Science*, 21.11.1997)

'*New technology is always followed by controversial issues, bringing forth new concerns requiring new solutions*' (*Science*, 27.04. 2001)

'*This kind of research could have tremendous value for people*' (*Nature*, 20.03.1997)

'*Therapeutic cloning's objective is information that might be useful in developing therapies for genetic defects in brain chemistry*' (*Science*, 10.05.2002)

The next set of warrants draws a completely different picture of public opinion and science policy compared to those used in technocratic types of arguing. Statements point to the importance of public representatives in the conduct of scientific practices. Here, people are given a role: they are stakeholders in the form of patients, funders, and voters; also they are a means in recognising scientific work. References to public trust and its importance in legitimasing relevant practices are also made. If the public loses trust in science, scientists lose their job.

'*Indeed, the one million Americans who suffer from Parkinson's disease would undoubtedly feel more affronted if these advances had not taken place*' (*Science*, 16.04.2004)

'*There is a need to protect the safety of patients and the public health*' (*Nature*, 22.01.1998)

'*This ban prevents taxpayer funding from bizarre experiments such as cloning*' (*Nature*, 12.11.1998)

'*This is a necessary tension to ensure the long-term quality of the publicly funded research enterprise*' (*Nature*, 22.05.2003)

'*Science-based regulatory agencies have learned that stakeholder consultation makes all the work going better*' (*Science*, 14.02. 2003)

'*We find it is often the flaws that inspire non-science students to want to know more about the current scientific research, the future possibilities and the responsibilities that come with them*' (*Nature*, 16.09.2004)

'*In highlighting the research, the press is responding to a sensitivity that its readers already have*' (*Science*, 31.10.1997)

'*Public trust is crucial to science*' (*Science*, 15.11.2002)

'*Because if we don't handle this right the public will lose trust in science*' (*Science*, 19.03.1999)

'*Trust is created through a complex of social interactions*' (*Nature*, 16.10.1997)

Backings

Some of the supporting premises in strategic argumentation are left unexpressed. To a large extent these refer to backings articulating science's humanitarian motives. Implied in the warrants used to exemplify the benefits of SCNT technology is the inherent view that scientists are acting in the service of the greater good. Another set of backings points to the pragmatism of public opinion, while ethical considerations of the technology and of science in general, are also included.

'*Ontological arguments do not distinguish between ordinary embryos and embryos that have been cloned*' (*Nature*, 05.02.1998)

'*To assume that viewer's don't understand that movies distort science in the same way that they distort historical events is somewhat patronizing*' (*Nature*, 16.09.2004)

Beliefs in protective democracy constitute the majority of backings in strategic argumentation. The idea that science policy serves with a view to protect individual rights and general standards is largely employed. Public accountability as an integral feature of scientific conduct is also taken into account, further enhancing the role of people as an important resource in the development of scientific research.

'*As science encroaches more closely on heavily value-laden issues, members of the public are claiming a stronger role in both regulation of science and the shaping of its research agenda*' (*Science*, 11.02.2005)

'*The centrality of science to modern life bestows an obligation on the scientific community to develop different and closer links with people*' (*Science*, 14.02.2003)

'*The intent is not to limit commercial applications stemming from the Human Genome Project, but to ensure that knowledge about the genome remains in the public domain*' (*Science*, 21.11.1997)

'*Our citizens will never forgive us*' (*Science,*25.07.1997)

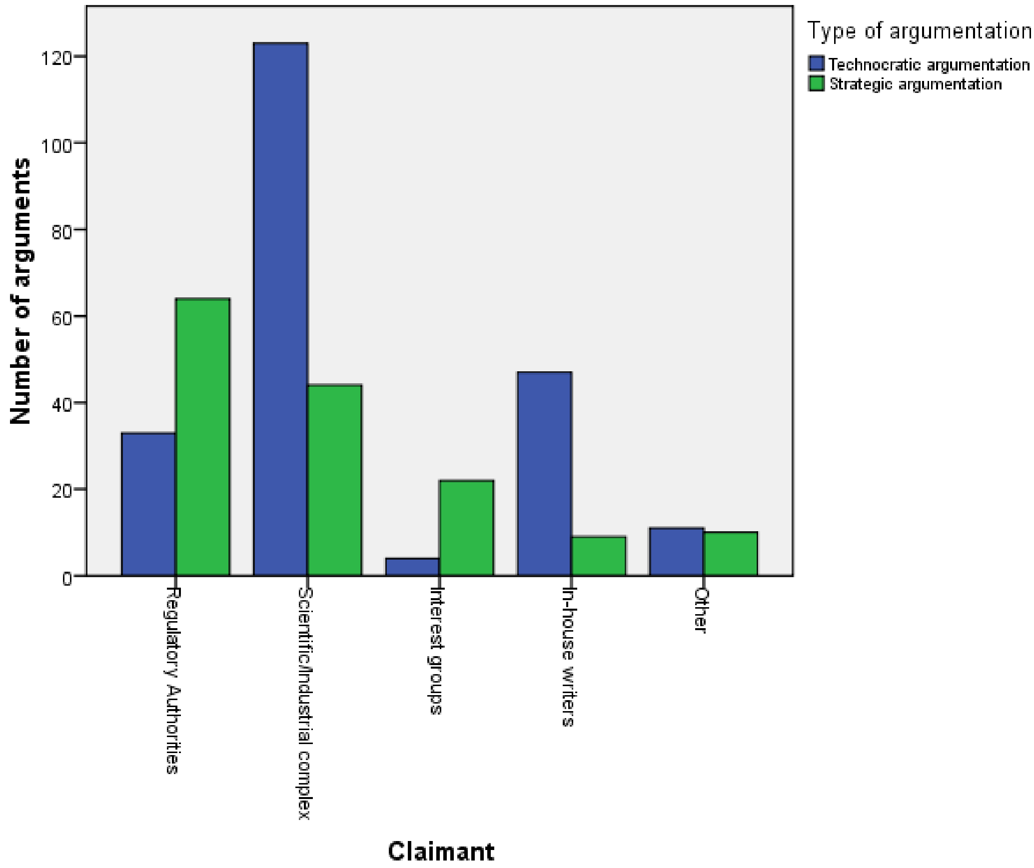
5.5.3 Recapitulating the results of argumentation analysis

Analysis of the arguments employed in formal discussions about the public developments of SCNT technology has concluded in the identification of two main argumentative types. Technocratic argumentation could be largely characterised as the rhetoric of logos. At the heart of argumentation lies a strong belief in the superiority of expert knowledge. A set of criteria is drawn, demarcating right from invalid opinion. Right opinion is characterised by the acquisition of technical knowledge and skills, rationality and objectivity. In contrast, emotionality and intellectual incapacity render non-technical opinions dubious. The rhetorical effect of such a means of argumentation is that of exclusion (reported also in studies by Michael & Birke, 1994a; 1994b) where participation in decision-making about the future of CNR technology is restricted to a small minority of experts and all other actors are not permitted to enter the debate.

Strategic argumentation seems to follow a different logic, that of ethos. Evident here are references to the moral obligations of science to society, the responsibility of policy to serve and protect citizens, as well as the identification of the validity of the ethical concerns characterising much of public reaction to SCNT technology. This type of argumentation, while informing the reader of the claimant's character and moral credentials, opens up the debate to other, non-scientific parties. It is a rhetoric of inclusion, inviting the voices of stakeholders, such as patients, voters, interest groups and funders, to contribute to the debate alongside more technoscientific opinions.

A comparative analysis between the two time frames covered, as well as between *Science* and *Nature* failed to reveal any significant shifts and alterations (see Appendix 18). However, considerable differentiations were detected regarding the argumentation type adopted by different claimants, as well as in relation to various countries.

Figure 5.2 Argumentation type by claimant

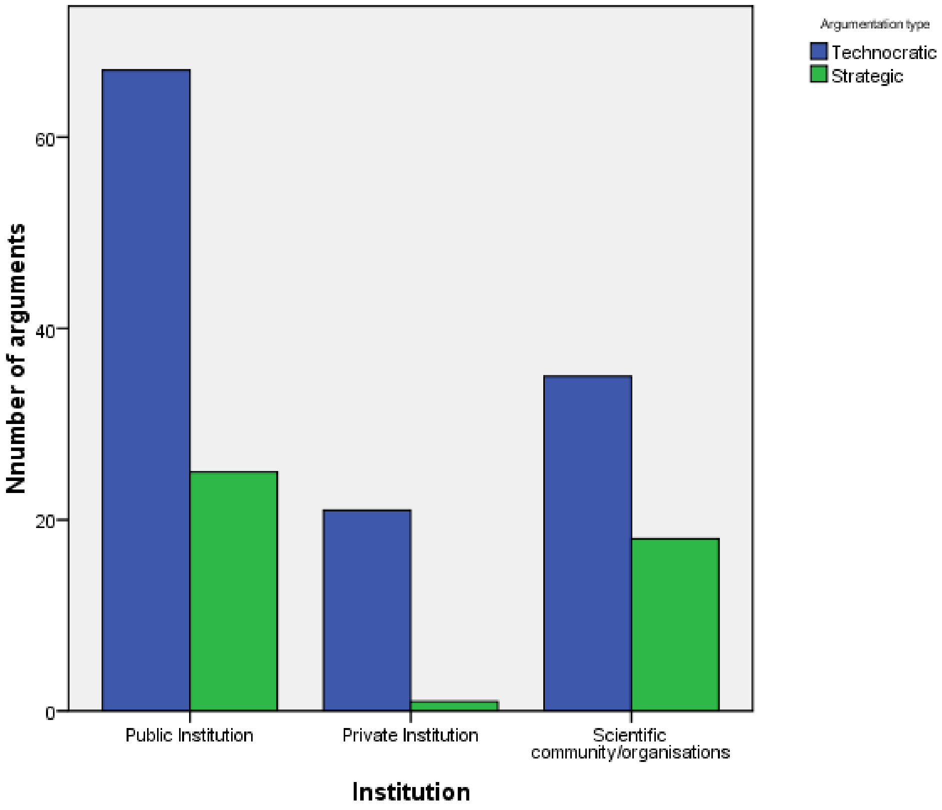


As shown in Figure 5.2, a large majority of the arguments employed by the scientific/industrial complex falls into the technocratic type. Such a rhetorical style permits scientists and industrialists to differentiate themselves from other claimants in the debate, assuming a superior status. By presenting themselves as the sole holders of true knowledge they succeed in undermining both public opinion and opposing views. This enables them to preserve a certain degree of freedom in their doings, while framing the debate around issues they can control. Overall, theirs could be characterised as a defensive strategy with the purpose of maintaining professional ideology and symbolic and technical resources. When strategic argumentation is employed it is mainly performed as a way to reconstruct the agents' public image. Claims to public accountability and references to the moral obligation of science and regulation to protect individual rights and ethics codes permit scientists to build an alternative icon to the image of 'mad scientists', namely a 'humanitarian' one. Such a rhetorical style restores public trust in expert knowledge and its holders.

Along the same lines, regulators also make use of technocratic patterns of argumentation as a way to control and preserve their decision-making role, while ensuring national competitiveness on the international map of techno-scientific progress. The more frequent use of strategic argumentation comes mainly as a reflection of politicians' needs to certify their support of their constituencies and their potential re-election. Interest groups' argumentation develops overwhelmingly within a strategic frame. Aligning themselves to wider concerns and reservations, mainly regarding the potential applications of SCNT technology on humans, they succeed in identifying themselves as representatives of a significant part of public opinion. Such a rhetorical style legitimises their role and actions in the CNR debate, while ensuring their participation in those to come.

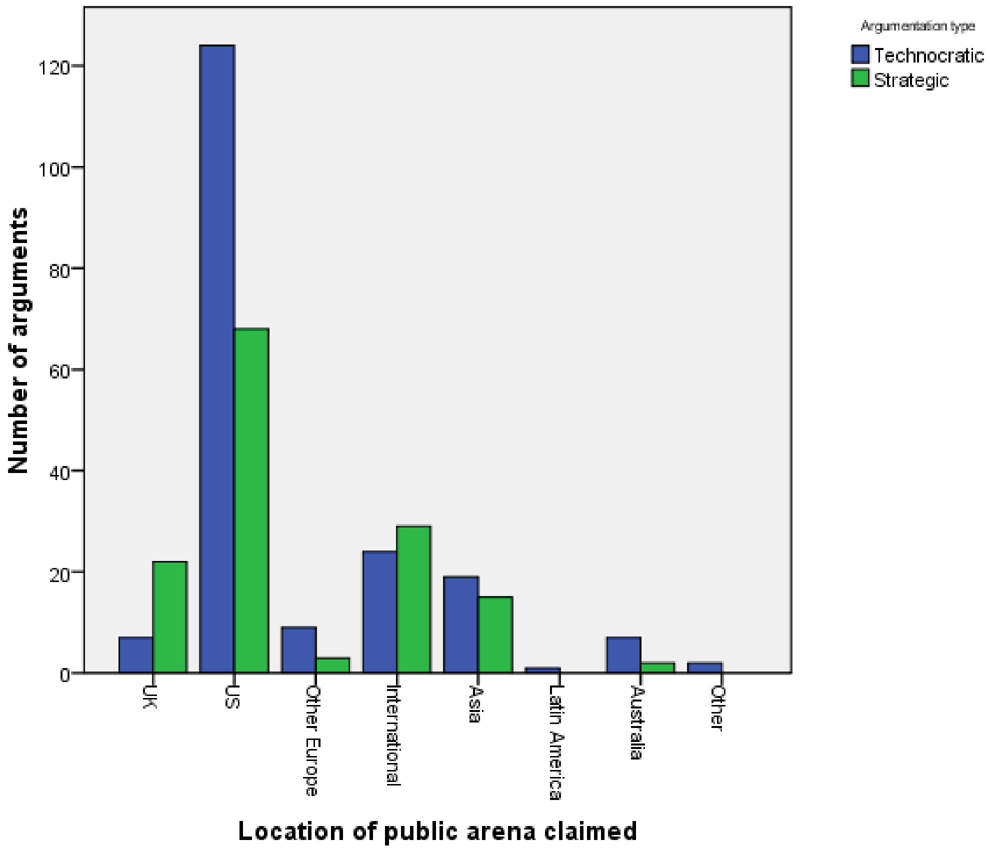
Possible discrepancies between the argumentation types adopted by the different representatives of scientific institutions were also considered. The results are presented in Figure 5.3 and they appear to be in-line with the findings of previous research by Rabino (1994). Thus, scientists working in private laboratories and representatives of the biotechnology industry seem to rely largely on technocratic arguments, holding more degrading images of public actors compared to their academic fellows. Since most of the claimants come from the United States and taking into account the permissive regulatory framework in which private research operated in the period analysed, the need to address non-scientific matters seems less obvious. An analysis of the rhetoric style of natural and social scientists was also conducted, however, it did not reveal any considerable differentiations.

Figure 5.3 Argumentation type by scientific institution



Accounting for locations and the argumentative type employed in reference to different national and international public arenas, an interesting amalgam was detected, as shown in Figure 5.4. At a national level, the U.K stands out since the proportion of strategic argumentation far outweighs that of technocratic. This is thought to be in-line with recent shifts and discussions in the country regarding the wider relationship between science and non-science and more participatory models of decision-making, a point considered fully in the final chapter. In contrast, technocratic argumentation dominates claims relating to US public developments, reflecting the need of the scientific/industrial complex to preserve control in an unclear regulatory environment. Arguments referring to other locations present an almost dichotomised picture with technocratic and strategic argumentation used interchangeably.

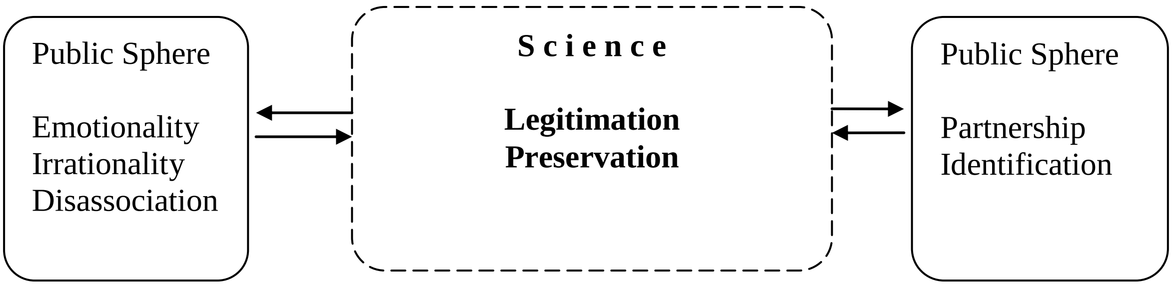
Figure 5.4 Argumentation type by location of public arena



5.6 The public sphere in scientific journals

The analysis of scientific journals regarding the coverage of the public developments of SCNT technology is thought to further enhance, both methodologically and interpretatively, the elaboration of the material collected from interviews with individual scientists. Thus, it proved to be a useful guide informing me about major research and public events as they occurred worldwide, while at the same time, assisting in the identification and crystallisation of relevant actors and experts. It also revealed the 'news value' of science policy and its institutionalisation in the scientific press in the form of regular spaces, as well as, the prioritisation of US developments regarding SCNT and stem cell technology. However, such an analysis is thought to illuminate emergent, circulating and communicated representations of the general relationship between science and non-science as covered in the field of formal communication. One can evidence not only how these wider representations are engaged but also how they are actually employed in the process of a specific type of research in the making to legitimise itself as a Science; in Latour's terms, as a reified form of knowledge. That stated, the coverage does not merely give an informative account of public perceptions, media coverage, and the regulation of CNR technology but by drawing from such diverse sources as technical knowledge, ideology and popular beliefs, it also puts forward specific theories and visions of democracy, public opinion, public dialogue, communication, even nature. The data discussed in the present chapter reveal a sort of tension in the network of metaphors and argumentations comprising the representational activity in formal settings of interaction. Figure 5.5 schematically captures such meanings.

Figure 5.5 Meanings of science and the public sphere in *Nature* and *Science*



On the one hand, there is a demarcation between science and non-science. Logic explains the scientific, while pathos the non-scientific. Such a disassociation permits the legitimation of scientific knowledge as superior. Disentangled from the irrationality of the social, science no longer faces the threat of being thus polluted. Science is about facts and scientists are the only credited spokespeople on nature. On the other hand, there is a degree of identification with the non-scientific where a more human picture of science prevails. Science is about people; it is a tool at their disposal in order for them to tackle dangers and problems that may be threatening the human race. What feeds science is the ethos of service to the wider good. Such a re-association distinguishes between good and bad science, while it legitimises the importance of the former by the preservation of investment in time, money and personnel.

In an analysis of a variety of UK and US popular media outlets (including films, television dramas and drama-documentaries, as well as, the press) covering human SCNT research and its potential reproductive and therapeutic applications, Haran et al. (2008) reveal similar tendencies in relevant representations of public perceptions. On the one hand, and largely composed of a mixture of agential subjects, rational deliberators and advocates for cures and enhancement, the public emerges as a somewhat ‘unbiased’ subject, becoming the new arbiter of objectivity. They are the people in whose name cloning comes to be a scientific practice for future generations. On the other hand, there is the ‘bad’ public, harbouring irrational, science-fictional and misinformed understandings. These are the people that need to be approached and educated. And while participation in science policy is granted to the former, the latter are dismissed as ‘outsiders’.

Public sphere meanings in *Nature* and *Science* are not treated as mere distributions or reflections of individual representations existing in isolation but rather as the ‘bubble’, according to Moscovici, of a certain elite community. At the same time as informing, they also transform, in this way creating a sense of belonging to a wider scientific community, whilst sustaining communication through the transgression of physical and time boundaries. The section that follows is thought to shed further light on the experience of being a scientist in such hotly debated research, allowing for the identification of the way individual researchers themselves play out the relationship with the non-scientific, nature and the self.

Chapter 6

The public sphere according to stem cell researchers in informal communication

Drawing from their own study on the social representations of biotechnology in different publics, Bauer and Gaskell (1999) offer a paradigm for research extending similar scholarship. Attempting to account for the complexities and richness of the different phenomena under study, they propose the elaboration of methodological pluralism. They discuss different modes and mediums of analysis covering behaviours, individual cognitions and different settings of communication by participant observation, individual and group interviews, and mass media documentation respectively. Triangulation then becomes a central objective for the social representations researcher, and as discussed in the methodology section of the present thesis, assists in capturing different aspects, elements, and processes of the object under study. Having presented metaphors and different types of argumentation in articles of two scientific journals discussing public developments on SCNT research, the purpose of this chapter is to present data from individual interviews with different experts in this technology. In their seminal paper, Bauer and Gaskell (1999) conceptualise individual interviews as a way of accessing social representations existing at the level of the person. While this remains undoubtedly true, I would also point to the communicative character of the interview situation, further elaborating on this in the final section of the present chapter. The interview situation is not only an instance of examination of thoughts as they exist in the mind of the individual but also a moment of informal communication between two people. As such, although retaining a disinterested attitude, in the sense that I tried to hold myself back from any immediate or direct intervention in the procedure other than that of nodding or further exploring a given statement, I could not help but notice those moments of genuine interest and curiosity by the interviewees expressed in enquiries about my motives in doing this research, my personal thoughts, my ethnicity, my religion and academic background. These moments further enlightened my understanding of the experience of working in a controversial field of research, while assisting in the interpretation of the data collected. In the following pages, I set to account for the metaphors and arguments employed by interviewees when discussing about public perceptions, mass media coverage and the regulation of their doings. In the following chapter and coming from a more synthetic perspective the social representations of the public sphere among experts will be fully examined.

6.1 Talking to scientists

The period under study was an interesting time to talk to scientists about SCNT and its applications on human embryonic stem cell research. While the debate over the regulation of CNR was still unsettled in countries like the U.S, and although in others such as Germany and Switzerland this type of research was illegal, the U.K was amongst the first to grant licenses allowing it to proceed (August 2004). This was a time of reflection, both of individual as well as collective activities, by the wider scientific community. Thus, discussions over the sequence of events following the birth of Dolly were coupled with explanations, opinions and ideas over the status of public opinion, contemporary science policy, media effects and democracy, while accounting for one's personal values and feelings regarding the ethical dimensions of the public debate. All the interviews started by prompting descriptions of the participant's research and possible experiences in science communication practices. Most of them happily agreed to confide to me their thoughts and opinions about public perceptions, media coverage and the regulation of human SCNT research. My role was then mainly to listen and to invite further elaboration. It was left to the interviewee to raise the themes that she/he considered important for discussion. An interesting pattern soon emerged. Public perceptions and media coverage of their research was what mostly preoccupied the interviewees' discussions. References to regulation were brief and overall positive, most of the times brought up at the end of the interview prompted by my questions. This absence in their discourses is thought to reflect an unproblematic, taken-for-granted trust in the perceived ability of the UK regulatory arena to frame relevant policies in a pro-scientific manner. It was this permissive context that motivated seven of the interviewees to abandon their home countries and settle in Britain. Some of them had been at the forefront of intense criticism by ethicists, Pro-life, religious groups, including media and policy representatives for crossing the boundaries between the 'natural' and the 'unnatural' as well as being criticized for destroying human life. The psychological bearing of such public unease was evident in their discourses. This unexpected condition permitted for the investigation of possible differences between UK and non-UK scientists. An extensive account of the metaphors and the arguments employed follows. While typification is attempted, the chapter ends with a consideration of the variations as they were identified. In doing so, the presentation of the results of the discourse analysis in formal and informal communication settings is concluded, leading to the final part of the thesis, the synthesis.

6.2 Metaphors and arguments of scientists

6.2.1 Metaphors

Relevant analysis of interview data identified 402 metaphors used by interviewees to categorise the public sphere, that is, public perceptions, media coverage and the regulation of human SCNT research. Identification of superordinate categories followed the same criteria applied in formal communication. Thus, metaphors were classified based on similarities between source domain and target domain, while taking into account the discursive context. Overall, 12 superordinate categories were identified: Conduit, Container, Economy, Engineering, Entertainment, Human Nature, Journey, Psychopathology, Parenthood, Popular metaphors, Statistics and War. Seven of the superordinate categories also appeared in relevant articles of *Science* and *Nature*, presenting a certain degree of parity with regard to categorisation. These are the categories of Container, Economy, Engineering, Entertainment, Journey, Psychopathology, Popular metaphors, and War. Following, a presentation of the main associations of each superordinate category will be given, including some examples of relevant metaphors. Again, the order of the presentation does not denote their frequency. The four categories specific to the context of informal communication will be described first, followed by the subsequent eight discussed in a more epigrammatic manner to avoid unnecessary repetition.

Conduit metaphor

Metaphors in this category involve the figurative assertion that language *transfers* human thoughts and feelings. More specifically, the structure of the metaphor could be roughly described as: (1) ideas or meanings are objects, (2) linguistic expressions constitute containers, and (3) communication is related to transportation (Wagner & Hayes, 2005).

‘*…the idea that stem cell research is one thing and nuclear transfer is another aspect of that thing has **not been put across**.*’ (Senior university stem biologist, male, 2)

‘*...the scientists can then sort of **put forward** to the public reasonably how maybe the benefits of what they do.*’ (Senior university embryologist, male, 5)

‘*I think they have been informed at a superficial level maybe, which is probably understandable because it is the easiest thing to **get across**.*’ (Junior government research institution geneticist, female, 11)

‘*The BBC documentaries that they do, where they kind of set them in the future and things like that, they are quite clever but they **get the message across**.*’ (Junior government research institution geneticist, female, 9)

In this context the media becomes the vehicle for communicating messages and information to wider public realms. The idea of balance in the dissemination of information assumes great importance.

‘*It is important because it* [the media] *is a **vehicle**, it is an effective vehicle, arguably it is **the vehicle** to communicate to the public*’ (Senior university stem cell biologist, male, 16)

‘*How else can you **transfer information** to the public without it being, in one **channel**?*’ (Junior university geneticist, male, 17)

‘*I think if you have the public deciding you need **to give them balanced information** because often the information they get is from people who appear in the media and those people most of the time are not interested in presenting the scientific facts.*’ (Senior, university embryologist, female, 8)

‘*But obviously people are interested to hear about it, people do not have necessarily all the background that is needed to understand that in detail but I think it can still be **made accessible** and simplified and that is important.*’ (Junior government research institution geneticist, female, 11)

According to Reddy (1979), the conduit metaphor is one of the most dominant used in the English language, comprising almost seventy per cent of the entire metalingual apparatus. It imposes the assumption of an external, intersubjective reality where thoughts are seen as ‘lamps’ or ‘tables’ (Reddy, 1979). Communication is treated as an automatic process of replication and no effort is required for it to be successful. Ideas and concepts are simply transferred from one person to the other. Even where there is an interruption in communication and an effort is needed to be made, the metaphor localises this expenditure almost entirely on the speaker or the writer (*ibid*, 1979). It is up to the speaker to put enough meaning *in* the words or to put the meaning *in* the right place. The role of the listener or the reader is trivialised. That is, the metaphor completely ignores the ability of the human mind to think, process, and reconstruct meanings in a creative and flexible manner. Instead, it encourages the idea that the more signals we create, the more ideas we ‘transfer’ and ‘store’.

In the context of the present interview material, the metaphor invites the assumption of an outside, objective world to which scientists have the only access. It is their duty to ‘transfer’ relevant information to people and the popular media seem to play a key role. By focusing on the centrality of the speaker or writer, communication is placed in the hands of scientists. It is scientists who should control what is to be disseminated. According to Bucchi (2002), the idea that scientific concepts need to be transported from a specialist context to a popular one originates in the professional ideology of both scientists and scientific journalists. On the one hand, scientists can distance themselves from the process of communication and thus become free to criticise possible errors, while on the other hand, journalists legitimise their professional role as mediators. Such a categorisation enables scientists simultaneously not only to be in charge of information dissemination but also be the rectifiers of any possible wrong doings.

Human Nature

This next set of metaphors categorises public opinion formation in the domain of human nature, offering a biologistic explanation on the way public and media representations of SCNT are formed and transformed. Thus, people are organisms programmed by their very nature to function in certain, predictable ways. There is a continuation between generations, and inheritance plays a crucial role in sustaining beliefs and values.

'*...but the reason everything was stopped was on the basis of publicity and the kind of* ***media nature****, rather than a careful analytical overview of what happened.*' (Senior university stem cell biologist, male, 2)

'*I think part of it though is just* ***human nature****. There is nothing new about the Dolly reaction and the cloning reaction, it has been seen before; heart transplants, that is exactly the same. Series of reactions, first of all sort of 'gut' reactions, 'the yuk' factor and of course nowadays is a routine* ' (Senior university stem cell biologist, male, 15)

'*I think minimally people should be relying on different sources for their information, they should not get all of their world perspective from Sky News. Ok.....I dare say perhaps a problem with humanity as a whole; we tend* ***not to digest*** *information and come up with, make up our own minds what we tend to do, and you are the sociologist not me, but I would say what we tend to do is* ***inherit*** *the vision of the world that our parents had; and never really do much to upgrade that in light of new experiences.*' (Senior university stem cell biologist, male, 16)

'*I think it is part of* ***our inheritance****, about belief. You don't want to change – once you've got a belief, you don't want to change it too quickly.*' (Senior university embryologist, male, 18)

There is a dual importance in such a categorisation. On the one hand, it appears to produce an image of the social actor close to Durkheim's (1898/1996) concepts of life in the collective. Memory and the past hold an authoritative status providing the basic means for explaining and understanding new concepts and phenomena. In this vein, resistance to novelty is what explains the world. On the other hand, it permits researchers to account for bias as inherent in human nature. People have a tendency to exaggerate leading to distortions and misconceptions; this inevitability legitimises the superiority of science and scientists' logic and motives.

Parenthood

In the next superordinate category, the concept of parenthood becomes the source domain explaining public and media perceptions of human SCNT research. (1) People are children, (2) Experts are adults, and (3) Knowledge is food. Some examples of relevant metaphors include:

'***We should try to feed information*** *to the public from a very young age – it has a huge impact, you know.'* (Junior university geneticist, male, 17)

'*...they* [journalists] ***swallow*** *any ridiculous story without checking it.*' (Senior university geneticist, male, 1)

The concept of childhood as a developmental stage leading to adulthood has invited debates over the status of the child in relation to adults. For some, the idea of treating children in the same way as adults is unthinkable, whereas for others, it should be the norm (Lliaudet, 1998). The metaphors above support an understanding of children as uncritical, instinctively driven creatures. Children would swallow and eat anything to ease their hunger. Such a categorisation of public opinion produces a tension between the image of people as children and that of scientists as adults. In this light, the paternalistic attitude of scientists emerges as a necessary and sufficient condition for the survival of people in the grownups' complex world.

Statistics

The use of concepts from the discipline of public opinion measuring, produces a statistical representation. Employed in their discussions are references to 'population', 'levels', 'peaks' , 'majority' and 'minority'; terms usually encountered in statistical reports about the public understanding of science. The image of public opinion promoted is that of an aggregation of individual points of views. Glynn et al. (1999), discuss this as the most common definition of public opinion in contemporary politics, which serves to justify the use of surveys and polls as a means to measure it. Such an assessment enables researchers to engage in complex causal analysis making general claims about the entire population. A mathematical and quantitative approach is assumed while it resonates with the structure of popular election, which is the basis for a democratic process.

'…*they* [journalists] *have an important role but I think they also contribute to what I have just described as* ***these peaks and valleys of interest**.*' (Senior university stem cell biologist, male, 16)

'…but their level of knowledge is nowhere near as good as we think it is as scientists and actually where it should be; I think it should be ***logarithmically better*** *to what it is.*' (Senior university embryologist, male, 5)

'*I do not think that the* ***public perception*** *of the different issues here is, I think it is a very* ***low level*** *because of the way it has been portrayed…*' (Senior university stem cell biologist, male, 2)

'*I think you have to have the support of the* ***general population**.*' (Senior university stem cell biologist, male, 6)

'…*but there is a tendency on the part of, possibly* ***a majority of the public, certainly a large minority****…*' (Senior, university stem cell biologist, male, 15)

'*But it has to be what is acceptable to the* ***population**.*' (Junior, research government institution geneticist, female, 12)

Container

This next set of metaphors presents an interesting amalgam of concepts like body, community, fence, building, and language with which to categorise the various relationships between science and the public sphere. Instead of treating them separately, it was best thought to group them under the superordinate category of 'container' for the way they were used by the interviewees, as well as the associative images they produce present an 'in-out' orientation.

Thus the use of certain physical metaphors creates the impression of a natural boundary performing a demarcation between the scientific and the public sphere. Some examples include:

'Maybe it is the scientists' job; they should be getting ***out there****...'* (Junior government research institution biologist, male, 10)

'*…so* ***import the knowledge*** *but make it convenient as well…*' (Junior government research institution geneticist, female, 11)

'*…you do not want* ***outside influences****…*' (Junior government research institution geneticist, female, 11)

Scientists are also pictured as a body of people working towards the realisation of common goals. These metaphors create a sense of belonging to a united community, which is assigned a strong, concordant identity.

'*And again I think the* ***scientific community****; there are some really powerful spokespeople…*' (Senior university stem cell biologist, male, 6)

'*I* ***socialise more with scientists than non-scientists*** *to be honest…*' (Junior government research institution geneticist, female, 12)

'*I do not want to say scientists, I don't mean it on an individual basis, but I mean it as a* ***body****…*' (Senior university stem cell biologist, male, 2)

The demarcation between the scientific and the public world is further accentuated through the conceptualisation of a tension between 'insiders' and 'outsiders' language.

'…it is the sort of ***grammar of science*** *rather than* ***the vocabulary of science****; but as a scientist you* ***get soaked in this grammar****.'* (Senior university geneticist, male,1)

Yet at the same time, and in accordance with the analysis of formal communication data, these same metaphors are also employed to transcend existing boundaries establishing new connections with the public sphere while securing legitimacy for individual actions.

'*...we do not want them to think that* ***we are doing something behind doors. So everything is open****.'* (Senior university stem cell biologist, male, 7)

*'Our research is about **being open and staying open**.'* (Junior university stem cell biologist, female, 13)

*'I am speaking from **both sides of the fence**…'* (Senior university embryologist, male, 5)

'They [journalists] *do not try to explain science in a **lay language** to the public.'* (Senior university stem cell biologist, male, 2)

Economy

Metaphors under this category present scientific research as a business opportunity de-contextualising it from any moral or ethical reference. An entrepreneur ethic prevails where it is all about money and client satisfaction. Competition amongst rivals invites for the identification of leaders and losers. Implied can also be found the assumption of knowledge as money. The more one knows, the richer she/he is.

'*...sometimes it is **business** we are doing…*' (Junior university stem cell biologist, male, 4)

'*...to try to find your **niche** somewhere were you can develop…*' (Senior university stem cell biologist, male, 2)

'*…if people were not going to **buy** this particular treatment then there is no point in really going down that route.*' (Junior university stem cell biologist, female, 13)

'*…so we are really, we are **selling them** the promise of this, and I firmly agree with that..*' (Senior university stem cell biologist, male, 6)

'*In general I would say that the public's understanding of science is pretty **poor**.*' (Senior university embryologist, male, 18)

'*It is becoming a political issue, it was a political issue in the American presidential **race last autumn, when you look at what all of the States in America are doing in***

***terms of competing** against one another to raise money…*’ (Senior university stem cell biologist, male, 6)

‘*It is right, which has meant that the U.K is one of the **leaders in this field** and certainly the regulatory system in the U.K is admired all over the world and has been copied now by many other countries; we have the first National Stem Cell Bank and there are centres in Sweden, U.S, Singapore, China…*’ (Senior university biologist, female, 4)

Entertainment

Associations of the public sphere to the realm of entertainment and spectacle are once again encountered, this time in the context of informal communication with experts.

‘*I get very frustrated watching TV science programmes, even the so-called good ones because it is all very **theatrical, you know, great rising scheme of orchestras in the background** when the guy makes a bold statement…*’ (Senior university stem cell biologist, male, 15)

‘*It* [Newspaper coverage] *is about **sexing it up!***’(Senior university stem cell biologist, female, 14)

‘*You get sensationalism because actually science is very boring. So that probably promotes the cloning embryos bit. It is, as a phrase, because it **captures the readers' imagination**…*’ (Senior university stem cell biologist, male, 2)

Journey

The superordinate category of journey is also identified in the metaphors anchoring the public sphere in the interviewees' discussions. This purposeful and progressive image of science creates associations of promise over the future of humankind while portraying society as a follower.

‘*…trying to **stop the progress of science** is as if trying to stop a flood coming through a dike, it is **going to come through; it is going up and all you can do is to try and slow it down a bit**.*’ (Senior university geneticist, male, 1)

‘*People’s attitudes* ***follow*** *science.*’ (Senior university geneticist, male, 1)

‘*You would have to be continually updated in those things,* ***so it is behind****, it is very difficult for the HFEA to probably see this…*’ (Senior university stem cell biologist, male, 2)

‘*It has got no choice****, science can only go forward, it cannot go backwards, you know, it has one gear which is forwards***.’ (Senior university geneticist, male, 1)

Engineering

The associations created under this category classify the human mind within the concept of machinery. Human cognition is about replication, in the same way that computers work. Once more, scientists are portrayed as engineers fixing the damage.

‘*Genetics, it* ***hits all the buttons*** *which the public likes.*’ (Senior university geneticist, male, 1)

‘*They may have heard the arguments a number of times but* ***it does not always register in the right boxes***.’ (Senior university embryologist, male, 5)

‘*I suppose I am not really a big fan of* ***social engineering.*** *I think that all that you can do is provide the facts as dispassionately as possible and let people get on with it.*’ (Senior university stem cell biologist, male, 15)

Psychopathology

The poles between normality and abnormality, health and illness, constitute the pool of metaphors to be found in this fifth category. Here, a demarcation is drawn between those who are entitled to enter the debate surrounding human SCNT and those who are not. Sanity and insanity become the criteria for participation. Scientists picture themselves as *normal* people, engaged in *normal* activities, while the doings of competing interest groups are demonised. The structure of the metaphor is as such: (1) there is health and illness in the world; (2) there are healthy people and ill people; and (3) science and scientists are healthy. Examples here are:

'*I think the media at the moment is really **fixated** on stem cells.*' (Senior university stem cell biologist, male, 6)

'*…it is just like the headings and things they put in the newspapers, they are always there to **shock** rather than to give the facts.*' (Junior government research institution geneticist, female, 9)

'They [Zavos and Antinori] *are just **psychos** really…'* (Junior government research institution geneticist, female, 12)

An important element of these metaphors is the idea of stigma and the stigmatisation of science as rupturing ethical and moral norms. A type of rectification is performed by the interviewees to associate science to normality and identify scientists as a group of normal people.

'*I think most scientists are **normal people**, they have their families and they like to work within a framework set up by the public; they do not like to be seen as doing unethical work.*' (Senior university embryologist, female, 8)

'*I have a number of friends in the U.S who will not do human embryonic stem cell research even if they can, even if they have government money. They do not want this **stigma** that is associated with doing it in the U.S.*' (Senior university stem cell biologist, male, 6)

War

As has already been discussed in the presentation of formal communication data, the categorisation of public legitimation processes of scientists' individual actions in the source domain of war promotes the image of a 'battle' among different interest groups. At times, certain arenas of the public sphere become the 'enemy'. At others, though, they form an indispensable ally for securing wider support.

'*…but you are **fighting** against a lot of images from movies and things, they work on their own and do what they want.*' (Junior government research institute geneticist, female, 12)

‘*If you have an important law to debate coming up, your worst* ***enemy*** *is somebody just not voting or not turning up...so if you* ***lose the public, you have lost*** *it all, .*’ (Senior university embryologist, male, 5)

‘*I am much more interested in* ***defending*** *why we use human embryos to create cells for therapy… I think the U.K is kind of unique, in a sense that we have the HFEA authority regulating embryo research for almost 15 years now and I think the government was very* ***pressing to win, they decided to push ahead with this by basically putting stem cells onto their back*** *and the HFEA an already existing regulatory body....*’ (Senior university stem cell biologist, male, 6)

‘*On the other hand, while you are doing this, for instance in Germany, you could be declared as a killer so it is a much nicer feeling when you know that* ***you have somebody behind you****, and that is the public. And that is the most important thing.*’ (Senior university stem cell biologist, male, 7)

Popular metaphors

In private discussions, experts are also involved in a process of de-anchoring by trying to disassociate their doings from the dominant images of the ‘Brave New World’, ‘Armies of Hitlers’, or the ‘Playing God’ metaphors, largely employed in public talks and debates about human SCNT research. In an attempt to nullify them, scientists are pointing to their fallacies. This de-classification process seems to contribute further to the establishment of images discussed above, like the ‘normality’ of scientists and the economic and progressive potential of science, as other, alternative ways to categorise human CNR technology.

‘The American public does not have a clue as to what is going on and they think that the idea of cloning is to ***create Hitlers****.’* (Senior university stem cell biologist, male, 6)

‘*Because the media portray scientists* ***as mad****; that image can be negative and it is not true.*’ (Senior university embryologist, female, 8)

‘*So when people say ‘scientists play God’ – you see they’ve got it wrong. It is parents who* ***play God***.’ (Senior university embryologist, male, 18)

6.2.2 Arguments: Structure and argumentative types

Analysis of argumentative parts proceeded in the same logic adopted for that in formal settings of communication. Thus, a first reading of each interview material was performed allowing for the identification of different arguments and their premises (Appendix 12). While accounting for the structure of each argument, and based on the overall context of the discussion and what was generally said, I also tried to account for missing premises. This was done mainly as a way to further illuminate the argument and its expressive meanings. Most of interviewees’ discourses were centred around basic claims and warrants with the intent of offering explanations on their stated thesis. Examples, in the form of data, were also given whereas backings were largely left unspoken. While trying to infer those missing backings, I soon realised that it was there that one could find all of those beliefs, norms and values taken for granted, which provide the backbone of the overall argument. It was this attempt, as well as a consideration of the arguments in the scientific journals that enabled me to finally group them all into argumentative types. Overall, 363 different arguments were detected. Table 6.1 offers a presentation of their structure. The authoritative nature of scientific argumentation is exemplified by the restricted use of rebuttals. Technocratic and strategic forms of argumentation were once again met, presenting a degree of continuation of discourses from the written to the spoken, from the informal to the formal and vice versa.

Table 6.1 Expressed, inferred and missing elements of 363 arguments identified

	Data	Warrant	Backing	Claim	Rebuttal
Expressed	210	340	189	358	2
Inferred	0	17	157	4	
Missing	153	6	17	1	

6.2.2.1 Technocratic argumentation

As in scientific journals, technocratic argumentation comes as a reminder of the superiority of expert knowledge. A split between the commonsensical and the scientific is performed contrasting logic to emotionality and passions. Public perceptions are criticised for a lack in the understanding of human SCNT and its different applications, the media are accused of misreporting, while the bureaucratic nature of regulation is seen as a hurdle to the advancement of research. Following, a presentation of the main premises of this type of argumentation is given and for the most part, I leave it to the interviewees in their own words to express thoughts and opinions, further bringing life to the text. Of the 363 arguments, 281 were identified to fall into this type.

Claims

The conclusive parts of technocratic argumentation can be classified into three main types. The first set of claims gives emphasis to the propensity for the non-scientist to resort to stereotypical understandings of human CNR. Scientists question the ability of people to comprehend: (1) the technical procedure of human SCNT research; (2) the distinction between the different applications of SCNT research; (3) the distinction between science and ethics; (4) the distinction between 'lies' and 'truth'; and (5) the scientists' genuine interest in finding cures for diseases. Instead, the public sphere is the sphere of irrationality and exaggeration. Media accounts sensationalise and in so doing provide distorted representations of the technology. In the same context, scientific unease is detected, not only reflecting dissatisfaction regarding the political scrutiny of science at large but also its invasion in everyday scientific practices, in the form of paperwork.

'*The basis of it is not understood; what is done to a cell it is not understood, or let's say why it would be so difficult to clone humans it is not understood.*' (Junior Government research institution geneticist, female, 11)

'*So, the concept of cloning, of reproductive cloning, was in people's mind as a fanciful future science fiction thing, really very different from the reality and I think that was what made it different from most new scientific advances.*' (Senior university biologist, female, 4)

‘*I think that most people think that we are just going to clone humans to make copies of each other rather than the actual stem cell advantage of cloning.*’ (Junior government research institution geneticist, female, 9)

‘*I think it* [media coverage] *has been completely over the top.*’ (Senior University stem cell biologist, male, 6)

‘*Yet when you listen to these programmes and you listen to, let’s say, stories about cloning, it always seems like it is so much closer like next year or something we will have a human clone that is born and I do not think that it is necessarily factual or realistic.*’ (Junior government research institution geneticist, female, 11)

‘*So certainly almost in every story you read, if you are intimately involved in this work, are errors.*’ (Senior university stem cell biologist, male, 15)

‘*We can persuade ourselves that we are being logical and objective but what all of these committees are doing is allowing science to step one step away rather than one step ahead.*’ (Senior university biologist, male, 1)

‘*So why should you have to report differently, why should you have to report twice as frequently for stem cell, that is driven by all the wrong reasons?*’ (Senior university stem cell biologist, male, 2)

The second type of claims relates to a bifurcation in the discussions of scientists regarding the ‘goodies’ and the ‘baddies’. While overwhelmingly claiming the inability of the people to follow scientific knowledge, certain distinctions are drawn based largely on the continuum of UK-non-UK and expert-non-expert. Foreigners come in the form of the distant other, the alien, providing a useful benchmark for relevant comparisons. The UK public is viewed as more supportive of other publics giving a competitive advantage to national research. Generally, there is a celebration of British pragmatism, arousing feelings of national pride and hope over the future of their respective field. Similarly, scientific training renders specific media outlets, like popular science journalism, different from the masses. Those who know understand better.

‘*I think the support in this country has been fairly substantial.*’ (Senior university stem cell biologist, male, 6)

‘*If you speak only about UK journalists they understand very well.*’ (Senior university stem cell biologist, male, 7)

‘*I think people will turn to it for a number of applications.*’ (Junior university geneticist, male, 17)

‘*I guess I do have a sense that people are more accepting of these technologies than they were when they first came into the public prominence.*’ (Senior university stem cell researcher, male, 15)

‘*So we are very lucky and we are ahead, so we have a good vision.*’ (Senior university stem cell biologist, female, 14)

‘*And it is in my mind much better to work in a country like the U.K or Canada, which is probably like the U.K kind of example, than work in a country like the U.S where the guidelines are much stricter and yet if you are in a private company you can do whatever you want.*’ (Junior government research institution geneticist, female, 11)

The final set of claims relates to the mode of relation with non-scientists. Some of the claims focus on the personal experiences of the interviewees and others are more normative in nature, suggestive of possible science communication strategies. On the one hand, a certain degree of alienation is sensed. In their accounts interviewees report dissociation from non-experts, unable to cope with questions and queries perceived to fall outside what they term as scientific and rational. Misunderstandings and prejudices are hard to overcome. If there is a need to communicate this should be done with caution and careful examination of the interlocutor’s motives.

‘*So I think that is a problem and I think that is one reason why a lot of scientists either don’t want to or can’t get involved with public discussions of science. They find themselves being asked questions which are not scientific.*’ (Senior university geneticist, male, 1)

‘*It probably makes scientists work more separately from the general public rather than trying to engage them*’ (Junior government research institution biologist, male 10)

‘*I don’t think I have much impact.*’ (Senior university embryologist, male, 18)

‘*There are now a couple of people whom I will not talk to at all.*’ (Senior university stem cell biologist, male, 6)

‘*You have to be very careful about who you speak to and how you speak to them and how things get released, and why is someone asking the questions, what do they want?*’ (Senior university stem cell biologist, male, 2)

On the other hand, scientists reflect on their activities to approach the lay public, the media and the regulators. Such a desire originates from a need to rectify mistakes and to set the ‘true’ state of affairs. Educating non-scientists is seen as one of their primary duties, for it is them and only them who have acquired the right knowledge. Such an overemphasis on expert knowledge turns the discussion into an identification of insiders and outsiders. Lacking the basic technical understanding of SCNT, non-scientists are excluded from direct decision-making. It is only those who are truly in-the-know that are to decide the future for any given technoscience. Furthermore, other competing voices, like the Church or Pro-life groups, are diminished to the level of being deviant as they produce unnecessary fear and tension.

‘*We spend a lot of time talking to the public. Tonight I am involved in a debate at the X. We give a large number of talks to charities. I speak at public events at the X; I have given public events up in X at C.*’ (Senior university stem cell researcher, male, 6)

‘*Maybe the scientific community should also be aware of that and when they speak to people in the media to really try and make an effort, try and keep some control*’ (Junior government research institution, female, 11)

‘*Well they* [regulators] *need to definitely be more involved with the scientists. They should really listen to what the scientists are saying.*’ (Junior university geneticist, male, 17)

‘*I think the media should open up the stem cell technology area. Try to categorise each type of technology.'* (Junior university geneticist, male, 17)

‘People may not necessarily agree with all aspects of the legislation governing reproductive technologies but the fact remains that it is preferable to a referendum.’ (Senior university stem cell researcher, male, 16)

‘*I just think it would be better to have people that you actually explain to them properly rather than trying to get across to the whole population and then let them decide.*’ (Junior government research institution geneticist, female, 12)

‘*You can’t make scientific decisions based on popular prejudices. It does not work that way.*’ (Senior university geneticist, male, 1)

‘*I think the public can be consulted or explained* [to]*, but the public don’t decide what science should be done.*’ (Senior university embryologist, male, 18)

‘…[religious groups] *are probably never going to change their minds.'* (Senior university stem cell researcher, male, 15)

Data

Some of the evidence used to support the above claims is drawn from the common history of the scientific community. These are references made to prior debates about the interplay between ethics and science and to a large part they form individual memories of human embryo research, organ transplantation and animal experimentation. Here, it is the past that explains the present, supporting the assumption that similar ethical issues have been dealt with before; that CNR adds nothing new, and as was the case in the past the use of SCNT as a source for human embryonic stem cells will become common practice.

'It is the same with IVF; IVF is always in the newspapers, no matter how you sort of see it; it is always there and has been between the years.' (Senior university embryologist, male, 5)

'In a way, heart transplantation was similar' (Senior university biologist, female, 4)

'*I think that it will end up becoming like the animal testing and things like that and there would be protestors all outside. I can see it happening.'* (Junior government research institution geneticist, female, 9)

'*One thing I always remember,* [the] *huge shock about telomeres about five years ago, where you could tell how old you were going to be when you died from telomeres; which you can't. And that shock must have lasted about two weeks and then the public got bored and moved to something new.'* (Senior university biologist, male, 1)

Other evidence originates from the interviewees' concrete and personal experiences. Either drawn from formal settings of communication (public speeches, exhibitions, debate, TV programmes) or from more informal encounters (friends and family), they are used as a solid base to support one's claims.

'*Obviously I have seen some shows on TV that generally discuss technologies like this, like embryo technologies. So, I mean I guess that is the only experience I have.'* (Junior government research institution geneticist, female, 11)

'*The other day in the pub we were talking about cloning and they were like 'wow, wouldn't it be great if you can do this SCNT and clone a whole football team!' And then we would have the best football team in the world!*' (Junior government research institution geneticist, female, 9)

'*The one thing that is quite interesting is that we participated in this cloning show that was on the BBC.*' (Senior university stem cell biologist, male, 6)

'*We published a paper last year and it had one of those press releases, so I worked on the press release with other people.*' (Junior government research institution, male, 10)

'*I remember when I was doing a talk in X, there were a couple of people in the audience that were quite happy to have clones of themselves that they can keep somewhere for spare parts.*' (Senior university stem cell biologist, male, 15)

Still others are drawn from present and contemporary developments relevant to CNR research. These are examples that refer to specific actors, like foreigners and activities in non-UK countries or specific groups of scientists, like the 'cloners', also found in relevant argumentation in scientific journals. References are also made to the ethical concerns people have about the human applications of SCNT, while previous claims, usually regarding the public's lack of understanding of the technology, appear once more to support proposed modes of communication.

'*So when there was the big referendum in Switzerland, it was about transgenic animals, and my friend pointed out to me, that they won in the long-run.*' (Senior university embryologist, male, 18)

'If you crossed the Atlantic that would be a mega problem because they do not have regulations in that respect.' (Senior university stem cell biologist, male, 7)

'*Until a couple of years ago the other way to get on the news was to put out a press release; that is what all of these 'cloning people' did.*' (Senior university biologist, male, 1)

'I think you get quite a lot of strong views and they tend to be really quite predictable views 'the embryo, you should not do research on the embryo and destroy it. How do

we know it is not a slippery slope argument?' (Senior university embryologist, male, 5)

'*I think people worry about it being used in humans.*' (Junior government research institution geneticist, female, 12)

'Now the concern has always been with cloning and stem cells; that there might be some abuse that would then have such a negative effect on the whole field.' (Senior university stem cell researcher, male, 16)

'*People think this is routine. People think that the occasional wrong scientist makes the moral decisions in cloning.*' (Junior university stem cell researcher, male, 3)

'*Using the word 'cloning' some people are thinking that we are cloning human beings. That is nonsense, we are trying to understand diseases and this is the message we want to pass to the public.*' (Senior stem cell researcher, male, 7)

Warrants

Explanations offered by the interviewees form a rich spectrum. Many of them derive from personal theories and ideas on the process of public opinion formation. By and large, common perceptions about SCNT technology and its applications are considered inauthentic. Lacking the ability to think critically, people rely on media reports and representations of the technology. Thus, media opinion becomes public opinion placing reproduction in a central position. Certain groups of people, such as the 'cloners' are also seen as contributing to misconceptions. As a result, the prospect of direct public involvement in decision-making processes is received with scepticism and unease.

'*Because the majority of the people who are familiar with the word 'cloning' watch bad movies from Hollywood; that is a stupidity.*' (Senior university stem cells biologist, male, 7)

'*Medics will blindly go out and say stem cell therapy is round the corner; gene therapy was round the corner 20 years ago and it still is.*' (Senior university geneticist, male, 1)

'*The public tends to believe what the media tells them.*' (Junior university stem cell biologist, male, 3)

'*The only thing they do is to read an article or watch a TV programme and this is the way they form their opinions about cloning.*' (Senior university embryologist, female, 8)

'*I think that the coverage of the media is always difficult because that is all that the public knows. So, what they read in the news…*' (Junior government research institution geneticist, female, 9)

'*I do not think they really worry about these things too much, it is just what they hear about in the media.*' (Junior government research institution geneticist, female, 12)

'*…because referendums, elections put a lot of power into the hands of people who do not have time to think about the issues and therefore are more likely to be swayed by the loudest voice, the flashiest logo or sales pitch.*' (Senior university stem cell researcher, male, 16)

'*But I do have a concern, if you let the public decide on whether it's right or wrong, you basically let the media decide what's right or wrong. Because the media tells the public what is right and wrong, and by and large, the public will believe what the media says.*' (Junior university geneticist, male, 17)

'*And I guess there is always going to be an irresponsible element of the press that are going to try to twist stories to their advantage.*' (Senior stem cell biologist, male, 15)

‘*For a long time there were all of the Antinoris in this world and Zavos standing up and saying ‘we have done this and that.*’ (Senior university embryologist, male, 5)

‘*There have been reports of clones being around but nothing has been confirmed but that also put a lot of fear in people.*’ (Junior university stem cell biologist, female, 12)

Other explanations are derived from notions regarding the nature and the modus operandi of the public sphere. What explains public perceptions about CNR is emotionality. This undermines the validity of public opinion, which contrasted to scientific rigour and thoroughness, seems instinctive and irrational.

‘*I think people get very emotional about embryo research. ‘Is it a human?’; ‘are you hurting somebody?’; or ‘what is happening?’, and they are driven emotionally rather than, really, logically.*’ (Senior university embryologist, male, 5)

‘*It is probably easier to just sort of say ‘oh it sounds like a bad thing’ rather than think about it more. It is easier to say ‘no’ rather than think about it.*’ (Junior government research institution biologist, male, 10)

‘*So I think quite often it would just be based on people’s instant reactions rather than any sort of thought process perhaps.*’ (Junior university stem cell biologist, female, 12)

A degree of apathy and disinterest is also detected in the public realm. People do not care and even if they do so there is not enough time to think. The complexity of life is such that deprives them from engaging in any real consideration of the issues at stake. Religious beliefs present an additional hurdle extinguishing any possibilities to appreciate the true nature and use of SCNT research.

‘*I think that most people do not really like science at school; they are not very interested. The only thing that they have to do with science after they have left school is through the media*’ (Junior government research institution geneticist, female, 9)

‘*Some people also do not want to see the distinction. Some people are very, very strong-minded against it and no matter what we say they will still be against it.*’ (Junior university stem cell biologist, female, 13)

‘There are many other things in life; such as pay the mortgage, so, there are other things you have to think about in your life ...’ (Senior university embryologist, male, 5)

A vicious cycle then is detected. The unthinking people drive the unthinking media who drive the unthinking regulators and the other way around. Errors, scandals, lies and sensationalism acquire almost contagious properties. This way of politicising scientific research further alarms its representatives. Science is about facts, truth and hard thinking.

‘*You want to be distinctive; you want to be interesting to your reader; you want to be provocative to make your reader think; you want to engage the reader.*’ (Senior university stem cell biologist, male, 2)

‘…*Because that is a more interesting story than just telling the truth…*’ (Junior government research institution geneticist, female, 9)

‘*So that tells you something about the press; they are not often really interested in the story; they just want something either funny or catchy that they can interest their readers with.*’ (Senior university stem cell researcher, male, 15)

‘*Everyone likes a good story, a good scandal, or something like that.*’ (Junior university geneticist, male, 17)

‘*It is not slow because they take time to think about it; it is slow because they are just not processing those quickly enough.*’ (Senior university embryologist, male, 5)

‘It certainly can be restrictive because you can only make amendments to the license once every 12 months, so if you ever wanted to do some other tiny project, then you can’t’ (Junior university stem cell biologist, female, 13)

‘I think again, there have been drivers there, that have been political and media driven and defensive for those reasons and not driven by science, [nor] *proper regulation and safety and making sure things don’t profit. It has been driven mainly by the political aspects.’* (Senior university stem cell biologist, male, 2)

‘*If you talk about the regulators, they are somewhat controlled by the public anyway.*’ (Junior university geneticist, male, 17)

‘Stem cells and cloning seem to become more and more politicised all the time.’ (Senior university stem cell biologist, male, 6)

However, it is not only because emotionality, irrationality and lack of critical thinking reign in the public realm. The complexity of CNR is such that only a true and genuine knower could ever appreciate its full potential. Drawing from a large pool of technical knowledge and expertise, interviewees emphasise the various benefits of the technology. Naming and the use of words such as cloning, appears once again as in the scientific journals, to account for the misconceptions. Trapped in the unfortunate associations that wording creates, people fail to distinguish between reality and fiction.

‘… you need thousands of eggs and you need women that are going to be able,[and] *who are going to be willing to carry these eggs and go through these pregnancies and have these children that would be abnormal or won’t be able to be born to be able to make that feasible.’* (Junior government research institution geneticist, female, 11)

‘*If you are talking about cloning you have never been asked ‘what is this problem with lack of imprinting, when you make a cloned embryo?*’ (Senior university geneticist, male, 1)

‘*People understand that you cannot clone human beings but lots of different animals and species have been cloned and it is not simple; and they had to do lots of trials so you do oocytes and the chromatin; you grow it, fertilise it and implant it into the womb and you get a clone, no problem with that. For therapeutic cloning, which is a wrong name, all that happens is that instead of implanting you let it grow and take the* *cells from the inner cell mass and this will be embryonic stem cells.*' (Senior university stem cell biologist, female, 14)

'*You are taking a cell, you are taking a nucleus, manipulating cells in the nucleus, you are not cloning embryos in the same way as the image of cloning that there is a potential for life there.*' (Senior university stem cell biologist, male, 2)

'*It's quite complicated stuff, and you're not just concerned with reproductive cloning, you're also concerned with making stem cells.*' (Senior university embryologist, male, 18)

'*…I think scientifically it is a fairly complex issue.*' (Senior university stem cell biologist, male, 6)

'*The idea of nuclear transfer just conjures up the idea of cloning which is the creation of identical individual, identical things. It has nothing really to do with that in terms of its exploitation, potential therapeutic exploitation, drug screening exploitation.*' (Senior university stem cell biologist, male, 2)

'*The fact that we are dealing with cells, the fact that we are very likely in the future to obtain enough from cloning that one day we can apply that knowledge to adult cells and change their fate without ever having to involve an egg makes people start to think about it.*' (Senior university stem cell biologist, male, 16)

'It is a valuable tool and people should not be scared of it. Once the technology is developed I am sure that everybody would want to use it anyway.' (Junior government research institution geneticist, female, 9)

'*A scientific journalist is generally quite well trained.*' (Senior university embryologist, male, 5)

'*Because they* [science journalists) *understand the science and they're good.*' (Senior university embryologist, male, 18)

Backings

Three distinct kinds of backings were evident in technocratic argumentation. First are explanations about the nature of the public sphere. By resorting to biological conceptualisations of humane, the inevitability of public irrationality and naiveté is further enforced. Deficit understandings of the type 'the more one knows about it, the more one loves it' are evident here as well. Ideas are also presented about the operating principles of the media. Economic explanations and capitalistic motives are put forward. The media are there to make money and since scandals interest their audience, exaggeration becomes the norm.

'*…what is unacceptable today will be acceptable tomorrow;* [this] *is a matter of simple human psychology.*' (Senior, university geneticist, male, 1)

'*I think part of it though is just human nature.*' (Senior university stem cell biologist, male, 15)

'*It is inherent in human nature.*' (Senior, university embryologist, female, 8)

'*…I think if you do not disclose what you are doing, people do not know what you are doing. Therefore, they are not as educated and probably they cannot make their own opinions about it and often they tend to perhaps go towards the more negative side as opposed to a positive just because of the fact that they do not know.*' (Junior university stem cell biologist, female, 13)

'*…I think that people who have watched it and understand what is happening, think 'well, there is no problem with it*' (Junior government research institution geneticist, female, 9)

'There are clearly a lot of well informed, well-educated, thoughtful people who have spent a lot of time thinking about it and have come to the view that controlled applications of these technologies are in general a useful and appropriate thing.' (Senior university stem cell biologist, male, 15)

'*They want to make money so they publish the stories that they know people will want to buy the paper to read. That is just the way it works.*' (Junior university stem cell biologist, female, 13)

The second type of backings originates from interviewees' inherent beliefs about the nature of scientific research per se. In contrast to popular notions, one of science's main priorities is not to transgress ethical boundaries but to really improve human life. Scientists should be trusted, for their motives are humanitarian. References to scientific freedom are also made. Thus, a disassociation from any moral context is made. Science is about giving answers to questions regarding the natural phenomena around us, and the way they work; and as such it is neutral. The laws of the politic cannot be applied here. Scientists' personal motives are also discussed. Excitement, professional recognition, and legitimation are all seen as irreducible parts of scientific conduct.

'I would like people to also understand that science is about excitement and discovery.' (Senior university stem cell biologist, male 15)

'*If there are samples that are going to be destroyed for other reasons, let us work with them, trust us that we will be responsible and there should not be any fear for the greater good.*' (Junior university stem cell biologist, female, 13)

'I want the debate in this country to be about science and less about politics.' (Senior university stem cell biologist, male, 6)

'*My line on that particular question is that science will tell you the facts but the facts are always neutral.*' (Senior university geneticist, male, 1)

'Common sense doesn't suit science.' (Senior university embryologist, male, 18)

'*...it is important for a researcher to have freedom and that a certain amount of trust is put into people*' (Junior university stem cell biologist, female, 13)

'*It is not practical to tell science where to go because you do not know where it is going to go.*' (Senior university geneticist, male, 1)

Lastly, statements are made about the nature and the form of the preferred democratic model. These are expressed in a more normative style and they discuss the way things should work. Participation in public affairs comes with certain obligations. In order for someone to make a decision or publicly express an opinion, she/he first needs to know. 'Right' knowledge becomes the epitome of democratic judgment. In this vein, scientists are portrayed as prototypes of what determines a 'good citizen'. Integral to their role is the dissemination of this knowledge and the education of the ill informed. The responsibility of the media, on the other hand, is to inform the citizens in a comprehensive and accurate way, enabling them to participate in the democratic process.

'*I guess only scientists can really understand, or researchers in their field can really know the value of research.*' (Junior government research institution geneticist, female, 11)

'*It is our duty to inform them and to give them the chance to see what we are doing; to explain to them what we are doing; to improve their knowledge or background; just to give the right information that we are not doing anything that is connected with creation; the creation of human beings, babies via cloning.*' (Senior university stem cell biologist, male, 7)

'*It does not matter what most people think. There is actually another way of working out if it is right or wrong, quite often, I think based on good knowledge in the field*' (Junior government research institution biologist, male, 10)

'I*f you are to make a choice, you should really make an informed choice, otherwise it's not really a good decision in the first place.*' (Junior university geneticist, male, 17)

'*I do not mind them saying 'no' to what we do as long as they understand what we are trying to do and get the pros and cons.*' (Senior university embryologist, male, 5)

'*I think if you are doing science programmes on the BBC or any other network you have a certain responsibility to maintain truthfulness in what you report.*' (Junior government research institution geneticist, female, 11)

'*I think accuracy is important in everything we do.*' (Senior university stem cell biologist, male, 2)

'They should serve a public good not a profitable remit.' (Senior university stem cell biologist, male, 15)

Rebuttals

In only two instances was the force of the proposed conclusion conditioned by rebuttals. In both cases, they were used while claiming for the supportive attitude of a large part of the British public towards CNR and its application in the derivation of human embryonic stem cells. People appreciate SCNT for it has the potential to save lives. It is only pro-life and religious beliefs that deprive certain groups from a true understanding of what the technology has to offer.

'*Unless they are devoted followers of a specific religion, which has a very peculiar view on the matter.*' (Senior university stem cell biologist, male, 16)

'*So long as they are not pro-life people because then everything is sacred and every baby should be protected*' (Junior government research institution geneticist, female, 12)

6.2.2.2 Strategic argumentation

Although to a large extent interviewees were found to argue within the context of the technocratic type, there were also moments of profound reflection on their work, their doings and its wider ramifications. It was at these moments that the degree of their humane sensitivity was able to freely unfold. This is not a discourse of demarcation but a blurring of the boundaries between the scientific and the non-scientific, the technical and the ethical, knowledge and its applications. A certain degree of power is assigned to the public sphere; people are stakeholders, the media is a means of communication, and the regulators apart from being a safeguard, were at the same time, an important source of feedback with deep implications on the psychological well being of the individual researcher. Overall, 82 arguments were found to fall in this type of argumentation.

Claims

A more holistic and participatory account of public opinion and science policy is assumed. People are invited into discussions concerning SCNT research and its human applications. The role of the individual scientist is to ensure and preserve such participation. Public accountability and involvement constitute the necessary conditions for the overall progress of this type of research.

'*If they decide to go and organise a referendum it is the decision that has been made and you follow it whether it has good or bad consequences on the research.*' (Junior university stem cell biologist, female, 13)

'*I do not think that you can just ignore the public, and say 'I do not really care about what they think, I am just going to pursue my research.*' (Senior university stem cell biologist, male, 6)

'*There has to be a reflection of what society wants.*' (Junior government research institution geneticist, female, 12)

'*We need people to sort of turn up and vote.*' (Senior university embryologist, male, 5)

'I think that people's interest in these stories, in TV programmes, public debates or whatever might be going on, actually is a positive thing for a researcher.' (Junior government research institution geneticist, female, 11)

'*I think that TV programmes and the newspapers offer a greater opportunity to elaborate on your points.*' (Senior university stem cell biologist, male, 16)

Authoritative claims about the inability of people to produce their own opinions give way to more constructive accounts underlying the multitude of reasons that determine individual attitudes. Moreover, regulation of SCNT technology is received with an overall tone of satisfaction. Careful evaluation and consideration of all the relevant scientific and ethical issues are seen as inevitable.

'*What determines people's beliefs about life, death, the afterlife and God is complicated.*' (Senior university embryologist, male, 18)

'*You know as well as I do that the public is a very mixed lot.*' (Senior university biologist, female, 4)

'I think the regulations in this country are very tight. I think they are appropriate for what we are doing.' (Senior university stem cell biologist, male, 6)

'*I agree with all of the regulation. It has to be strict.*' (Senior university embryologist, female, 8)

'*I think the Human Fertilisation and Embryonic Authority have done extremely well.*' (Senior university embryologist, male, 18)

'*We need to have a proper world-wide regulation on cloning.*' (Junior government research institution geneticist, female, 12)

Data

A large part of the evidence originates from a consideration of the ethical issues and concerns raised by the non-scientists. Their elaboration here, however, is performed so as to further establish their validity. Examples are also drawn from individual memories and experiences in science communication.

'*They have concerns and again a lot of people think that this technology could then be transferred from animals to humans. I think that this is scary.*' (Junior university stem cell biologist, female, 13)

‘*I think everyone is entitled to their individual, religious beliefs and therefore, some people would feel it is wrong. And that is good, I am happy with that.*’ (Senior university stem cell researcher, male, 2)

‘*So, for example, with our ambitions to clone for stem cells or to derive new stem cell lines we did not just communicate this as a laboratory, we communicated it with the approval of our institution as reflected by ethics approval.*’ (Senior university stem cell biologist, male, 16)

‘*On a personal level I have been quite heavily involved with how you try to communicate with the public on the value of, let's say, therapeutic cloning and embryonic stem cell research in general.*’ (Senior university embryologist, male, 5)

References are also made to current regulatory developments as they occur both nationally and abroad. Foreigners are once again used as a benchmark for comparison, implying the assumption that UK CNR research is more aligned to public concerns than in other countries, such as the U.S, where political indecision postpones the closure of eminent ethical dilemmas posed by SCNT.

‘*Of all the places in the world where you can do full reproductive cloning America is one of the few.*’ (Senior university stem cell biologist, male, 6)

‘*The regulatory framework is different depending on where you go. And probably the strangest example is America, where my understanding is that if you have federal funding you are restricted to using a very few, very small number of pre-existing lines. However, if you are working with commercial funding there are no restrictions what so ever.*’ (Senior university stem cell biologist, male, 15)

‘*Certain types of cloning are already allowed.*’ (Junior university geneticist, male, 17)

Warrants

Explanations give an emphasis on the perceived role of public perceptions, the media and the regulators in the development of a new scientific field of research. Public voices are invested with power and prestige; they are the voters, the consumers, the funders and as such confidence in scientific activities is what drives research initiatives.

'*If they do not like it they are quite happy to tell you about that. There are lots of mechanisms to do that.*' (Senior university embryologist, male, 5)

'*People's interest in the field kind of gets translated into people like politicians who are responsible for allocating money to research. I think it encourages them to continue supporting research into embryo technologies or nuclear cloning technologies or understanding basically what underlines normal embryology so that we can understand why these techniques do not work and how to get them to work.*' (Junior government research institution geneticist, female, 11)

'*If we want to keep money in science it is important to keep people trusting in scientists.*' (Junior government research institution biologist, male, 10)

'*Most of us spend significant amounts of public money.*' (Senior university stem cell biologist, male, 15)

'*People have a right to know what they consume and have a right to choice.*' (Junior university stem cell biologist, female, 13)

'*There is no point developing therapies for treatment of cancer or diabetes or whatever if people are not going to want to receive the treatment.*' (Junior university stem cell biologist, female, 13)

'*I think you really gain public confidence when you perceive and seem to be and actually are open and honest about what is going on.*' (Senior university embryologist, male, 5)

'*If public opinion had been very much against stem cell research and cloning that would not have happened*' (Senior university biologist, female, 4)

A certain degree of identification with the non-scientists is also performed. This is either done explicitly or through the elaboration of the ethical problems of SCNT research. Here, scientists take on board public concerns further enriching them with their own personal values and opinions about CNR.

‘*If you want to do this kind of science you should know that it has very important ethical concerns*’ (Senior university stem cell biologist, male, 6)

‘*You do get these scientists who are just doing whatever they want.*’ (Junior government research institution geneticist, female, 12)

‘It is sensitive and we are dealing with human material; we are dealing with human life, early life form and you just cannot do anything about it.’ (Junior university stem cell biologist, female, 13)

‘*Cloning and safety is obviously one of those things. The problems of gene regulation in the cloned embryo make it extremely risky. The risk is so high that to do it on humans at the moment is unacceptable.*’ (Senior university geneticist, male, 1)

‘*I am part of the X* [regulation]*, I am a scientist and I am a member of the public.*’ (Senior university embryologist, male, 5)

Not only is the public sphere an important source to sustain overall scientific growth but also a means of personal recognition in the scientific community per se. Thus, explanations are offered pointing to the legitimating function of the media. It is through the media that co-workers and colleagues across the world come to identify their fellows, securing fame and acknowledgment. At the same time, the non-expert comes as a reassurance of personal choices and motives. Wider appreciation of one’s work is a source for establishing individual psychological well being and personal gratification.

‘*The media is show-casing your work and you are more recognised in the community; people know about your research. That is always a good thing and it could be a good thing financially as well.*’ (Junior university stem cell biologist, female, 13)

'*Knowing that there is an interest or that there is somehow some kind of benefit to the research obviously motivates you as a researcher.*' (Junior government research institution geneticist, female, 11)

'*I personally am much happier if I see the recognition that the public is on my side. If not, I have to think 'the majority of the people do not agree with my science so maybe I am doing something wrong?*' (Senior university stem cell biologist, male, 7)

'*You do not want to do something that you yourself think is wrong because you know other people would feel that it is wrong; it is about mental well being.*' (Junior government research institution geneticist, female, 12)

Backings

Personal values and beliefs regarding the role of the wider society to ensure and protect individual rights and moral standards constitute the majority of backings in strategic argumentation. Science is an inclusive system of debate, accounting for the range of opinions of a variety of different actors. This is largely based on the image of protective democracy, also encountered in the argumentation of scientific journals. Here, the scientists' responsibility is to ensure the legality of their actions. The notion of the media as a conduit further enhances its important role for the legitimation of scientists' work.

'*I see science as an open system and debate. I do not see it as 'the scientists versus the public.*' (Senior university embryologist, male, 5)

'*It is not scientists' job to decide what research to follow but it is the job of society to decide what scientists should be permitted to do.*' (Senior university embryologist, female, 8)

'*I think the public has to feel that they have a voice in these things.*' (Junior government research institution geneticist, female, 12)

'*I just believe it is a democracy.*' (Senior university embryologist, male, 5)

‘*Part of doing the work is being able to communicate your results not only to other scientists but also to the public.*’ (Senior, university stem cell biologist, male, 2)

‘*Media is the vehicle to communicate to the public.*’ (Senior university stem cell biologist, male, 16)

At the same time, a more economic and user-oriented image of science prevails. Here, interviewees speak the language of money, for science is about selling products. The more resources one engages, the more possibilities she/he has in sustaining financial and personal growth.

‘*In order to make sustained growth of any scientific discipline there needs to be consistent growth, you can’t do peaks and drops. So you need to carry everyone with you and one important part of that is carrying the government with you.*’ (Senior university stem cell biologist, male, 16)

‘*Media coverage helps with funding and with letting the government know about our research, its benefits and the money we need. There is never enough money in science.*’ (Junior university stem cell scientist, female, 13)

6.2.3 Recapitulating the results of metaphor and argumentation analysis

Private discussions with scientists provided a rich and fruitful amalgam of metaphors and arguments put forward about the public perceptions, media coverage, and regulation of human SCNT technology. A continuation of meanings, opinions and ideas is evident between formal and informal settings of communication. Thus, the same types of symbolic resources are once again mobilised, anchoring the public sphere into a final set of 12 categorisations. In doing so, light is shed on different properties of it, while others are left in the background.

Hence, categories like ‘Conduit’ and ‘Engineering’ prioritise a certain image of the world as objective, universal and untouched by human interaction. In this vein, scientific facts are somewhere ‘out there’ requiring transmission. Thus, a one-way communication with the public sphere is assumed. ‘Parenthood’ metaphors further accentuate a more paternalistic attitude towards the public understanding of science securing control of dissemination in the hands of those who truly know.

The use of 'Entertainment' metaphors seems to perpetuate the distinction between the world of science and that of the public sphere, presenting a sort of parity with data derived from formal communication. And while certain metaphors in the categories of 'Container', 'Psychopathology' and 'War' are used to further promote such a dichotomy, at the same time they are also employed in an opposite manner, presenting a degree of identification with the non-scientist ('normal', 'ally') while establishing new and more participatory and engaging channels of communication and interaction, blurring the boundaries between 'insiders' and 'outsiders'. 'Economy' metaphors further contribute to such blending by prioritising a more entrepreneurial rapport with the public sphere.

Metaphors like that of 'Human Nature' and 'Journey' highlight pioneering and progressive conceptualisations of science while the category of 'Statistics' incorporates a more quantitative understanding of the public sphere, largely drawing from the concept of electorate. Lastly, and once more, the category of 'Popular metaphors' is incorporated in an effort to revisit past and present debates with the scope of offering alternative, largely rectifying explanations[11].

Argumentation too seems to unfold in a parallel way to that identified in the scientific journals. Thus, technocratic argumentation represents once again the voice of *logos*. Claiming for the incapacity of the non-scientist to apprehend the technicalities and different applications of human SCNT technology, a rhetoric of exclusion is performed. Rationality, objectivity, authenticity and intellectuality become the criteria for inclusion into the public debate. This, by and large, is a defensive way of argumentation. Scientists defend their professional autonomy and their doings by framing their discussions within a highly technical context. While enabling them to exclude opposing voices, it assists to preserve their control over knowledge. Control is exerted not only on the content of non-scientists representations of human CNR but also on their use. The demarcation between reality and fantasy empowers the superiority of scientific knowledge over other forms. The end result is a clear and well-demarcated boundary between science and non-science.

[11] Associations between the superordinate category and metaphor user could not be performed due to the small number of frequencies in the cells.

The flow of communication adopted is one-way, from the scientific to the public sphere.

Strategic argumentation is about aligning with the public. Either by acknowledging the ethical ramifications of their actions or by accounting for the different types of public participation and its contribution to their every day practices, a form of partnership is formed with the non-scientists. The boundaries between the scientific and the non-scientific become more permissible. As was the case in the scientific journals, this is the rhetoric of ethos. If in search of a motto, this could be: ‘we are you’. Such a way of arguing while permitting the construction of a more humane image of the scientist, assists in the accumulation and expansion of symbolic and material resources for the advancement of SCNT research. This alignment with the public also trivialises other competing voices in the debate, like the Church, pro-life groups or the ‘cloners’.

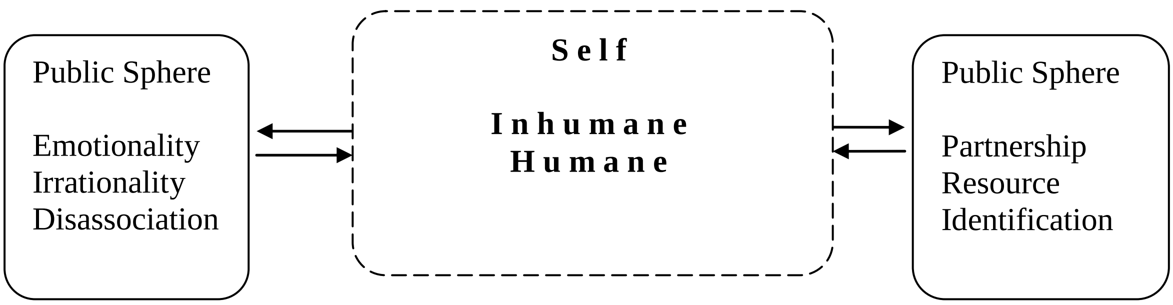
A statistical analysis of relevant data did not produce any significant differences between interviewees and types of argumentation used (see Appendix 19). It should be noted, however, that senior scientists were more likely to rely on their experiences in formal settings of communication with representatives of the public sphere. Junior scientists reported limited participation in formal science communication. This lack of involvement was largely based on the belief in the primacy of expert knowledge. Thus, it is the duty of the older scientists, those who know better, to disseminate their findings to a wider audience. Junior scientists were also more likely to refrain from giving immediate answers and explanations, referring to a lack of information or knowledge about public perceptions, media coverage and the regulation of human SCNT technology. This too was defended by personal references to their being subordinate. It is again the older scientists that have a better and deeper understanding of related issues. Although during the course of the discussion such reservations were soon overcome, they undeniably point to the commitment of the experts in the production of precise and well-verified claims.

A consideration of relevant research points to similar results. Thus, research conducted by MORI (2000) identified analogous discrepancies between senior and junior scientists. Opinions, ideas and consequent attitudes regarding public degradation and superficiality were also reported by the majority of PUS studies as presented in Chapter 2. Instances of boundary construction in rhetorical styles adopted are also discussed in studies under the auspices of the sociology of science. However, despite the fact that prior research, by and large, has verified types of argumentation typical of the 'technocratic' kind reported here as well, there have been few occasions where the possibility of a different conceptualisation of the public sphere has been raised. Thus, only Michael and his colleagues in their studies on xenotransplantation observed a similar '*we are different- we are the same*' tension in scientists' conceptualisation of the public. More specifically, they attribute such a switch in the context of conversation, reporting how when moral and cultural criteria entered the discussion experts employed a 'non-expert popular' rhetoric aligning with the wider concerns regarding their research, as expressed by non-scientists (Brown and Michael, 2001). A closer examination of the present data however, could not account for such an explanation. Indeed, the whole interview instance was a discussion of the main ethical and moral repercussions of SCNT research and its treatment by people, media and regulators in the UK, as well as, in other countries. Metaphors and arguments contrasting science and scientists to non-scientists were coupled with anchors and objectifications blurring those same borders, presenting, thus, an interesting and mixed amalgam. The fact that the analysis of the non-reactive formal communication data presents similar results calls for a consideration of different possible explanations far exceeding the confines of the interview situation. And while Brown and Michael (2001) discuss this as exemplary of the conscious efforts of scientists to present themselves as the representatives of the public, as protectors of civil rights, permitting them to marginalise the role and voices of animal rights activists, it does not exhaust all possible justifications. Therefore, I would argue that the employment of metaphors emphasising transparency and alignment ('*be open*', '*stay open*', '*normal*', '*ally*') and arguments of the strategic type could also be attributed to the particular area of research studied, the time-frame adopted and its geographical focus. Hence, it should be noted that the U.K was the first to provide a clear and permissive regulatory framework on human SCNT and relevant embryonic stem cell research. At the time of the interviews, the public debate on CNR and related research had lost much of its intensity. This would have undoubtedly contributed to a sense of reassurance for the individual researcher. In addition, this seems to be in-line with the findings of the present study relating to the analysis of the two scientific journals ('strategic argumentation' was significantly more evident in the UK than in any other individual country reported), as well as prior research results by Waterton et al. (2001) whose findings showed that researchers involved in less controversial areas were found to be more reflective of their doings. This does not mean to suggest that human SCNT research has ceased to arouse controversies; this is hardly the case. Rather, the present results may relate to a particular phase in the UK public debate, when discussions about the future of CNR had, to an extent, already been settled by the appropriate legal framework. The future possibility of applying this technique directly on human patients might well rekindle yet another heated discussion. Future research may account for such a hypothesis. However, I would also suggest that this identified tension in the metaphors and arguments typified in both formal and informal settings of communication is not just a matter of switch between different linguistic repertoires, as per Brown and Michael (2001), but evident of the complex and hybrid content of relevant social representations in relation to their functions as well as to their overall context of production. Indeed, social representations are always representations *of* something *by* someone in a particular place and time. Based on such a conceptualisation, a more synthetic account is proposed in the next chapter. Before such an attempt, however, one is obliged to reflect on the position of the self in relation to the non-scientific, the scientific, the other, the world, as presented in the interview data.

6.3 The public sphere in informal communication

Individual interviews provide access to the ontogenetic level of social representations. Not only are they a way of tapping into individual cognitions about a certain object of representation but they also inform about the way the individual thinks and acts in the wider world. The same kind of tension is evident in the metaphors and arguments employed in individual discussions with experts, as was the case with the articles in the scientific journals. Figure 6.1 attempts to provide a pictorial depiction of this.

Figure 6.1 Meanings of the public sphere and the self



While thinking and talking about SCNT technology and its public dimensions conceptualisations of the self, democracy, science and non-science are also enacted. Thus, the image of science as an almost unnatural process reigns; it virtually being a sphere in which the Platonic ideal prevails, where ideas about the essence of nature and how things are, remain untouched by human intervention. It is this human agency that contaminates knowledge with passions and emotions. The public sphere becomes the place of irrationality, bias and error. If ideology is taken to denote a set of ideas, values and beliefs, which distort reality, then this is the realm of ideology. Underlying this, there is the assumption that scientific knowledge is to be accepted as the only truth in the world. Everything else is just story telling. However, how do scientists acquire authority as the sole representatives of nature? The answer to this question lies in the positioning of the other, and in this case the non-scientist. It is the non-scientist that secures scientists almost super-natural properties. This is mainly performed through a process of disassociation of the self from the other. Contrasted to the unthinking other, scientists and their training in the laws of objectivity, intellectuality, and neutrality create an almost mythical identity - the scientific identity. Detached from the public sphere, the self becomes the only credited representative of true facts. A sense of belonging to a different community, that of the global scientific community is sustained.

At the same time, however, it is the social that renders the scientific possible mainly through the allocation of material and symbolic resources. Thus, the public sphere is the ally, the stakeholder, the interested other. Internal laws do not suffice to explain science. While science's job is to produce statements and facts about the way things work, the role of the non-scientist is to define the way these products are to be used. Science then becomes an enterprise and different outsiders become insiders at different times during the process of production. Once again, authority is granted to the self but now through identification with the other. 'You are not me' becomes 'I am You'. Such a positioning of the self not only secures legitimation of individual actions but also a sense of personal morality and worth. The end result is a more humane identity, a sense of belonging to a wider community of different social actors bound together with the common project to better human life.

During the interview process, I had the opportunity to fully experience this tension. The interlocutors transformed from individuals with authoritative, almost inhuman status, to people driven by personal motives and interests. Questions examining my own understanding of the technicalities of SCNT (‘*but you have a biology background, don’t you? Otherwise how could you do this work?*’ as one of my interviewees told me) were coupled with enquiries about my personal views and ideas regarding the ethical standing of their doings (‘*so, what do you think of what I do?’* as I was asked by another). I could see myself through their eyes being transformed, from an ignorant social scientist, an outsider, into an exotic foreigner, a potential buyer, patient, customer, promoter. In the course of the discussion, I received explanations of how things work to how things could work for me. While maintaining a disinterested attitude, it was precisely these moments that assisted in being able to listen more empathically. The chapter that follows brings us to the final part of the present thesis, which will give an account of the various meanings of the public sphere and science as observed in both the formal and informal settings of communication studied from a more synthetic view.

Chapter 7
The public sphere among experts: Synthesis

While the relationship between science and the public sphere has for a long time preoccupied numerous scholars as a philosophical quest, the present thesis has turned it into an empirical question for experts in one particular scientific area, that of SCNT research. Representation, that is, the process of making present what is absent through the use of symbols, became the focus of attention. However, instead of treating it as a form of empirical equation testing for possible discrepancies between the world 'out there' and the world 'therein', a more socio-psychological approach was assumed. Moscovici's social representations set the basis for such an endeavor. As a theory, they point to the constituted and constitutive nature of knowledge. Thus, every representation of something is always a representation by someone in a specific place and time, inviting the individual researcher to approach her object of study from a disinterested attitude. As a phenomenon, they call for a mapping out, a typification of relevant contents as they are embedded in different modes and mediums, while linking them back to the people who hold them and the functions they possibly serve.

The present study has been an exploration of the way UK stem cell scientists conceptualise the public sphere, that is, their representations of the public perceptions, media coverage and regulation of human SCNT research. Accounting for developments in relevant social representations research, the object of study has been approached in a triangulated manner. Thus, instead of focusing on meanings and contents existing solely at the individual level, an attempt was made to explore additional, more collective settings of communication. Therefore, data from individual interviews with stem cell scientists in the UK have been triangulated with relevant material from two scientific journals. This is because social representations are not reached in isolation but through a constant and complex process of communication and interaction with and between individuals. And while this being a theoretical imperative, a methodological necessity also formed part of such a choice. Hence, comparison between different types of data offers the possibility of further strengthening interpretation by detecting potential absences and presences.

Relevant results, as presented in the previous two chapters, indicate a continuation between meanings existing at the collective and the individual levels. More specifically, the typification of metaphors and arguments with which to anchor and objectify the public sphere in both formal and informal settings of communication present a degree of parity, revealing a similar tension across the representational fields studied. Below, this tension is revisited in light of Abric's account. Core and peripheral elements of the representation are discussed in relation to its contents and functions. This is performed by a consideration of the overall context of its production, as per current discussions and trends, in the relationship between science and the public sphere.

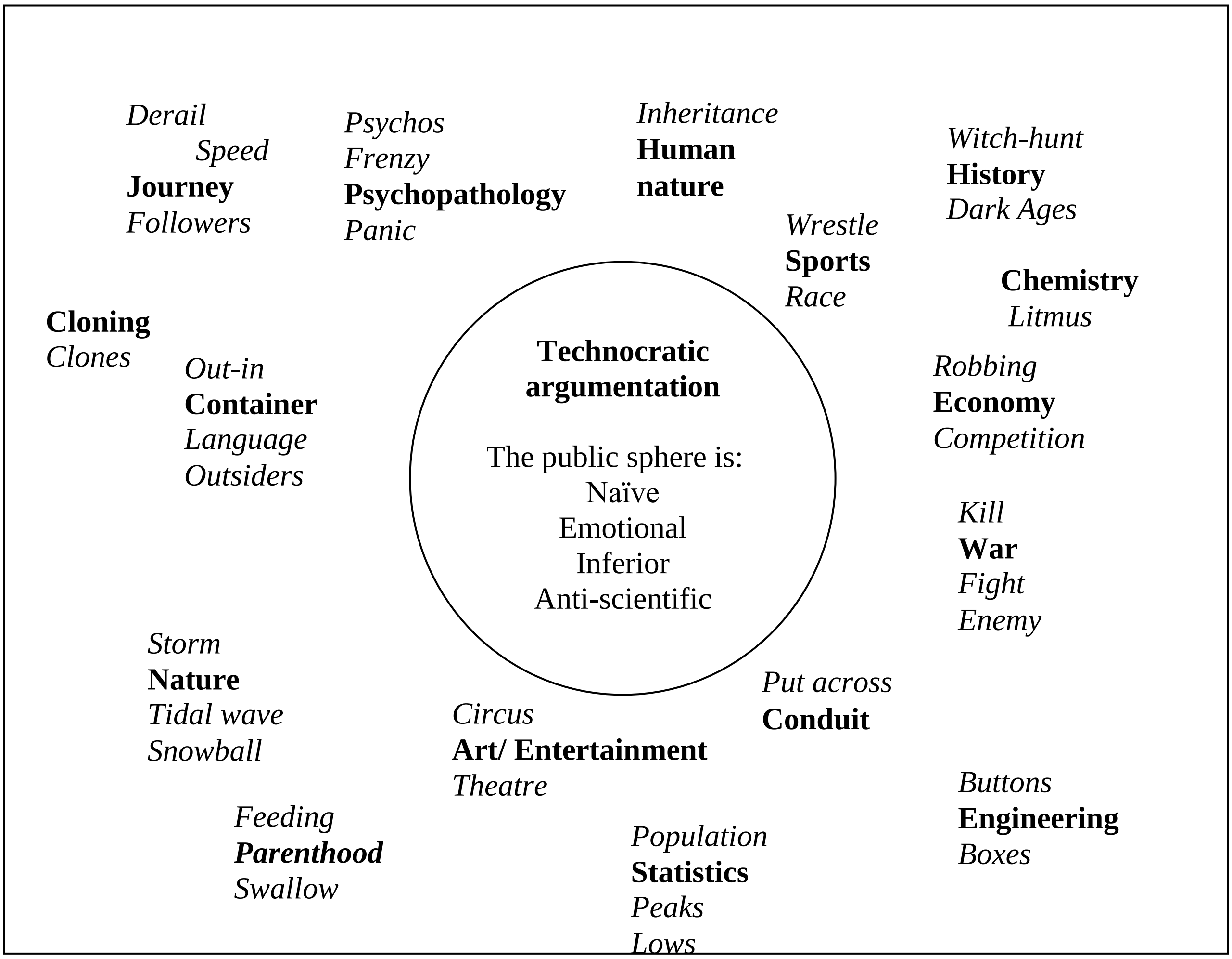
7.1 Representing the public sphere: contents, structure and functions

The typification of the various meanings, that is, anchors and objectifications of the public sphere in both formal and informal settings of communication resulted in the the identification of an overall 18 superordinate categories of metaphors, as well as, two main types of argumentation. A consideration of their associations and contents presents a dual tension. On the one hand, a demarcation is performed between science and the public sphere. On the other hand, a form of blurring of those same boundaries is achieved. Indeed, a first glance at the data suggested a kind of Gordian knot (to quote Dr Bauer, my supervisor). Was I then to split the data in two, as another Alexandra, and discuss the workings of two distinct representations of the public sphere? Or were these different anchors and objectifications indicative of a more complex web? The answer was to be found in the data *per se*. Suggestive of the consensual, yet flexible nature of social representations, they were evidence of the composite structure of human thought. The same object can be perceived in different ways by the same individual at the same place and time; yet this diversity manages to work as a coherent whole. In search of illuminating this phenomenon further, I was introduced to the work of Abric (1993, 2001). It is through his structural understanding of social representations that I was permitted to fully appreciate and do justice to the dynamic and complex character of my data, while further assisting in the identification of the subjective, the intersubjective, and objective dimensions of representation (Jovchelovitch, 2007).

Abric's (1993, 2001) structural approach to the study of social representations comes as an extension of Moscovici's seminal theory. Specifically, it propounds that every social representation is organised around a central core further enriched by peripheral elements. The core represents the rigid and stable part of the representation; it is about stability and homogeneity. It is through the core elements that the past dictates the present. This is the historical and normative part of the representation. Peripheral elements are more flexible in nature, permitting for differentiations and changes between individuals. They are adaptive and absorbing of new information and events, capable of challenging the central core. One of their main functions, thus, is to protect core elements in the light of new and threatening developments. Below, a more structural consideration of the accumulated data is performed. Thus, central meanings and their functions are distinguished from more peripheral elements, while demonstrating their complex, smooth and simultaneous co-existence under one **hybrid** representation in relation to its wider context of production.

Hence, Figure 7.1 offers a schematic presentation of the core elements of the representation as expressed by certain metaphors and the 'technocratic' type of arguments identified in the scientific media and in private discussions with individual scientists.

Figure 7.1 Core elements of anchoring and objectifying the public sphere in discourse



Based on the above elements it is evident that at the centre of the representation lies the image of the **unthinking** public sphere. As also discussed by Moscovici (1984), the denial that the public realm thinks, assumes two different forms. Firstly, and largely adhering to Cartesian logic, the public mind is treated as a unified black box. Ideas are transmitted from an outside world and reproduced in the form of opinions, attitudes and so forth. No room for creativity is left; it is replication that reigns. This takes us to the second point where people are seen as being under the sway of the dominant ideologies of the media or other interest groups, such as the Church or pro-life representatives. Through this denial of authenticity, originality and individuality, the public sphere emerges almost as a Lebonian crowd (2002). 'Crowds are as incapable of willing as of thinking for any length of time' (p. 12, *ibid)*. Lost in the homogeneity of the crowd, the individual lacks critical judgment, once more proving our primitive inheritance. Suggestion and contagion restrict public life into impulses and exaggerated feelings. The irresistible force of illusions refutes any distinction between what is real and what is not. The laws of logic have no power over crowds; instead, it is appeals to their sentiment that impresses them. Public opinion then becomes the aggregated sum of individual and certain prestige opinions of the elite, i.e. the leaders. In terms of communication between public perceptions, the media and regulation, it is the media that play a central role, as shown in Figure 7.2.

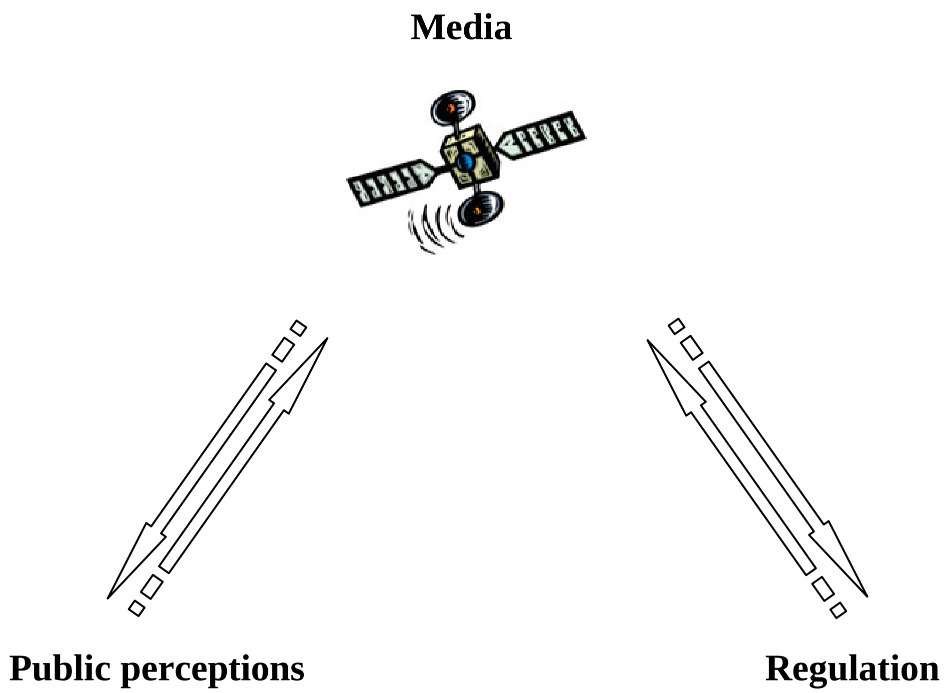


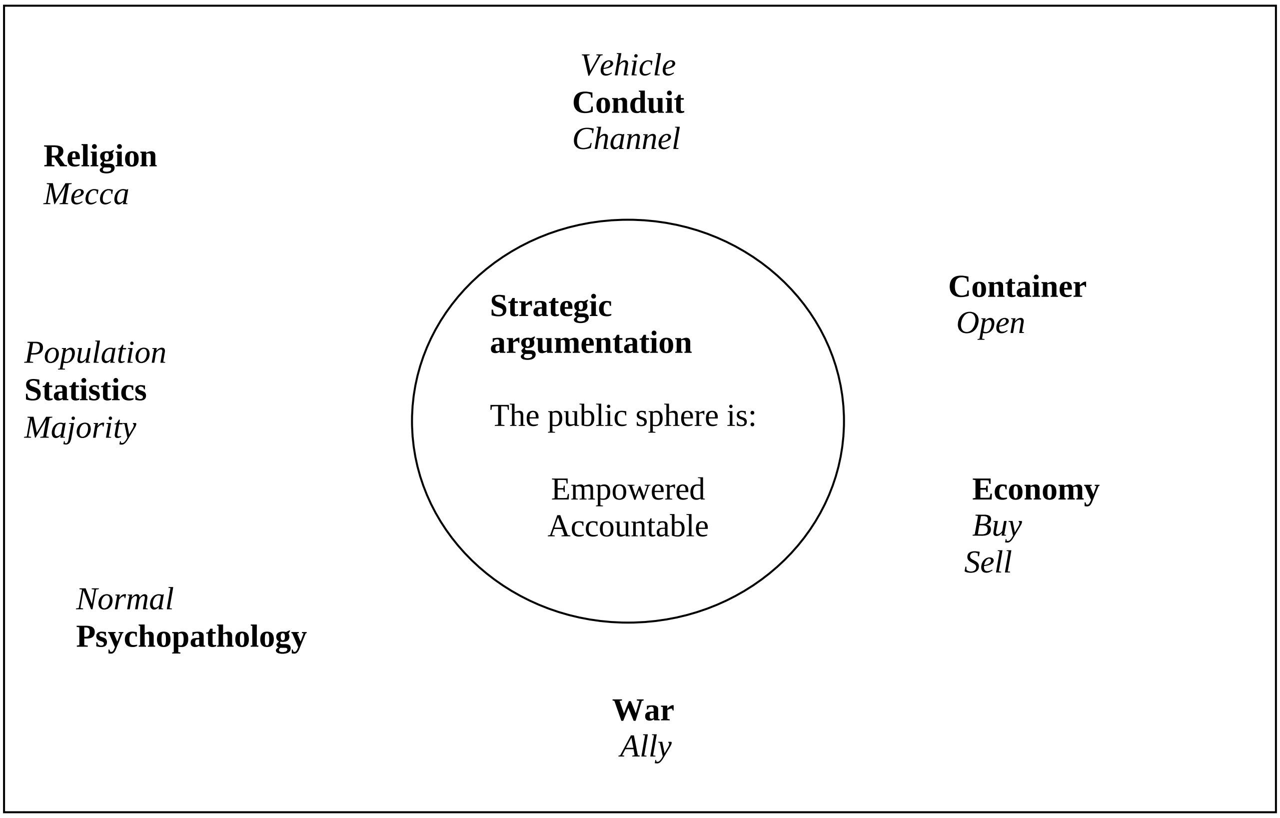
Figure 7.2 The 'satellite' function of the media

Like a satellite, every piece of information is transmitted and disseminated through the media. This is how opinions are formed; this is how laws are decided.

Contrasted to this social world, one finds the world of science. Beyond and above this is the realm of truth. Standing in isolation, science thinks hard. It is an esoteric sphere governed by internal rules and strict organisation. Objectivity and neutrality render scientific knowledge universal and ahistorical. Plato's idea of an exoteric natural order whose structure the sciences aim to expose is of centrality here (Kitcher, 2001). Thus, the work of science is that of cosmology, the production of statements of how things really are and work. This is the apotheosis of human achievement. It is this apodictic nature that has managed to replace old prejudices and superstitions, ameliorating human life and sustaining progress. What is being performed here is rapture with our primitive past: 'We are no longer the same, we are better' (Latour, 1993).

Around this central nucleus more peripheral elements are to be found, as shown in Figure 7.3.

Figure 7.3 Peripheral elements of anchoring and objectifying the public sphere in discourse



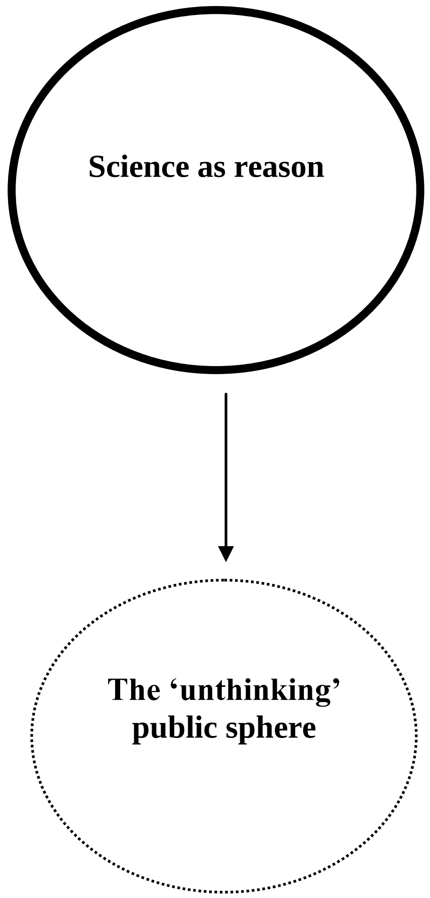
It does not matter that the public cannot think; what matters is what the public can do. The image is drawn of an **active** public. There is a blurring of the boundaries between citizen and consumer (Michael, 1998). The constitution of contemporary democracies is based on the ‘voting’ power of the citizen/customer, not only through the typical path of elections but also through their consumer choices and purchases. A different conceptualisation of science prevails. Science is a product for consumption; an enterprise with specific audiences and partners. Nature is not only something that exists out there awaiting discovery but also a valuable resource to master and to exploit. At the same time, people and their opinions are of psychological value for they guarantee personal choices and actions. Science then becomes politics by other means; an almost Machiavellian process incorporating more and more individuals and resources (Gaskell and Bauer, 2001). It is a user-oriented design, an opportunistic endeavor. Thus, people are to be persuaded, the media is to be used, and regulators are to be influenced. This is how science is made.

But how is this hybridity to be accounted for? Although some considerations were proposed earlier (Chapters 5 & 6), one is also obliged to take into account the wider context of its production and current debates and trends in the relationship between science and non-science, for this hybridity seems to be expressive of those. Therefore, during the last two centuries, the institution of science has witnessed immense alterations. The increase in private and public capital funding scientific research has led to the incorporation of commercial and political interests into the scientific sphere. While debates among scientists lose their esoteric character, as they are performed more and more in the public eye, discussions over public participation in science become ever more topical. Referendums, citizen juries, advisory and ethics committees, public consultation strategies and the like blur, even the boundaries between expert and non-expert. As social researchers currently debate over the extent of the ‘participatory’ qualities and motives of these initiatives, they have undoubtedly contributed to an increased politicisation of science (Hellström and Jacob, 2000; Einsiedel and Kamara, 2007; Braun and Schultz, 2008). At the same time, different stakeholders come into existence, such as environmental groups, the Church, pro-life groups, consumer organisations, patients organisations and so on and so forth. As a result, a multitude of voices and interests become part of the game of science. The public image of science likewise has changed. Thus, nuclear technology, I/T, biotechnology, human SCNT, bovine spongiform encephalopathy (BSE), to name but a few, have brought the ethical and risk ramifications of the sciences to the forefront. And while in the past, these effects had a more local nature, at present they have assumed global dimensions (Tenner, 1997). These changes have resulted in Touraine (1995) proclaiming what he sees as a crisis in progress. Humans have ceased to believe in the same force as they used to in the potential of science for salvation and/or emancipation from dangers and threats. It is, rather, taken as constitutive of those. Inglehart (1990) identifies shifts in the values of youth, moving away from materialism to more humane orientations, at the same time as the latest Eurobarometer studies (Gaskell et al, 2001b) identify a crisis of public confidence not only regarding the institution of science *per se* but also traditional regulatory and policy agents. Adding to that is the social research of science, both as a sanctifier and demystifier (Fuller, 2000). As stated earlier, Comte was the first to anoint the natural sciences the successors to the Roman Catholic Church. More recently, it was sociologists' and social psychologists' studies of crowds, public opinions, attitudes and public understandings of science that contributed vastly to a deficit conceptualisation of the public, while fuelling scientific primacy. However, work, mainly after the Second World War, reversed this process. Ethnographic and historical studies of the day-to-day operations of science and scientific discourses have 'humanised' the neutrality of the scientist (Latour and Woolgar, 1986; Gilbert and Mulkay 1984). Research like that of Wynne's (1992a; 1996) has pointed to the authority of local knowledge, while work into social representations further establishes a more complex and less degrading image of the lay thinker. In one way or another, these shifts in the focus and interpretative accounts of social research have contributed to a demystification of scientific thought and practices bringing into question their prior superior status. Although brief and even laconic, the above account manages to capture the complex interplay between science and the public sphere. Indeed, this hybridity is expressive of this complex and blurred web but it also constitutes a functional response to it (Gervais and Jovchelovitch, 1998).

Core elements comprise the part of the representation taken-for-granted, which are self-centered, solid and rigid resulting in the unification of individual differences. One finds here, the collective memory of a group of people operating in a consensual way. Any threat is assimilated into the common past, indicative of the resistant function of social representations. Control is exerted to the reality of today through that of yesterday. The ideological function of the representation is also illuminated

(Jovchelovitch, 2007). This is mainly exemplified by the demarcation of the scientific from the non-scientific. Neither are they merely different forms of knowing and being, but rather a certain hierarchy is presumed. Thus, an asymmetry is sustained, with scientific knowledge being superior to that of the non-scientific, which permits the assumption of an emancipated identity. Disassociated from the messiness of the commonsensical, the individual scientist emerges as the one and only credited spokesperson of nature. This disassociation, however, is also a continuous effort to distance from one's own self, her/his social and individual values. It is in isolation, from both the other and the self, that one hears nature loud and clear (Latour, 1993). Simultaneously, this emancipation assists in the preservation of the epistemic division of labour and the perpetuation of the sense of belonging to a unified community, that of the scientific. At the same time, the universality and superiority of scientific knowledge allows its penetration into other knowledge systems (Jovchelovitch, 2007). As recognition of the other's perspective is denied, the power of one knowledge system over others results in their displacement. Public dialogue, as a form of rational communication amongst individuals, is trivialised as superficial and shallow. Public dialogue, as a form of communication between the non-scientific and the scientific is dominated by authority and exclusion. Decision-making is secured in the hands of those who truly know. Participation in the *agora* is only permitted to a handful of skilled and wise experts, as was the case in the oldest form of democracy, the Athenian. This meritocratic vision of democracy leads to the adoption of a one-way communication with the public sphere. Thus, a paternalistic attitude prevails, coordinating action towards the dissemination of facts and education of those less equipped. Homogeneity, continuity and conformity are sustained in the group and in its relations with outsiders. Core elements are, thus, the basis of the 'scientific institution'. Figure 7.4 attempts to capture the various central meanings, values, ideas and their functions in a visual manner.

Figure 7.4 Constituents and functions of the core



<u>Functions</u>

Ideological

Resistant

Past oriented

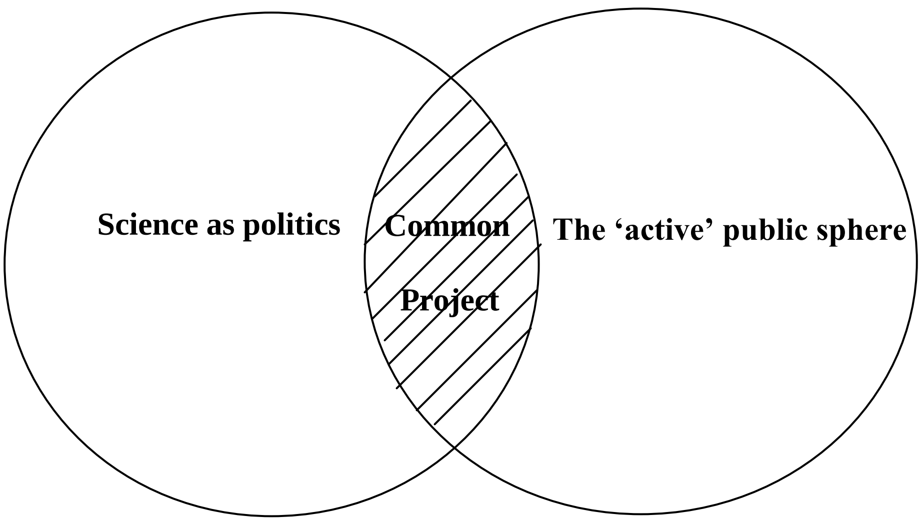
Identity: Emancipated

Attitude: Paternalistic

While core elements keep the group together and united allowing for the defense of central values and beliefs, peripheral elements constitute the interface between concrete reality and the nucleus (Abric, 1993). Threats and dangers are accommodated in the form of referendums, public relations offices, marketing strategies, and the alteration of initial research agendas and individual choices to suit public concerns (for example through abandoning of human reproductive cloning or through immigrating to more permissive countries). Identification with the non-scientific permits the assumption of a sublimated[12] identity, carrying the goals of the collectivity (both scientific and public), and at the same instance, resists the image of the 'outsider', the person who pursues her/his own goals without accounting for collective desires and rights, as other interest groups (for example, the Church) attempt to assign to the individual scientist. By accounting for public participation in the form of citizen/consumer interests, peripheral elements activate and preserve dialogue with the public. There may be asymmetries but coexistence carries with it the potential for inclusion and hybridisation of different forms of knowing. Individual differences among scientists permit for the adoption of more or less participatory models of democracy. Overall, action is oriented towards the accumulation of material and symbolic resources to preserve and expand individual choices, bringing forth a more entrepreneurial attitude towards the public sphere. Thus, this part of the representation is more present and future oriented, dictated less by the past, while opening the possibility of revisiting common history in a different light (Jovchelovitch, 2007). Changes and alterations are permitted to occur at the same time as core elements are protected. This is mainly performed through the recognition of the public sphere as more a potential holder of rights and less of knowledge. It is not that lay knowledge is scientifically valid but because it has a political and strategic function that it should be accounted for. Figure 7.5 depicts the main peripheral constituents and their functions.

[12] The terms 'emancipated', 'sublimated' and 'outsider' have been borrowed from Moscovici's (1987) discussion of the different identities of the individual actor.

Figure 7.5 Constituents and functions of the periphery



Functions:

Adaptive

Protective

Future oriented

Identity: Sublimated

Attitude: Entrepreneurial

7.2 Hybrid identities

While Jovchelovitch (2007), drawing from Weber and Habermas, discusses the 'disenchantment' and 'linguistification of the lifeworld' (p.95) as the drama of local communities to preserve their identities within the context of the increasingly open communicative patterns of contemporary societies and the penetration of scientific forms of knowledge, scientists themselves are experiencing a parallel process. Science is progressively losing its authoritative and unmistakable status. Instead of providing solutions it becomes itself a part of the problem, scrutinised by individual, economic, political, ethical and other interests. In the midst of these alterations, scientists find resonance in both memory and future. On the one hand, a strong demarcation from the public sphere preserves professional autonomy and ideology. On the other hand, it is through mixing and/or blurring these same boundaries that hope about the future of scientific enterprise is sustained. Being, itself becomes hybrid. From the isolated individual of the sanitised laboratory, scientists are at one and the same time, transformed into public orators, social engineers, salespeople, entrepreneurs and migrants, to name but a few. I do not mean to draw a romanticised picture. What I am truly interested in is presenting reality through the eyes and voices of the participants and the views presented in the scientific journals in this research. They are defensive, attacking, persuasive, and reflexive, in a nutshell: they are thinking and acting. What maintains this is their belief in the superiority of their knowledge, their personal interests and narcissism, as well as the dedication to their community, which partly due to their own doings and the increased specialisation of knowledge, partly due to more exoteric influences has become more and more fragmented (Waterton et al., 2001). As social research tightens its links to intervention, it is important to avoid establishing a reverse deficit. It is not that scientists are naïve and misunderstand of the public sphere, as they accuse their fellow citizens of being, making it our job to rectify their biases (one needs also to question such motives); it is because they understand, live and interact in a complex and hybrid world that they appear to simultaneously be distant and close, inhuman and human. Thinking always takes place in a certain context. The illumination of this context, the interaction of different communities, both non-expert and expert, and their coexistence should take priority. While the present thesis lacks such a 'microgenetic' approach, future social representations research may well account and further elaborate such an agenda. Again, I do not mean to assume a relativistic stance. Indeed, there are errors and biases, power struggles and misdoings. As Jovchelovitch (2007) astutely points out, it is through communication and negotiation between different forms of knowing and knowers that what is right and wrong, ethical and unethical, true and false is established. Indeed this is not only the way different types of knowledge grow and develop but also how democracies live and breathe. The potential role of the individual social researcher in further promoting this exchange through her/his studies necessitates a degree of self-reflexivity and critique. It is with that in mind that I move to the last and concluding part of the present work.

7.3 Researching the public sphere among experts

In the remainder of this chapter, I wish to draw some concluding remarks regarding the reasons guiding the choice of the phenomenon under study and the rationale of the conduct and formulation of exegesis, as well as some notes regarding future work and research. This is done mainly through a need to locate and reflect on the many ways my own theoretical conceptualisations, methodological choices, and interpretations have influenced the research subject. To identify any possible gaps in my study does not pose a threat to my overall standing and argumentation but rather functions as a resourceful indicator enabling researchers to ponder, make their critique, and expand, for this is how theories and research are enriched and developed further.

7.3.1 On genesis and context

There is no parthenogenesis in research. On the contrary, tracing back her/his steps, the individual researcher rediscovers a plethora of people, ideas, theories and practices that have fertilised thoughts, interests and choices, which consequently were followed by framed research questions and paths. Thus, it was through the teaching and writings of George Gaskell and Martin Bauer that I was introduced to the concept of strategic technologies and to contemporary debates regarding biotechnological developments and their interface with larger social, economic, ethical, political and other issues. This is the way I also came to appreciate Latour’s work for its holistic and ‘realistic’, as he prefers to term it, approach to scientific conduct. Sandra Jovchelovitch and Marie-Claude Gervais expanded my understanding of the local, detraditionalised public spheres, agency and social representations. Knowledge is always historical, contextual, individual and social. This was also a time when national policies and strategies on the relationship between the scientific and the non-scientific were redefined in the light of new social research developments, scientific scandals and related public debates. It is this fruitful context that preceded and cultured interest in the present thesis.

So, how is one to conceptualise different forms of knowledge like science and common sense? What is the relationship between the scientific and the non-scientific? These and other similar pertaining questions as well as proposed answers have, for a long time, occupied the pages of philosophy, sociology and social psychology of knowledge, to name but a few. Social representations theory and Moscovici's own discussions of the consensual and the reified, lead to distinct conceptual and empirical paths, according to the way one chooses to interpret this proposed dichotomy. The aim of the present research was to substantiate the theoretical and methodological underpinnings of social representations in the study of the relationship between science and common sense. The ability of Moscovici's theory to cast light on the subjective, the intersubjective and the objective elements of knowledge and representation permits one's view and standing in the world to be investigated in relation to and communication with others. Abandoning biases and errors, one comes closer to capturing and appreciating the essence of living. However, a reconsideration of the non-scientific and the scientific was needed before undertaking such an endeavor. As a result, instead of treating this dichotomy as a *fait-accompli*, trying to explain the one in terms of the other, a different conceptualisation was adopted. How is this dichotomy reflected and used in the efforts of experts to communicate and legitimate their research? What representations of the relationship between the scientific and the non-scientific are enacted in this process? What kind of communication strategies and symbolic resources are employed on the way? This last point called for a consideration of discourse and its relation to rhetoric and persuasion. Prior work by Liakopoulos (2000) on metaphors and argumentation, and his proposed links with anchoring and objectification proved a useful and inspiring base calling for further development. It was Caroline Howarth who raised my attention to Billig and his discussions on the relation between argumentation, thinking and social representations. Billig does not produce an isolated view of the individual trapped in the seclusion of her/his thoughts, but like Moscovici, the individual is regarded as an active thinker in constant communication and exchange, whose choice of arguments reveals projections of the interlocutor, worldviews, beliefs and ideologies. While linking theory to methodology, such a consideration is also pivotal for the study of a debate about controversial scientific research taking place in and between the 'public'. Who, though, is the 'public'? Bauer and Gaskell's (2002) proposed model for the study of the relations between science, technology and the public, provided a resourceful framework for the identification and differentiation between actors, challengers, counter-challengers, the public sphere and their consequent role therein. Human SCNT research, as the first-global media story of biotechnology, was considered to be an interesting case through which to study the interface between the scientific and the public sphere, for it represented a strong example of the increasing interplay between ethics and science. And while prior research into public understanding of science sustains interest in the way lay publics receive and transform expert knowledge, the issue, here, was reversed. This was not only in tune to relevant calls from the social representations tradition (Foster, 2003) but also to a wider need in the midst of discussions regarding shifts in contemporary science policy, increased public participation, and the restoration of public trust in science. However, the present thesis bears no socio-therapeutic aspirations, in the sense of presenting conceptual errors and providing solutions for their neutralisation. Instead, it is born out of a conviction that any intervention and proposed change needs to account for the way different forms of knowledge, opinions, and ideas are formed, sustained, and function. This brief presentation of the conceptual groundings of the present thesis is believed to summarise its basic underpinnings and to provide a quick view of the spectrum of the different theories that have worked as a resource for its execution. At the same time, besides assisting in its elaboration, they have also influenced the way the research phenomenon was perceived and approached.

7.3.2 On implementation and interpretation

As a continuation of the above remarks, a more reflective account of the present work is discussed. Thus, and accounting for my social representations background, the representational field was approached in a more intuitive than pre-established way. That is, research questions and hypotheses remained in the background, largely fluid and of a more general nature, reworked in the light of new data and analysis. The public sphere and the adopted operational definition prioritised a specific understanding of it, what Braun and Schultz (2008) call the 'general' public. Demarcated from more interested and expert publics, like interest groups and organisations, this view of the public permits it to be understood as people, citizens, lay media outlets and regulators. In a way, and for the purposes of analytical research, it perpetuates the differentiation between expert and non-expert. It is through this reading that articles in the scientific journals were analysed, interview questions were posed and experts were identified. This, and especially regarding the interview situation, does not mean that other themes raised by the interviewees were not explored. However, and taking into consideration the participants' strict work schedule, available time was organised, albeit non-systematically and non-invasively, so as to secure the discussion of matters of interest.

Focus on metaphors and arguments, as a way of studying anchoring and objectification processes in discourse are another issue for discussion. This proposed distinction is more reflective of methodological and analytical purposes than conceptual, for the two processes are interlinked. Thus, there are elements of argument in every metaphor as metaphoricity may lie in every argument. While the choice of a specific argument with which to address and discuss the public sphere is thought to illuminate the process of objectification, certain premises of the argument, like data and warrants, have at times a classificatory role. Either as references to past scientific debates ('it is like the embryo debate') or to specific developments and actors ('If you look at the United States…'), they perform an anchoring function linking memory, present, and future. That stated, it should also be noted that certain metaphors seem to have acquired an ontological status. This is mostly evident with regard to the superordinate categories of 'engineering' and 'conduit'. The idea of public opinion as a unified mind, a black box in which to input crystallised information has been reproduced not only in the arguments studied but also in models and schemes of popularisation initiatives from both scientific, media and regulatory representatives for years. The whole establishment of the deficit approach in the public understanding of science has been largely based on such images. Another hypothesis can also be made about 'psychopathology', especially regarding the metaphor of 'contagion'. Though not explicitly stated in the data analysed, 'contagion' might have played a significant role in the quality and form of relations between the scientific and the public sphere. For example, how far does the metaphor underlie past (like the first attempts to set up the Royal Society, where membership was excluded to craftsmen and artisans (Kitcher, 2001), and more recent activities to institutionalise science in more self-inclusive contexts? And what do new developments, such as, public relations offices, the Internet and other contemporary forms and forums of communication entail? Future research may well trace such steps.

More to the point of the present study, and drawing from Gervais and colleagues (1999), an attempt was made to account for the missing parts of the arguments analysed, for ‘what is omitted is assumed to signify every bit as much as what is included’ (p. 421). Though a conscious effort was made to stay as close as possible to the given and from there infer the unsaid, it would be unrealistic to propose that full control was exerted on my personal unconscious understandings of the interview situation, the public sphere, and science itself. This preoccupation with discourse has also resulted in the exclusion of other possible modes and mediums of social representations. As prior research on social representations has indicated (Jodelet, 1993, Howarth, 1996), representations exist not only in language but also in practices and actions, visual images and non-linguistic sounds, for often it is in the unspoken that taken-for-granted elements assume existence.

The focus of the research on human SCNT and the public debate that followed after the creation of Dolly the sheep, as well as its final results are by no means taken as representative of all the possible ways of conceptualising , making sense, thinking about, in one word representing, the public sphere in science. Nor is the partial sample of people interviewed representative of the whole of the research community performing work in SCNT and human embryonic stem cells. However, the metaphors and arguments analysed and the hybridity they suggest, are indicative of possible representations and ways of being and living in a small, restricted, almost artificial community whose operations regularly challenge widely shared definitions of life and death, the human and the non-human, the natural and the unnatural, the ethical and the immoral. As the present work comes to an end, I do not mean to have accounted for all possible exclusions and absences. After all, though disinterested as one may try to stand[13], total escape from one’s own subjectivity can never be fully accomplished. Again, this is not a relativistic point but a rather realistic one.

[13] I could not help but notice here a certain degree of identification with my participants. Is not this same claim to a ‘disinterested attitude’ evident also in the experts’ attempts to silence personal thoughts, values, and ideas so as to listen to their phenomenon of study? And does not this same claim attempt to persuade colleagues and like-minded individuals of the objectivity of one’s own actions and findings?

7.3.3 The way ahead

I wish to conclude with some somewhat sketchy and preliminary thoughts regarding social representations both as a theory of knowledge, as well as, a conceptual framework in the future study of the relationship between the public and the scientific spheres.

Social psychology's lengthy domination by individualism and behaviourism deprived the study of representation from its human sources and its context of production, resulting in a radical dehumanisation of the subject representing (Jovchelovitch, 1997). Moscovici's (1961/1976) initial work marked the beginning of a new era in social psychology's understanding and study of knowledge. And while focus was initially placed on less expert types of knowledge and knowledge holders, new developments in social representations tradition, with most paradigmatic Jovchelovitch's (*ibid)* latest work, point to a more symmetrical treatment of all forms and types of knowledge. Thus, all knowledge is made of representation calling for an illumination of the numerous and complex interrelations among the people who hold them (the 'who' of the representation), its contents (the 'what'), its functions ('how-why-what for') and its overall context. However, how far and with what kind of implications can such an account be applied to the understanding of scientific knowledge *per se*, that is, of its conditions of genesis and functions?

Indeed, Moscovici is not the only one arguing for a more historic, humane and creative treatment of representation. Latour and his ethnographic studies of scientific laboratories seem to draw analogous conclusions. Nevertheless, at first glance, one might well be alarmed by the stark difference between the concepts used by the two scholars. Latour's work is full of references to action ('name of action', 'programs of action', 'science in action', 'actants', 'event', 'practices') whereas Moscovici seems to give primacy to cognition ('thinking society', 'thinking world', 'thought about the world - thought in the world'). This may suffice to start a discussion over the epistemological differences of the two. However, seen in the context of their respective disciplines a different interpretation may be possible. More specifically, they are haunted by different ghosts, the former by the ghost of the 'ahuman' scientific world and the latter by the ghost of the 'inhuman' social world.

Thus, Latour prefers to talk about action in an attempt to stay as close as possible to the everyday reality of the scientists, and to demonstrate the constructive character of their practices (Latour and Woolgar, 1986):

> We should emphasise, therefore, that we do not deny that science is a highly creative activity. It is just that the precise nature of this creativity is widely misunderstood. Our use of creative does not refer to the special abilities of certain individuals to obtain greater access to a body of previously unrevealed truths; rather it reflects our premise that scientific activity is just one social arena in which knowledge is constructed (p. 31).

On the other hand, Moscovici (1984), as has been aforementioned, talks about the thinking world in an attempt to overcome the notion of the 'unthinking society' and to demonstrate the rationality of the modern thinker:

> When asking the question: what is a thinking society? We refute at the same time the conception which, I believe, prevails in the human sciences, that is, that a society does not think, or, if its does, that this is not an essential attribute (p. 15).

Thus, they attack the notion of the 'input-output' situation that views representation as a mere reproduction of the world by accounting for knowledge in association with its conditions of production. Knowledge about something is always knowledge of someone in a specific place and time. That science is less about discovery and more about creativity and construction, in a similar manner society is more about shaping reality than replicating it. And while Moscovici's discussion of 'anchoring' and 'objectification' recuperates the links between the cognitive and the social, Latour proposes analogous associations by introducing the concept of 'circulating reference' to account for the representational activities taking place in the genesis of scientific knowledge. More specifically, Latour demonstrates the way the past comes to form a part of the making sense of a new phenomenon establishing a continuation with prior scientific research and meanings through processes of classification and categorisation. It is through such developments that a pictorial dimension is given to the object represented, transforming it into a map, a diagram, an image in an article. Progressively, and in analogy to Moscovici's objectification, what is lost in matter is gained in form. Thus, at the same time that a map is a thing made out of paper, it is also the thing in itself; "it does more than resemble. It takes the place of the original situation” (Latour, 1999, p. 67). As Latour notes ‘ontology is granted to non-human entities’ (1999, p.287).

Indeed, a number of interesting analogies are evident in the work of the two scholars. Though preliminary, and far exceeding the scopes of the present thesis, future work may well trace and make use of these links in a view to further promote and substantiate a more symmetrical account of all types of knowledge, bringing to the forth its subjective, objective, and intersubjective elements.

More to the point of the present research and regarding the study of the relationship between science and the public sphere, a series of propositions could well be developed paving the way for novel enquiries. Thus, the present study and its typification of the various meanings of the public sphere as they exist in both formal and informal settings of communication with experts, resulted in the identification of a rich representation. Core and peripheral elements bear witness to a tension between preservation and accommodation. As boundaries between outsiders and insiders are defined and redefined, opening possibilities for hybridisation in both knowing and being, old demarcations between mind and body, scientific and non-scientific, still hold. While some initial attempts have been made towards the explanation of such a complex and mixed representation, future research may well contribute to its further illumination. For example, do variations in spatial and/or time parameters result in the activation of different elements of the representation identified? Are specific elements more absent or present depending on the scientific research group studied or is this more of a universal nature? These and related questions could well be addressed in the future.

A more microgenetic perspective could also bring further breadth and life in social psychology’s understanding of relevant phenomena. Studies like, for example, that of Jodelet’s (1993) and Gervais’ (1997), have contributed greatly to this view, however, there is still much work to be done towards this realisation. An investigation of scientific organisational settings and rituals could well enrich such an attempt. How far is communication with the public sphere institutionalised in specific scientific establishments? What is the form of such institutionalisation and under what agenda does it operate? What types of ‘publics’ are preferred or represented? How do particular public or private research groups internalise, assimilate, and accommodate more external views on their everyday practices? What are these external views? What types of artifacts are engaged in the process? What kinds of functions do they perform? What and who is empowered? What and who is submerged? What lies in the least visible and most unspoken? What do all of these mean for the self?

These and similar questions and their answers could further enrich our comprehension of social representations, as a way of thinking, being, and acting in a live, thinking, and active world. They could also promote a socio-psychological study of expert knowledge. This should not be taken as an attempt to use the social so as to account for the scientific, but as an opportunity for observing how different modalities of knowing come together and/or clash, how different knowledge holders meet others, as well as mapping possible forms and instances of self-evaluation and reflection in the process (Jovchelovitch, 2007). In this vein, the visions of socio-psychological theory and research are expanded. At the same time, they are made use of in the continuous effort to sustain communication, to promote different perspectives, and to enhance encounters and coexistences.

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Appendices

Appendix 1

Cloning and its meanings

Form of cloning	*Definition*	*Applications*
Cell cloning	A group of genetically identical cells produced by mitotic division from an original cell. This is how replacement cells are produced in the body when the old ones wear out.	A naturally occurring procedure practiced in biomedical research for over 50 years
DNA cloning	A group of DNA molecules produced from an original length of DNA sequences produced by a bacterium or a virus using molecular biology techniques	A naturally occurring procedure practiced in biomedical research for over 20 years
Cloning by asexual reproduction	A group of genetically identical individuals descended from the same parent by asexual reproduction. Many plants show this by producing suckers, tubers or bulbs to colonise the area around the parent.	A naturally occurring procedure that has been part of traditional agricultural schemes for centuries
Cloning by embryo splitting	The production of genetically identical animals by 'embryo splitting'. This can occur naturally at the 2-cell stage to give identical twins.	This procedure, occurring spontaneously in mammals, has mainly been used commercially in cattle industry for breeding purposes. Also useful in research settings for the production of animals for experiments
Cloning by nuclear transfer or Cell Nuclear Replacement	The creation of one or more genetically identical animals by transferring the nucleus of a body cell into an egg from which the nucleus has been removed.	An artificial procedure with applications on both animals (transgenic technology) and humans (reproductive-therapeutic cloning)

(Based on: McLaren, 2002b, p. 175; Seidel, 2000)

Appendix 2

From Weismann to Wilmut: A Brief History of Nuclear Transfer

Vertebrate **C**loning **T**imeline	
1885	*Weismann* proposes the theory that there is a loss of genetic information (genes) as cell specialize; this theory later proves to be incorrect.
1914	*Spemann* performs first nuclear transfer with early newts embryonic nuclei.
1938	*Spemann* publishes *Embryonic Development and Induction*, in which he suggests a 'fantastical' future experiment: the cloning of an adult animal
1952	*Briggs* and *King* perform first nuclear transfer where early embryonic Rana frog nuclei are microinjected into enucleated eggs
1958	*Fischberg, Elsdale* and *Gurdon* clone sexually mature *Xenopus* frogs using late embryonic nuclei
1962	*Gurdon* uses differentiated donor nuclei to clone sexually mature *Xenopus* frogs.
1975	*Bromhall* performs mammalian nuclear transfer in rabbits, but clones do not develop past the embryonic stages.
1979	*Willadsen* splits early sheep embryos and artificially produces 'identical' (monozygotic) twins

(*continued….*)

(*continued…*)

1981	*Ilmensee* and *Hoppe* claim to have cloned three adult mice by nuclear transfer, but their result has never been repeated
1983	*McGrath* and *Solter* perform mouse nuclear transfer, but only between two zygotic cells, which are basically just fertilized eggs
1986	*Willadsen* successfully clones sheep from embryonic (undifferentiated) cell nuclei.
1993	*Hall* artificially clones humans via 'embryo splitting', but does not implant the embryos.
1994	*Campbell* and *Wilmut* clone sheep from differentiated cell nuclei (announced in 1996)
1996	*Wilmut* clones Dolly the sheep using adult cell nuclei (announced in 1997)

(Based on Gurdon & Byrne 2002, p. 49)

Appendix 3

Types of stem cells

Type of stem cell	***Description***
Totipotent stem cells	They can be defined in two ways, either as cells that are capable of producing an entire adult organism or as cells that can give rise to every cell line in the developing fetus. Based on the former definition they exist for a short period of embryonic development, probably up to the 2-4 cell stage in humans. In some cases, totipotent cells are equated with pluripotent cells which, however, cannot by themselves generate embryos
Pluripotent stem cells	They can differentiate into many types of cells and have the capacity to renew themselves indefinitely. These cells can be derived either from blastocyst-stage embryos or from fetal primordial germ cells (the region that is destined to develop into the sperm or eggs). In the former case, they are termed embryonic stem cells (ES cells), while in the latter they are called embryonic germ cells (EG cells)
Multipotent cells	They can be found in later stages of fetal development. They are capable of developing into a smaller range of cell types without being able to self-reniew endlessly
Stem cells with more restricted potency	These cells are able to differentiate into only one or a few types of specialized cells. Hematopoietic stem cells for example can only produce blood cells, skin stem cells only skin cells and so on. Recent studies have indicated that adult stem cells may have the ability to generate tissues of other sorts, as has been the case for example in adult mouse brains

(Based on Royal Society, 2000; Nuffield Council on Bioethics, 2000; Clarke, et al., 2000)

Appendix 4
Possible uses of tissue derived from stem cells to treat disease

CELL TYPE	***TARGET DISEASE***
Neural (nerve) cells	Stroke, Parkinson's disease, Alzheimer's Diseases, Spinal cord injury, multiple sclerosis
Heart muscle cells	Heart attacks, Congestive heart failure
Insulin producing cells	Diabetes
Cartilage cells	Osteoarthritis
Blood cells	Cancer, Immunodeficiencies, Inherited blood diseases, Leukaemia
Liver cells	Hepatitis, Cirrhosis
Skin cells	Burns, Wound healing
Bone cells	Osteoporosis
Retinal (eye) cells	Macular degeneration
Skeletal muscle cells	Muscular dystrophy

(Source: UK Department of Health 2000, p. 18)

Appendix 5
Complete coding frame (version 7)

Basic Information
V1 Coder
V2 Item Number
V3 Scientific Journal Name

Science	1
Nature	2

V4 Month [2 digits]
V5 Day of Month [2 digits]
V6 Year [4 digits]

Attention structuring
V7 Size of the article (small= less than 500, medium= less than 1000, large= anything above that)

Small	1
Medium	2
Large	3

V8 Journal Section

News	1
Editorial	2
Correspondence	3
Commentary	4
Book Reviews	5

V9 News Format

Article with latest news/ developments	1
Response, review of prior article	2
Interview, mainly	3
Opinion piece, commentary	4
Other	5

Authorship
V10Author

Not applicable, unknown	0
In house-writer	1
Sent-in	
Scientists	
University	2
Private Laboratory	3
Scientific organization	4
Government research institution	5
Hospital	6
Museum	7
University scientist/ ethics committee member	8

University scientist/ scientific organisation member	9
University scientist/ scientific advisory group	10
Private lab scientist- ethics committee member	11
Private lab scientist- Scientific organisation member	12
Private lab scientist- Scientific Advisory group member	13
Private lab scientist- Biotechnology organisation member	14
Government research inst. scientist- ethics committee member	15
Government research inst. scient.- scientific organisation member	16
Government research inst. scient.- scientific adv. group member	17
Hospital scientist- ethics committee member	18
Hospital scientist- scientific organisation group member	19
Hospital scientist- scientific advisory group member	20
Museum scientist- ethics committee member	21
Museum scientist- scientific organisation group member	22
Museum scientist- scientific advisory group member	23

Public

Government	24
Government agency	
Health	25
Industry	26
Research Funding	27
Ethics committee	28
Scientific Advisory Group	29
National Patent office	30

Economic

Biotechnology organisation (industry- private)	31

Other	32

Identifying cloning

V11 Type of cloning

Not applicable, not specified	0
Human	1
Animal	2
Other	3

V12 Human cloning applications

Not applicable, not mentioned	0
Cloning for the birth of genetically identical individuals	1
Cloning for embryo as a source of stem cells/research	2
Both the above	3

The public

V13 ab Identifying the public

Not applicable	0
Public communication of science	1
Public perceptions, people, society	2

Public opinion poll	3
Public Protest	4
Public forum, exhibition	5
Public consultation, public jury	6
Media coverage (general)	7
TV coverage	8
Radio coverage	9
Newspaper, magazine	10
Internet	11
Legal regulation, law	12
Proposal, draft, bill, guidelines, recommendation, report	13
Legal ruling, court	14
Science Policy (general)	15
Public funding scheme	16
Patenting	17
Public hearing, briefing	18
Public investigation, inspection (regarding illegal actions)	19
Other	20

V14 ab Focus of the story

V14a) Cloning

Not applicable	0
Main cloning	1
Other, cloning reference	2
Other symbolic or rhetorical usage of cloning	3

V14b) (regarding nuclear transfer and embryo splitting)

Not applicable	0
Main Public	1
Other, public reference	2

V15 Controversy

V15 Public controversy

Not applicable	0
Balanced	1
Imbalanced	2

V16 Location of the story

Not applicable, not mentioned	0
Australia	1
Austria	2
Belgium	3
Brazil	4
Canada	5
China	6
Cyprus	7
Czech Republic	8
Denmark	9

Estonia	10
EU	11
Finland	12
France	13
Germany	14
Greece	15
Hungary	16
Ireland	17
Israel	18
Italy	19
Japan	20
Latvia	21
Lithuania	22
Luxembourg	23
Malta	24
The Netherlands	25
New Zealand	26
Norway	27
Poland	28
Portugal	29
Russia	30
Saudi Arabia	31
Slovakia	32
Slovenia	33
Spain	34
Sweden	35
Switzerland	36
United Kingdom	37
United States	38
Worldwide, ‘The world’	39
Other Europe	40
Other Latin America	41
Other Asia	42
Africa	43
‘Europe’	44
Third World	45
UN	46

Arguments and metaphors

V17abcdef Claimant (who is arguing about public perceptions- media coverage- \regulation)

Not applicable	0
Public	
Upper House	1
Lower House	2
Legislature	3
Government	4
EU Commission	5
EU Parliament	6

EU Council	7
Government agencies	
Health, Environment	8
Research Funding	9
Industry	10
National Patent Office	11
European Patent Office	12
Court	13
Specific member state/country	14
UN Organizations	15
Policy makers (general)	16
Ethics Committee	17
Scientific Advisory Panel	18
Media (general)	19
Newspaper	20
TV programme	21
Radio programme	22
People, public (general)	23
Public opinion poll	24
Scientists	
University scientists/ research group	25
Scientists/ research group in private lab	26
Hospital research group	27
Government institution research group	28
Scientist/ Research Group in Museum	29
Joint ventures	
Interuniversity research group	30
University-industry research group	31
University-government institution research group	32
University- Hospital research group	33
University- Museum research group	34
Inter-companies research group	35
Industry- government institution	36
Industry- Hospital research group	37
Industry- Museum research group	38
Inter- government institution research group	39
Government institution- Hospital research group	40
Government institution- Museum research group	41
Inter- hospital research group	42
Hospital- museum research group	43
Inter- museum research group	44
University scientist-ethics committee member	45
University scientist- Scientific organisation member	46
University scientist- Scientific Advisory group member	47
Private lab scientist- ethics committee member	48
Private lab scientist- Scientific organisation member	49
Private lab scientist- Scientific Advisory group member	50
Private lab scientist- Biotechnology organisation member	51
Government research inst. scientist- ethics committee member	52

Government research inst. scient.- scientific organisation member	53
Government research inst. scient.- scientific adv. group member	54
Hospital scientist- ethics committee member	55
Hospital scientist- scientific organisation group member	56
Hospital scientist- scientific advisory group member	57
Museum scientist- ethics committee member	58
Museum scientist- scientific organisation group member	59
Museum scientist- scientific advisory group member	60
Scientific organisation	61
Scientific community, scientists (general)	62

Economic

Biotechnology company	63
Biotechnology organization (industry, private)	64
Patients groups	65
Pro-life, anti-abortion organizations	66
Religious groups, Church	67
Environmental groups	68
'*Anti-cloning groups*'	69
'*Pro- cloning groups*'	70
Author(s)	71
Other	72

V18abcdef (string variable)
Area of research - Applicable only when the arguer is a scientist (relevant to V17, code for each actor)
V19abcdef Type of argument

Not applicable	0
Technocratic	1
Strategic	2
Other	3

V20abcdef Public arena claimed (equivalent to V17)
V21abcdef Location of public arena (equivalent to V16)
V22abcdef Metaphor user (equivalent to V17)
V23 abcdef Area of research - Applicable only when the metaphor user is a scientist (String, code for each actor)
V24abcdef Metaphor (relevant to V22, string variable)
V25abcdef Public arena to which the metaphor refers (equivalent to V17)
V26abcdef Location of the arena to which the metaphor refers (equivalent to V16)

Appendix 6
Basic frequencies of corpus variables of the public sphere in *Nature* and *Science*

Table 1. Number of articles discussing the public sphere in *Nature* and *Science* (*V*3)

Scientific journal	No of articles	Percentage %
Nature	235	51
Science	226	49
Total	**461**	**100%**

Table 2. Number of articles discussing the public sphere by year (*V*6)

Year	No of articles	Percentage %
1997	45	10
1998	65	14
1999	35	7.5
2000	36	8
2001	48	10
2002	82	18
2003	44	9.5
2004	54	12
2005	52	11
Total	**461**	**100%**

Table 3. Number of articles discussing the public sphere by size (*V*7)

Size of articles	No of articles	Percentage %
Small	243	53
Medium	161	35
Large	57	12
Total	**461**	**100%**

Table 4. Number of articles discussing the public sphere by journal section (*V*8)

Journal section	No of articles	Percentage %
News	352	76
Editorial	42	9
Correspondence	28	6
Commentary	20	4
Book reviews	19	4
Total	**461**	**100%**

Table 5. Number of articles discussing the public sphere by news format (*V*9)

News format	No of articles	Percentage %
Article with latest news/developments	346	75
Response/ review of prior article	17	4
Opinion piece/commentasry	98	21
Total	**461**	**100%**

Table 6. Percentage of authors of articles discussing the public sphere (*V*10)

Type of author	Percentage %
Not applicable	1
In-house journalist	80
University research group	11
Scientific organisation	0.5
Government research institution	1
Museum	0.2
University/ethics committee member	1
University/ scientific advisory group member	0.5
Government	1
Ethics committee group member	0.2
Biotechnology organisation	0.2
Hospital	0.2
Other	3
Total	**100%**

Table 7. Percentage of types of cloning reported in articles discussing the public sphere (*V*11)

Type of cloning	Percentage %
Not applicable	6
Human	83
Animal	11
Other	2
Total	**100%**

Table 8. Percentage of types of human cloning reported in articles discussing the public sphere (*V*12)

Type of human cloning	**Percentage %**
Not applicable	30
Human reproductive cloning	13
Human therapeutic cloning	24
Both	33
Total	**100%**

Table 9. Percentage of public developments reported in articles discussing the public sphere[1] (*V*13ab)

Type of public development	**Percentage %**
Not applicable	29.0
Public communication of science	1.0
Public perceptions	10.0
Public opinion poll	1.5
Public forum/exhibition	0.5
Public consultation/jury	1.0
Internet	0.1
Media coverage	3.0
TV coverage	1.5
Newspaper	2.0
Legal law/regulation	3.0
Proposal/ draft	24.0
Legal ruling	1.0
Science policy	8.0
Public funding scheme	7.0
Patenting	2.0
Public hearing	4.0
Public investigation	0.3
Radio coverage	0.2
Other	0.1
Total	**100%**

[1] Combined multiple codings

Table 10. Focus of the story of articles discussing the public sphere (*V*14b)

Focus	**Percentage %**
Main public	49.6
Other, public reference	50.3
Total	**100%**

Table 11. Controversy in the story of articles discussing the public sphere (*V*15)

Controversy	**Percentage %**
Not applicable	35.5
Balanced	24.7
Imbalanced	39.6
Total	**100%**

Table 12. Percentage of locations reported in articles discussing the public sphere (*V*16)

Location	**Percentage %**
Not applicable	8.0
Australia	2.0
Brazil	0.4
Canada	1.0
China	1.0
EU	4.0
Europe	0.4
France	2.0
Germany	3.0
Italy	2.0
Japan	5.0
Netherlands	1.0
Norway	0.2
Russia	1.0
Spain	0.2
Sweden	0.4
Switzerland	0.4
UK	11.0
UN	5.0
USA	45.0
Other Europe	0.2
Other Latin America	0.2
Other Asia	5.0
Worldwide/the world	2.0
Total	**100%**

Table 13. Percentage of claimants reported in articles discussing the public sphere[1] (*V*17abcdef)

Claimant	**Percentage %**
Not applicable	84.5
Anti-cloning group	0.3
Author	4.4
Biotechnology company	0.2
Biotechnology organisation	0.5
Ethics committee	0.4
EU Parliament	0.1
Government	0.4
Government research institution group	0.2
Government research institution/ethics committee member	0.1
Health agency	0.1
Legislature	0.1
Lower House	0.2
Patients	0.2
Policy makers (general)	0.1
Pro-cloning group	0.1
Religious group/church	0.2
Research funding agency	0.2
Scientific community/scientists (general)	0.4
Scientific organisation	1.6
Scientific advisory panel	0.2
Specific member state/country	1.0
University scientist/research group	2.3
University scientist/ethics committee member	0.3
University scientist/scientific organisation	0.1
University scientist/ scientific advisory group	0.1
Upper House	0.4
Other	0.7
Total	**100%**

[1] Combined multiple codings

Table 14. Percentage of types of arguments reported in articles discussing the public sphere[1] (*V*19abcdef)

Type of argument	**Percentage %**
Not identified	87.0
Technocratic	8.0
Strategic	5.4
Total	**100%**

[1] Combined multiple codings

Table 15. Percentage of public arenas claimed in articles discussing the public sphere[1] (*V*20abcdef)

Public arena claimed	**Percentage %**
Not applicable	84.5
Ethics committee	1.5
EU Council	0.2
EU Parliament	0.3
Government	1.0
Health agency	0.1
Industry agency	0.1
Legislature	3.6
Lower House	0.1
Media (general)	0.4
National patent office	0.1
People/ public in general	2.2
Research funding agency	0.3
Scientific advisory group	0.1
Specific member state/country	0.6
UN organisation	1.3
Upper House	2.0
Total	**100%**

[1] Combined multiple codings

Table 16. Location of public arenas claimed in articles discussing the public sphere[1] (*V*21abcdef)

Location of public arena claimed	Percentage %
Not applicable	86
Australia	0.4
China	0.1
EU	0.6
Germany	0.2
Japan	0.8
UK	1.2
USA	8.0
Worldwide/world	0.8
Other Asia	0.4
UN	1.3
Total	**100%**

[1] Combined multiple codings

Table 17. Metaphor users in articles discussing the public sphere[1] (*V*22abcdef)

Metaphor user	Percentage %
Not identified	90.0
Anti-cloning group	0.3
Author	8.5
Scientific organisation	0.2
University research group	0.4
Other	0.1
Total	**100%**

[1] Combined multiple codings

Table 18. Public arenas anchored in articles discussing the public sphere[1] (*V*25abcdef)

Public arena anchored	Percentage %
Not applicable	90.0
Ethics committee	0.8
EU Council	0.3
EU Parliament	0.3
Government	0.6
Health agency	0.1
Legislature	1.3
Lower House	0.6
Media (general)	1.2
People/ public (general)	1.0
Policy makers (general)	0.2
Research funding agency	0.1
Specific member state/country	0.2
UN organisation	0.5
Upper House	2.3
Total	**100%**

[1] Combined multiple codings

Table 19. Location of public arenas anchored in articles discussing the public sphere[1] (*V*26abcdef)

Location of public arena claimed	**Percentage %**
Not applicable	91.0
Australia	0.2
EU	0.6
Japan	0.2
Other Asia	0.1
Switzerland	0.1
UK	1.0
UN	0.5
USA	6.0
Worldwide/the ‘world’	0.3
Total	**100%**

[1] Combined multiple codings

Appendix 7
Argumentation analysis: an example

Response Letter published in *Science*, Vol 297, Issue 5578, 51-52, 5 July 2002

Response

We thank Jones for the historical context. We can think of no one better to emulate than King, Briggs, and Gurdon, who have contributed so many elegant studies to modern embryology. "Nuclear transplantation" was a good term when they coined it, and it remains good. It is far more accurate than "therapeutic cloning" and much more easily pronounceable than "somatic cell nuclear transfer."

Meyer has, unfortunately, missed the point of our Policy Forum. Human cells growing in a Petri dish are not equal to a human being. This is fact, not opinion. Cells in a Petri dish can't talk, think, move, love, laugh, or cry, to name a few of the numerous and obvious differences. Thousands of laboratories around the world already grow human cells (fibroblasts, lymphocytes, etc.) in Petri dishes. Each of these cells has the theoretical capacity to develop into a human being after experimental manipulation. The major medical goal of nuclear transplantation is to produce human cells growing in Petri dishes that can be used for regenerative medicine. The public needs to understand that there is a huge difference between such cells and an actual human being. It is important that the current confusion about these issues does not lead to a ban on the production of certain types of human cells growing in Petri dishes, precluding potential therapies for the millions of human beings who currently suffer from otherwise incurable diseases.

Step 1: Identifying main points of argumentation

Human cells growing in a Petri dish are not equal to a human being. This is fact, not opinion. Cells in a Petri dish can't talk, think, move, love, laugh, or cry, to name a few of the numerous and obvious differences. The major medical goal of nuclear transplantation is to produce human cells growing in Petri dishes that can be used for regenerative medicine. The public needs to understand that there is a huge difference between such cells and an actual human being. It is important that the current confusion about these issues does not lead to a ban on the production of certain types of human cells growing in Petri dishes, precluding potential therapies for the millions of human beings who currently suffer from otherwise incurable diseases.

Step 2: Identifying the structure and type of argumentation

Data: The public needs to understand that there is a huge difference between cells in a Petri dish and an actual human being

Warrant: Cells in a Petri dish can't talk, think, move, laugh or cry

Backing: Potential therapies for the millions of human beings who currently suffer from otherwise incurable diseases could come from cell in a Petri dish

Claim: It is important that the current confusion about these issues does not lead to a ban on the production of certain types of human cells growing in Petri dishes

Type of argumentation: Technocratic

Appendix 8
Contact e-mail: Example

Dear Dr ____________ ,

There have been a number of studies focusing on the public understanding and conceptualisation of somatic cell nuclear transfer technology, however there is a lack of information with regard to the way scientists have experienced public engagement with and understanding of this technology. I was wondering if you or any of your colleagues have some time available to talk to me about this issue.

I am fully aware of your busy schedule and of other similar demands made on you by the social science community and I apologize in advance if this message puts an additional pressure on you. However, I would be grateful if you agreed to take part in this research, for it is one of the few instances in which scientists are given the opportunity to talk about their work and interests.

I will e-mail you again so as to discuss the details of a possible meeting.

Thanking you in advance for your assistance I look forward to hearing from you.

Kind regards,

Alexandra Kolka
PhD student in Social Psychology
Institute of Social Psychology
London School of Economics
http://www.lse.ac.uk/collections/socialPsychology/whosWho/researchStudents.htm

P.S. Additional information about the research project

My name is Alexandra Kolka and I am currently conducting my PhD research project at the Institute of Social Psychology, London School of Economics. The project involves the study of scientists working in areas relevant to somatic cell nuclear transfer technology and it focuses on the scientific point of view on the public reaction to the human applications of the technique (otherwise known as human reproductive cloning and human therapeutic cloning). The project is funded by the LSE Research Studentships Award (2004-2005) and supervised by Dr Martin Bauer (m.bauer@lse.ac.uk). An integral part of the project employs the conduction of individual interviews with scientists licensed by the Human Fertilisation and Embryology Authority to work with human embryonic stem cells. The interview will be conducted at a place and date of your preference and any information that could reveal your identity and the institution you are working for will be regarded as strictly confidential and will not be disclosed.

Appendix 9
Interview Topic Guide

Initiation phase

Introducing the researcher, explaining confidentiality, expressing gratitude, presenting the principles of the interview, granting permission for the use of a tape recorder, allowing preliminary questions to be asked, listening, and preparing for the questioning phase.

Themes to be discussed
1. Interviewee's research interest
2. Interviewee's personal experience with science communication

Questioning phase

Exploring themes in the narration, prompting descriptions, examples, explanations and justifications

Themes to be discussed
1. Public perceptions of human cloning research and applications
2. Media coverage of human cloning research and applications
3. Regulation of human cloning research

Closure

Summarizing the discussion, enquiring about uncovered issues, expressing gratitude
1. The Switzerland scenario
2. Final thoughts and comments

Appendix 10
Additional information sheet

About you!

The following information about you is necessary for further statistical analysis and will be treated with confidentiality:

Current profession: ________________________________

Working in this profession since: ________________________________

Research interests:____

Participation in science communication activities since __________________

Age: _______________

Appendix 11
Documentation sheet

Contextual information about the interview and the interviewee

Date of the interview: ………………….……………………………………..

Place of the interview: ………………….……………………………………..

Duration of the interview: ………………….……………………………………..

Gender: ………………….……………………………………..

Age: ……………………………………………………………..

Profession: ……………………………………………………………..

Working in this profession since: ……………………………………………………………..

Research interests: ……………………………………………………………..

Peculiarities of the interview:
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(Based on Flick, 2000, pg. 84)

Appendix 12
Argumentation analysis: example of interview data

Extract from interview #5 with a senior university embryologist

(I= Interviewer, P= Participant)

- I: So, would you like to tell me a little bit more about your research, the kind of research you are involved in?
- P: The research we actually do is, we have set up a system where you can donate embryos for stem cell research. And we are doing two things: one is deriving embryonic stem cell lines and secondly looking at the epigenetic profile of the inner cell, and the development of the epigenetic pattern, as the development of the embryo takes place. In addition to that, we have applied to a funding, although we have not been qualified yet, to set up a good manufacturing and practicing laboratory for IVF, so that you can produce high quality embryos that you can then use for stem cell research for treatment; at the moment it is only research. So, that is really our primary focus. But I am also a member of the X [regulatory body], so we have quite a lot of discussions about nuclear transfer.
- I: I see, can you tell me a little bit more about these meetings and the chances you get to communicate your research to a wider audience?
- P: On a personal level I have been quite heavily involved with how you try to communicate with the public on the value of, let’s say, therapeutic cloning and embryonic stem cell research in general. I think you have to strike the balance between being secretive and trying to sort of pretend you know everything and the public knows nothing and trying to protect the information you already have, because a lot of it is confidential, a lot of it is quite preliminary, to then give the public confidence. And I think you really gain public confidence when you perceive and seem to be and actually are open and honest about what is going on. And there is a lot of debate, so for example, in the U.K they were quite lucky because there was a lot of debate about animal research for many, many years but certainly it was solidified in 1991 with the HFE Act. And that really set strong the concept of embryo research; once you have got that then the issue of stem cells came there was further debate but it was on a

platform that was actually quite strong. And the U.K took a different concept, you could do nuclear transfer, but there was a lot of debate about how to do that, not to do reproductive cloning, what the advantages and disadvantages are and there was a host select committee etc., etc. I think once you got a lot of debate around what is happening and it is an informed debate rather than an emotional the scientists can then sort of put forward to the public reasonably how may be the benefits of what they do. Of course, they do not know that for certain but they know to a large degree. So, that strikes me as the best model. I think if you use a model of 'well scientists know best, go away', it is suicide, and if you use that model you just stop putting anything in the public. I think that is also a problem because you are not using any informed decisions.

- I: So what about your experience, have you ever participated in a debate where SCNT was discussed?
- P: Yes, I have. I think you get quite a lot of strong views and they tend to be really quite predictable views, you know, 'the embryo, you should not do research on the embryo and destroy it, how do we know it is not a slippery slope argument?', and there are lots of ways of dealing with this. I think once you can portray those to the people 85% of the people will understand that, 15% percent no matter what you do they never going to change their mind and, you know, all you have got to do to those people is actually be prepared to debate it; you cannot hide, you have to go over there and say: 'no I disagree with that, that is not right', you know? But not from an emotional point of view, because this is the way it is.
- I: So, what do you mean by this emotional point of view?
- P: I think for the emotional point of view, I think people get very emotional about embryo research. 'Is it a human?', 'are you hurting somebody?', or 'what is happening?' and they are driven emotionally rather than really logically. Once you start to explain to them what goes on and the loss of the human embryos etc., etc., then they start to get a grip of actually 'I thought every embryo was a human'. Even if you get that stage you can start to then properly inform them of what really is going on and how it happens and then they see people who are involved in research and they discuss with them and they become a lot more open and you know, it is less instinctive, less

emotional, it is much more, they say things like ‘I did not know that, now I understand why you are trying to do so and so’. I think that is a positive thing.

- I: And you think this is the same with SCNT research?
- P: I think so, at least in my limited experience. There is still confusion as to move away from the term ‘cloning’, for example, but there is still confusion about nuclear transfer and how that will go forward. There, for a long time there were a lot of, you know, all of the Antinoris in this world and Zavos standing up and saying we have done this and that. And that tends not to help at all. I think we have put quite a strong campaign to assure that that is not really at all; but mind you, a few months ago we had the first license for stem cells for nuclear transfer and, you know, the technology is there it is just a case of using it, and how that can be done. And a true license is now in the U.K with X, but basically they have done that. You know, that is a very positive thing; it has opened up the debate, there is some information on the website for people. I think it has generally been handled very well.
- I: I see. So you are saying that although the actions of specific scientists like Antinori and Zavos had to do a little bit with an initial confusion..
- P: Yes, I mean, they were trying, they were just PR idiots as far as I am concerned and they know nothing of what is going on. Now, that does not stop them from being front page in the newspapers, because the newspapers they just want a headline. But what you have to do with those, you have to sort of face that issue head on and say: ‘ they have claimed ‘x, y’ and ‘z, x, y’ and ‘z’ is not true. And you just go over scientific opinion to sort of put that forward. And then, in most cases, the editors of the newspapers have been basically informed and, you know, these are disreputable people, this is not the way to do it. Yet, if this is to happen you will know about it and it will be done in this way and we will tell you as soon as this is done, it will be done in some stage. So, I think that strikes me as a positive way to deal with this and then you can write articles in the paper that are more balanced rather than ‘clones on the horizon’.

Step 1: Identifying main points of argumentation

On a personal level I have been quite heavily involved with how you try to communicate with the public on the value of, let's say, therapeutic cloning and embryonic stem cell research in general. I think you have to strike the balance between being secretive and trying to sort of pretend you know everything and the public knows nothing. And I think you really gain public confidence when you perceive and seem to be and actually are open and honest about what is going on. And there is a lot of debate; so, for example, in the UK there was a lot of debate about animal research for many, many years but certainly it was solidified in 1991 with the HFE Act. I think once you got a lot of debate around what is happening and it is an informed debate rather than an emotional the scientists can then sort of put forward to the public reasonably how the benefits of what they do may be. I think if you use a model of 'well, scientists know best, go away', it is suicide, and if you use that model you just stop putting anything in the public. I think that is also a problem because you are not using any informed decisions. I think you get quite a lot of strong views and they tend to be really quite predictable views 'the embryo, you should not do research on the embryo and destroy it, how do we know it is not a slippery slope argument', and there are lots of ways of dealing with this. I think once you can portray those to the people 85% of the people will understand that, 15% percent no matter what you do they never going to change their mind and all you have got to do to those people is actually be prepared to debate it, you cannot hide, you have to go over there and say: 'no I disagree with that. It is not right'. I think people get very emotional about embryo research and they are driven emotionally rather than really logically. Once you start to explain to them what goes on and the loss of the human embryos then they start to get a grip of it. There is still confusion about nuclear transfer and how that will go forward. For a long time there were all of the Antinoris in this world and Zavos standing up and saying we have done this and that. And that tends not to help at all. I think we have put quite a strong campaign to assure that that is not really at all. They were just PR idiots as far as I am concerned and they know nothing of what is going on. Now, that does not stop it from being front page in the newspapers, because the newspapers they just want a headline. What you have to do with those, you have to sort of face that issue head on and say they have claimed 'x, y' and 'z, x, y' and 'z' is not true. And you just go over scientific opinion to sort of put that forward. So, I think that strikes me as a positive way to deal with this and then you can write articles in the paper that are more balanced rather than ‘clones on the horizon’.

Step 2: Identifying the structure and type of argumentation

1st argument

Data: On a personal level I have been quite heavily involved with how you try to communicate with the public on the value of, let’s say, therapeutic cloning and embryonic stem cell research in general.

Warrant: I think you really gain public confidence when you perceive and seem to be and actually are open and honest about what is going on.

Claim: I think you have to strike the balance between being secretive and trying to sort of pretend you know everything and the public knows nothing.

Implied backing: (*since we need the public’s confidence in order to proceed with our research*)

Type of argumentation: Strategic

2nd argument

Data: In the UK there was a lot of debate about animal research for many, many years but certainly it was solidified in 1991 with the HFE Act.

Warrant: We need an informed debate rather than an emotional one.

Backing: (Since) we should be using informed decisions.

Claim: The scientists can then put forward to the public reasonably how the benefits of what they do may be.

Type of argumentation: Technocratic

3d argument

Data: There are quite a lot of strong views and they tend to be really quite predictable.

Warrant: I think people get very emotional about embryo research and they are driven emotionally rather than really logically.

Backing: Once you start to explain to them what goes on and the loss of the human embryos then they start to get a grip of it.

Claim: You have to go over there and say: 'no I disagree with that. It is not right'.

Type of argumentation: Technocratic

4th argument

Data: There is still confusion about nuclear transfer and how that will go forward

Warrant: For a long time there were all of the Antinoris in this world and Zavos standing up and saying we have done this and that.

Baking: As far as I am concerned they know nothing of what is going on.

Claim: I think we have to put quite a strong campaign to assure that that is not really at all.

Type of argumentation: Technocratic

5th argument

Data: Antinori and Zavos are front page in the newspapers.

Warrant: The newspapers just want a headline.

Backing: They should be writing articles in the paper that are more balanced rather than ‘clones on the horizon’.

Claim: What you have to do with those, you have to sort of face that issue head on and say they have claimed ‘x, y’ and ‘z, x, y’ and ‘z’ is not true. You just go over scientific opinion to sort of put that forward.

Type of argumentation: Technocratic

Appendix 13- Instructions for coding

Content analysis: Instructions to coders

1. The coding frame

The coding frame is roughly divided into four sections. Thus, each article is coded in such a way so as to document issues relating to 1) basic information about the article (item number, name of journal, date), 2) salience of the public sphere (size, journal section, news format, author,), 3) identification of the public sphere (public themes, focus, location and type of cloning), 4) arguing about the public sphere (claimant[14], public arena claimed, location of public arena claimed). According to syntactical procedures, the use of metaphorical concepts are documented (string code) while information regarding the metaphor user and the arena to which the metaphor applies are coded as well. The purpose of the coding frame is to identify the way public developments regarding human and animal cloning (public perceptions, media coverage and regulation) are reported.

2. Before coding

In order for the coder to fully appreciate the rationale of the coding frame it is pivotal to read the attached files named 'the rationale', 'on cloning' and 'on the public sphere'. The files provide information about the rationale of the overall research, the type of cloning that is of interest to the present study (that is somatic cell nuclear transfer (SCNT) for human and non human applications) as well as a workable definition of the 'public sphere' (that is, public perceptions, media coverage, regulation of SCNT). Please do not start coding unless you have read and fully understood those files.

3. Coding

In what follows basic instructions are provided for each variable:

v1: Just write your name in the coding sheet

[14] In cases where the claimant or the user of metaphor was a scientist, a string code documents his/her specialisation

v2: Each article has been assigned a code. The code is provided both on the copy of the article as well as in the list of articles given (file: 'List of Titles of 46 articles to be coded')

v3: Identification of the journal in which the article has been published. Two are the scientific journals under analysis: *Nature* and *Science*. Please code accordingly

v4-v6: Date information

v7: The size of the article is coded. If the article is **less** than 500 words, then code as '**small**', if **less** than 1000 code as '**medium**', anything above that is coded as '**large**'

v8: In which section is the article appearing? In *Science* the following sections are coded as '**news**': News, News of the week, News focus, ScienceScope, Random samples, News and Comment. Sections like Policy forum, Breakthrough of the year, Science's compass and Pathways of discovery are coded as '**commentary**'. Letters is coded as '**correspondence**'

In *Nature* sections like Brief, News feature and News in brief are coded as '**news**'. Correspondence is coded as '**correspondence**'. The sections Millenium Essay and Words are coded as '**commentary**'.

v9: The article is coded according to the content and the way of reporting

V10: If the article has been written by more than one author then you code for the one reported first. Note than in *Science* the sections Random Samples' and ScienceScope are always coded as written by 'in-house authors'.

List of names of *Science* authors coded as 'in-house':

Philip **Abelson**, Joseph Alper, Tim Appenzeller, Palava **Bagla**, Michael Balter, Marcia Barinaga, Floyd Bloom, Monica Bradford, John Brauman, Anne Brinlmann, Kathryn Brown, Gilbert J. **Chin**, Adrian Cho, Barry Cipra, Daniel Clery, Jon Cohen, Elizabeth Culotta, David **Ehrenstein**, Martin Enserink, Linda **Felaco**, Dan Ferber, Richard **Gallagher**, Candace Gallery, Joshua Gewolb, Ann Gibbons, Christine Gilbert, James Glanz, Trisha Gura, Michael **Hagmann**, Brooks Hanson, Jeffrey Hearn, Pamela Hines, Belinda Holden, Constance Holden, Stella Hurtley, Barbara **Jasny**, Patricia **Kahn**, Jocelyn Kaiser, Katrina Kelner, Donald Kennedy, Richard Kerr, David Kestenbaum, Paula Kiberstis, Cherlene King, Robert Koenig, Carolyn Kyle, Steven **Lapham**, Andrew Lawler, Josh Lipicky, Diane Long, John **MacFarlane**, Charles Mann, Eliot Marshall, Jean Marx, Dawn McCoy, Jefrey Mervis, Linda Miller, Anne Simon Moffat, Patricia Moore, Virginia Morell, Oliver

Morton, Colin **Norman**, Dennis Normile, Elizabeth **Pennisi**, Richard Peters, John Pickrell, Beverly Purnell, Bryan **Ray**, Leslie Roberts, Wade Roush, Linda Rowan, Ellis Rubinstein, Charles **Seife**, Robert Service, Robert Sikorski, Stephen Simpson, Orla Smith, Richard Stone, Phillip Szuromi, Gary **Taubes**, Julia **Uppenbrink**, Gretchen **Vogel**, David Voss, Ingrid **Wickelgren**, Nigel Williams, Anita Wynn, Ding **Yimin**

List of names of *Nature* authors coded as ‘in-house’:
Alison **Abbott**, Sara Abdulla, David Adam, Peter Aldhous, Laura **Bonetta**, Xavier Bosch, Geoff Brumfiel, Declan Butler, Erika **Check**, Harriet Coles, David Cyranosky, Rex **Dalton**, Carina Dennis, David Dickson, Olivier de Gandt, Natalie DeWitt, Jim **Giles**, Jenny **Hogan**, K.S. **Jayaraman**, Jonathan **Knight**, Sally **Lehrman**, Carl Levith, Natasha Loder, Heather **Maccabe**, Colin Macilwain, Ehsan Massod, Nicola **Nosengo**, Helen **Pearson**, Kendall Powell, Asako **Saegusa**, Quirin Schiermeier, Paul Smaglik, David Swinbank, Robert **Triendl**, Meredith **Wadman**

List of institutions coded as ‘**University**’: Monash Institute for Reproduction and Development

List of institutions coded as ‘**Private Laboratory**’: Carnegie Institution of Washington, Donald Danforth Plant Science Center, Institute for Genomic Research, USA;

List of institutions coded as ‘**Scientific organisation**’: The Scripps Research Institute The Skaggs Institute for Chemical Biology

List of institutions coded as ‘**Government research institution**’: Banbury Centre, John Innes Centre, Institut Cochin de Genetique Moleculaire, Max Planck Institut (Germany), Pacific Centre for Ethics and Applied Biology, Pangea Systems Inc., 1999 National Human Genome Center, Shanghai, China; Salk Institute for Biological Studies, Salk Institute, La Jolla;

List of institutions coded as ‘**Hospital**’: Clinical Trial Service Unit., MacCallum Cancer Institute

v11: Each article could be referring to more than one type of cloning. For example, if an article is discussing about both the human and animal applications of cloning then you code according to the main focus. There are times where general, non-specified, references to cloning are made; then you code as 'not specified'. If other than human or animal uses of cloning are reported then you code for 'other'.

v12: Only to be used for **human applications** of cloning! If an article does not discuss the human applications of cloning then you code as 'not mentioned'. Again, in some other cases a general reference to human cloning may be made. If you are not **100%** sure which type of human cloning it is meant then code as 'not mentioned'. If the article discusses human cloning as a form of human replication then you code as '1'. If the article makes reference to the therapeutic applications of human cloning and stem cells research then you code as '2'. If the article discusses both then you code accordingly.

v13ab: The purpose of this variable is to identify the different ways and types in which the three main arenas of the public sphere that are of interest (public perceptions, media coverage, regulation) are reported in the scientific press. Again more than one reference may be made. Our interest lies at the top two references. After you have read the article you then need to identify which are the main public references and then you code them according to the order of their appearance in the text. You may have noticed that law is coded separately from proposal, bill and the rest. The purpose here is to demarcate between science policy in the making (= in this case reference is usually made to proposal, bill, draft, guidelines, recommendation, report) and science policy as a fait accompli (law). Also public perceptions (usually referred to generally as people, society, the public) is to be treated separately from public opinion poll (when direct reference is made to the results of a study). **Caution**: the variable refers only to public developments relevant to cloning. If an article is also discussing the public developments of another type of research, for example nuclear power or stem cell research with no direct relevance to cloning, then you ignore that. Again, we are interested only in those developments in public perceptions, media coverage and regulation that relate to cloning.

v14ab: The variable identifies the focus of the story. Again v14b measures **only** those public developments that refer to cloning.

v15: if a public controversy regarding cloning is reported then code if it is a balanced reporting or not. A report is considered balanced when the author does not directly position himself/herself and/or all the relevant rival points and voices are given equal attention.

v16: Identification of the location. If more than one location is discussed in relation to public developments of cloning then you code based on the main location.

Arguments and metaphors (v17abcdef- v26abcdef)

The last set of codes identifies arguments and metaphors used when discussing the public perceptions, media coverage and regulation of cloning. The codes are interrelated. That means that v17a is relevant to v18a and v19a and v20a and v21a and so on and so forth. Before coding for this last part you first need to proceed with the argumentation analysis. Please see the instructions included in the folder 'Argumentation analysis of articles'.

v17abcdef: The purpose of this code is to identify the person that is making an argument about the public perceptions, and/or, the media coverage, and/or the regulation of cloning. Up to 6 different claimants could be coded. Again they are coded based on the order they are reported in the article. Sometimes the same person, either the author, or someone reported in the text might make more than one argument. Two or more different arguments may be made about i.e. public perceptions or the same argument may refer to both i.e. public perceptions, media coverage or still two or more different arguments may be made about i.e. the public perceptions and regulation. You code separately for each argument. The following steps might be of help:

1. Read through the article identifying those sections of it that contain argumentative material relevant to the public perception and/or media coverage, and/or regulation of cloning.
2. Perform argumentation analysis- here you basically need to identify the structure of the argument (claim- data- warrant- backing-rebuttal). This will help you to identify the exact number of arguments reported in the article. In the case of commentary sections where the purpose of the article is to provide the author's opinion about a development try to identify the number and the structure of the arguments made by the author. If in the process of his/her

argumentation the author is making reference to somebody else's argument, either in an attempt to destroy or line himself/ herself with that way of thinking, there is no need to account for that person's argument separately. Most of the times, that 'somebody else's argument' is part of the author's main arguments and is usually accounted for as 'data'. In other cases, mostly regarding articles that report the latest news, reference is only made to different claims made from different claimants without including the reasons why those people are arguing in such a way. Again, you code separately for each claimant.

3. Identify the claimants and code accordingly

An example: An article reporting the latest regulatory developments regarding human cloning in the US, includes 3 different arguments. The first argument is made by a stem cells university scientist and discusses his ideas about an ethics committee's proposal regarding human cloning. The second argument is made by a member of a scientific organisation and is addressed to the government's plans about cloning whereas the same person makes also an argument about the US public and its understanding of cloning. After performing argumentation analysis you have managed to identify the structure of the first argument, warrant and claim. Only the claims of the second and the third argument have been reported. You make separate notes for each argument. Then you return to the coding frame and code as follows:

v17a: University scientist (25)
v18a: Stem cell scientist
v19a: You code for the type of the argument the scientist made, let's say 'strategic' (2)
v20a: Ethics committee (17)
v21a: United States (38)

Then you code for v17b
v17a: Scientific organisation (61)
v18b: Not relevant
v19b: Let's say 'technocratic'(1)

v20b: Government (4)

v21b: United States (38)

Then you code for 17c

v17c: Scientific organisation (61)

v18c: Not relevant

v19c: Let's say 'technocratic' (1)

v20c: People (23)

v21c: United States (38)

Some titles of Upper Houses:

- Senate
- House of Lords
- Legislative Council
- Bundesrat- Germnay
- Council of States- Switzerland
- Eerste Kamer- Netherlands
- Federation Council- Russia
- House of Councillors- Japan
- National Council- Slovenia
- Rajya Sabha- India

Some titles of Lower Houses:

- House of Representatives
- Chamber of Deputies
- House of Commons
- National Assembly
- House of Assembly
- Chamber of representatives- Uruguay, Columbia, Belarus
- Congress of Deputies- Spain
- Dail- Ireland
- Duma- Russia
- House of Keys- Isle of Man
- Lok Sabha- India
- Sejm- Poland
- Tweede Kamer- Netherlands
- National Council- Switzerland, Austria

Some titles of National Legislatures:

- Parliament

- Congress
- Diet
- National Assembly
- Althing- Iceland
- Bundestag- Germany
- Cortes Generales- Spain
- Eduskunta or Riksdag- Finland
- Federal Assembly- Russia, Austria, Switzerland
- Folketing- Denmark
- Knesset- Israel
- Legislative Yuan- Republic of China-Taiwan
- Oireachtas- Republic of Ireland
- Riksdag- Sweden
- Sejm- Poland, Lithuania, Latvia
- State Assembly- Estonia
- Staten- Generaal- Netherlands
- Storting- Norway
- Tynwald- Isle of Man

v18abcdef: This code is relevant to v17abcdef and it is a string code. It is only to be used when the claimant is a scientist and direct information is given about his/her area of research i.e. ‘sociologist’ or ‘molecular biologist’

v19abcdef: The variable tries to provide a typification of the argument, that is a general sense that captures the essence, the main idea of the argument. If unable to specify the type of the argument then code as ‘not identified’.

Definition of ‘technocratic’ type of arguments

The term ‘technocratic’ has been used to capture the tendency of the arguments under this type to prioritize expertise over other forms of knowledge. More specifically, a demarcation is performed between scientific knowledge as factual based and public opinion as emotive and biased. In this way, science policy is placed in the minds and hands of those who have access to ‘true’ facts. A one-linear model of communication between science and the public is assumed with people envisaged as the final receptors of a *fait- accompli*. Media reports of cloning are degraded as sensational or lacking objectivity. Science policy is either treated with scepticism or enthusiasm. Promotion of scientific knowledge and the wellbeing of the scientific community is the common basis for all the above.

Definition of 'strategic' type of arguments

The term 'strategic' reflects the participatory role assigned to members of the public sphere. In contrast to the previous type of argumentation, here people, the media and regulators are given voice, voice of a certain weight and status. Thus, instead of being treated as a bad caricature of scientific knowledge, public opinion is perceived in the wider context of its production. People and media are portrayed as playing a central role in the legitimation of scientific practices while decision making is based on the idea of civil rights and their protection. Overall argumentation proceeds in the wider background of ethics regarding not only cloning research but that of science and humanity.

v20abcdef: To which arena of the public sphere is the argument addressed? To code use the values in v17abcdef

v21abcdef: Code the location of the public arena claimed about. You code separately for each argument. Use the values in v16.

v22abcdef: There might be more than one metaphor user in an article or the same person may use two or more different metaphors. Code for each metaphor separately. Again you follow the same logic as shown in the example regarding arguments. Codes v22a-v23a-v24a-v25a-v26a are interrelated. The same holds for the rest. To code use the values of v17abcdef

v23abcdef: Applicable only when the metaphor user is a scientist. If reported directly write down his/her area of research

v24abcdef: Write down the full metaphor. The basis for the identification of metaphors in the text lies in the definition of non-literal speech as a form of wording intended to mean something other than what is exactly said. However, analysis of relevant literature indicated that there are other tropes of non-literal speech, from which metaphor needs to be carefully distinguished. Examples of non-literal tropes that are **not metaphors**:

1. **Irony**: An utterance used to express the very opposite of what it is said. For example, to say 'what lovely weather' to refer to a dark and rainy day is ironic.
2. **Hyperbole**: an utterance that contains exaggeration beyond what is really possible. For example to say 'I told you a thousand times'

3. **Dead metaphor**: figures of speech which, although deriving from metaphorical concepts, have lost their value as metaphors. For example, ‘the law endangers current research’ is an instance of a dead metaphor. A law is not a living entity able to ‘endanger’ something. Although originating from metaphorical concepts, it is not perceived as a metaphor for it is quite common to use active verbs in association with immaterial concepts.
4. **Simile**: an utterance describing similarities between different entities. For example to say that somebody ‘sits on his chair like a king on his throne’ is an instance of simile. A useful way to distinguish simile from metaphors is the use of words such as ‘as’ or ‘like’ in expressions of the former.

V25abcdef: To which public arena is the metaphor addressed? Code based on the values of v17abcdef

V26abcdef: Code for the location of the public arena for which the metaphor has been used. Use the values of v16

Argumentation analysis: Instructions to coders

Basic steps to follow when conducting argumentation analysis of articles:

1) Read through the article and try to identify whether anyone makes any argument either about public perceptions and/or media coverage and/or regulation of cloning. In some cases it helps to paraphrase the argumentative material (see example provided in Appendix 7).
2) Try to identify the structure of argumentation, that is what is the main claim the person is making and how he/she supports it and keep a record of every argument, as shown in the example. In some cases you will find just the claim reported whereas in other cases other premises would be directly given in the text. Yet again, in other cases you might be able to deduce those parts of the argument that are missing by inferring them from what is explicitly stated. Just make a list of them. This will help you in the next step which involves the identification of the overall argumentative type.
3) Try to identify the type of argumentation. Is it a 'technocratic' or a 'strategic' argument. If not sure just write down 'not identified'.
4) Return to the coding sheet (content analysis) and code all the relevant information.

Basic steps to follow when conducting argumentation analysis of interviews

1) Read the whole interview 2 or 3 times before you start coding it.
2) While in step 1 you can identify which parts of the interview refer to public perceptions and which to media coverage and regulation (you can highlight that).
3) Start by reading those parts of the interview where public perceptions are discussed.
4) The questions posed to the interviewee will help you identify the major arguments. Usually an answer is given in one or two paragraphs.
5) In those paragraphs you may identify one or more arguments and their constitutive elements (Data- Warrant- Backing- Claim).
6) When you are confused, try to paraphrase what the interviewee is saying. In the process of paraphrasing try to keep as close to the original as possible (see

Appendix 12). In cases where a premise is missing try to deduce it by inferring from what is explicitly stated. Make a list of the inferred premises. This is mainly done to assist the identification of the argumentative type.

7) Important questions to ask when identifying the argumentative parts:

a) **Claim**: What is the main point of argument? What is the conclusion?

b) **Data**: Where is this information drawn from? What evidence does the interviewee have in her-his disposal?

c) **Warrant**: Why is the interviewee claiming x or y? How does he get there?

d) **Backing**: On what basis is this explanation founded? What is the 'bigger picture?'

8) Identify the overall type of the argument. Is it a 'technocratic' or a 'strategic' argument? Do the same thing separately for media coverage and regulation.

Appendix 14- Reliability Test

Table 1. Intercoder reliability of content analysis of articles (percentage agreement between two coders)

Variable	*Name*	*Percentage agreement*
V7	Size	0.87
V8	Section	0.91
V9	Format	0.82
V10	Author	0.78
V11	Type of cloning	0.85
V12	Human cloning application	0.70
V13ab	Public development	0.61
V14ab	Focus	0.66
V15	Controversy	0.63
V16	Location	0.90
V17abcdef	Claimant	0.99
V18abcdef	Area of research	0.99
V19abcdef	Type of argument	0.99
V20abcdef	Arena claimed	0.99
V21abcdef	Location of arena claimed	0.99
V22abcdef	Metaphor user	0.91
V23abcdef	Area of research	0.98
V24abcdef	Metaphor	0.92
V25abcdef	Arena anchored	0.91
V26abcdef	Location of arena anchored	0.90
Mean		**0.86**
Median		**0.85**

Table 2. Results of inter-coder reliability of argumentation analysis of articles[1]

	ARGUMENT PARTS					
CODER A / CODER B	Data	Warrant	Backing	Claim	**Total**	**Percentage Agreement**
Data	9	2	0	0	**11**	**0.86**
Warrant	1	8	0	0	**9**	**0.80**
Backing	0	1	4	1	**6**	**0.72**
Claim	0	0	1	28	**29**	**0.96**
	10	**11**	**5**	**29**	**55**	**0.89**

Percentage agreement in 'argumentation type'[1]: 0.86

Table 3. Results of inter-coder reliability of argumentation analysis of interviews[1]

	ARGUMENT PARTS					
CODER A	Data	Warrant	Backing	Claim	**Total**	**Percentage Agreement**
CODER B						
Data	23	7	4	0	**34**	**0.73**
Warrant	4	30	3	0	**37**	**0.76**
Backing	0	5	11	1	**17**	**0.61**
Claim	2	0	1	42	**45**	**0.95**
	29	**42**	**19**	**43**	**133**	**0.79**

Percentage agreement in 'argumentation type'[1]: 0.88

[1]Percentage agreement is extracted by the formula: number of agreement in the codes over (number of agreement in the codes plus number of disagreement in the codes by coder 'a' plus number of disagreement in the codes by coder 'b')

Appendix 15

Salience of the public sphere in scientific coverage of SCNT research

1997-2005

Journal * Year Crosstabulation

Journal * Phase Crosstabulation

Count

		Phase		
		Early phase	Later phase	Total
Journal	Science	42%	58%	49%
	Nature	59%	41%	51%
Total		100%	100%	100%

Pearson χ^2 (1, N= 461) = 10.349, p =0.001

Size * Year Crosstabulation

Size * Year Crosstabulation

Count

		Year		
		Early phase	Later phase	Total
Size	Small	48%	57%	53%
	Medium	37%	33%	35%
	Large	15%	10%	12%
	Total	100%	100%	100%

Pearson χ^2 (2, N= 461) = 5.427, p =0.066

Section * Year Crosstabulation

Section * Year Crosstabulation

Count

		Year		
		Early phase	Later phase	Total
Section	News	79%	74%	77%
	Editorial	9%	9%	9%
	Correspondence	4%	8%	6%
	Commentary	5%	3%	4%
	Book reviews	3%	6%	4%
	Total	100%	100%	100%

Pearson χ^2 (4, N= 461) = 8.113, p =0.088

Format * Year Crosstabulation

Format * Year Crosstabulation

Count

		Year		
		Early phase	Later phase	Total
Format	Article with latest news/development	76%	74%	75%
	Response, review of prior article	2%	5%	4%
	Opinion piece, commentary	21%	21%	21%
	Total	100%	100%	100%

Pearson χ^2 (2, N= 461) = 2.909, p =0.233

Author * Year Crosstabulation

(An exact significance test was selected for Pearson's chi-square, due to small numbers of count in the cells)

Author * Year Crosstabulation

Count

		Year		
		Early phase	Later phase	Total
Author	In-house	81%	80%	80%
	University research group	9%	14%	12%
	Scientific organisation	0.9%	0%	0.4%
	Government research institution	2%	0.9%	1.5%
	Museum	0.4%	0%	0.2%
	University/ ethics committee member	0.9%	0.9%	0.9%
	University/ scientific advisory group	0%	0.9%	0.4%
	Government	2%	0%	1%
	Ethics committee group	0.4%	0%	0.2%
	Biotechnology organisation	0%	0.4%	0.2%
	Other	4%	2.5%	3%
	Hospital	0%	0.5%	0.2%
	Total	100%	100%	100%

Pearson χ^2 (11, N= 458) = 16.458, p =0.06

Appendix 16
Identifying public developments

Public developments * Year Crosstabulation

Public developments * Year Crosstabulation

Count

		Phase		
		Early phase	Later phase	Total
Public developments	Public perceptions	13%	13%	13%
	Public opinion poll	2%	2%	2%
	Media coverage	5%	5%	5%
	TV coverage	4%	2%	3%
	Newspaper	4%	4%	4%
	Legal law	2%	6%	4%
	Proposal/ draft	39%	30%	34%
	Science policy	8%	14%	11%
	Public funding	9%	10%	9%
	Public hearing	4%	7%	6%
	Other	10%	7%	9%
Total		100%	100%	100%

Pearson χ^2 (10, N= 658) = 27.355, p =0.02

Type of cloning * Year Crosstabulation

Cloning * Year Crosstabulation

Count

		Year		
		Early phase	Later phase	Total
Cloning	Human	82%	95%	89%
	Animal	18%	5%	11%
	Total	100%	100%	100%

Pearson χ^2 (1, N= 434) = 17.918, p =0.000

Human cloning type * Year Crosstabulation

Human cloning * Year Crosstabulation

Count

		Year		
		Early phase	Later phase	Total
Hcloning	Human reproductive	52%	40%	45%
	Human therapeutic	48%	60%	55%
	Total	100%	100%	100%

Pearson χ^2 (1, N= 480) = 7.202, p =0.007

Focus of the article * Year Crosstabulation

Focus of the story-public * Year Crosstabulation

Count

		Year		
		Early phase	Later phase	Total
Focus of the story-public	Main public	52%	47%	50%
	Other, public reference	48%	53%	50%
	Total	100%	100%	100%

Pearson χ^2 (1, N= 461) = 1.354, p = 0.245

Controversy * Year Crosstabulation

Public controversy * Year Crosstabulation

Count

		Year		
		Early phase	Later phase	Total
Public controversy	Balanced	39%	38%	37.5%
	Imbalanced	61%	62%	61.5%
	Total	100%	100%	100%

Pearson χ^2 (1, N= 297) = 0.103, p = 0.748

Location of the story * Year Crosstabulation

Location * Year Crosstabulation

Count

		Year		
		Early phase	Later phase	Total
Location	UK	16%	8%	12%
	US	41%	58%	50%
	Other Europe	13%	8%	10%
	International	16%	8%	12%
	Asia	13%	11%	12%
	Other	1%	7%	4%
Total		100%	100%	100%

Pearson χ^2 (5, N= 425) = 26.951, p =0.000

Appendix 17 - Metaphor analysis

Metaphor user * Year Crosstabulation

Metaphor user * Year Crosstabulation

Count

		Year		
		Early Phase	Later Phase	Total
metaphor user	Regulators	3%	4%	3%
	Scientific-industrial complex	19%	17%	18%
	Interest groups	2%	1%	2%
	In-house writers	72%	75%	74%
	Other	4%	3%	3%
Total		100%	100%	100%

Pearson χ^2 (4, N= 269) = 0.988, p = 0.912

Public arena anchored * Year Crosstabulation

Public arena anchored * Year Crosstabulation

Count

		Year		
		Early Phase	Later Phase	Total
	Regulation	72%	83%	77%
	Media	18%	8.5%	13%
	Public perceptions	10%	8.5%	10%
Total		100%	100%	100%

Pearson χ^2 (2, N= 266) = 6.052, p =0.048

Location of public arena anchored * Year Crosstabulation

(An exact significance test was selected for Pearson's chi-square, due to small numbers of count in the cells)

Location of public arena * Year Crosstabulation

Count

		Year		
		Early phase	Later Phase	Total
Location of public arena	UK	17%	5%	11%
	US	51%	72%	62%
	Other Europe	5%	2%	3%
	International	22%	13%	17%
	Asia	5%	3%	4%
	Latin America	0%	1%	0%
	Australia	0%	4%	3%
Total		100%	100%	100%

Pearson χ^2 (6, N= 244) = 22.946, p =0.000

Superordinate category * Year Crosstabulation

(N= 269)

Superordinate category * Year Crosstabulation

Count

		Year		
		Early phase	Later Phase	Total
Superordinate category	War	41%	56%	49%
	Arts/Entertainment	3%	7%	5%
	Nature	9%	7%	8%
	Economy	3%	1%	2%
	Psychopathology	14%	3%	9%
	Journey	14%	10%	12%
	Sports	4%	4%	4%
	Cloning	0%	1%	0.5%
	Religion	0%	1%	0.5%
	History	2%	1%	1%
	Engineering	0%	1%	0.5%
	Chemistry	1%	0%	0.5%
	Popular metaphors	8%	7%	7%
	Container	2%	2%	2%
Total		100%	100%	100%

Superordinate category * Year Crosstabulation

(Threshold for inclusion 5% for N= 269)

(An exact significance test was selected for Pearson's chi-square, due to small numbers of count in the cells)

Superordinate category * Year Crosstabulation

Count

		Year		
		Early phase	Later Phase	Total
Superordinate category	War	48%	66%	57%
	Arts/Entertainment	0%	8%	8%
	Nature	10%	8%	8%
	Psychopathology	17%	0%	8%
	Journey	17%	11%	14%
	Popular metaphors	8%	7%	7%
Total		100%	100%	100%

Pearson χ^2 (5, N= 230) = 33.819, p =0.000

Superordinate category * Metaphor user Crosstabulation

Superordinate category * metaphor user Crosstabulation

Count

		metaphor user					
		Regulators	Scientific-industrial complex	Interest groups	In-house	Other	Total
Superordinate category	War	3	16	0	108	5	132
	Arts/Entertainment	0	5	0	9	0	14
	Nature	0	5	0	17	1	23
	Economy	1	1	0	5	0	7
	Psychopathology	1	4	1	17	0	23
	Journey	1	4	0	26	1	32
	Sports	0	0	0	9	1	10
	Cloning	0	1	0	0	0	1
	Religion	0	0	0	1	0	1
	History	1	0	0	1	1	3
	Engineering	0	0	0	2	0	2
	Chemistry	0	0	0	1	0	1
	Popular metaphors	2	11	4	0	0	17
	Country	0	1	0	5	0	6
Total		9	48	5	201	9	272

Superordinate category * Journal Crosstabulation
(An exact significance test was selected for Pearson's chi-square, due to small numbers of count in the cells)

Superordinate category * Journal Crosstabulation

Count

		Journal		
		Science	Nature	Total
Superordinate category	War	47%	51%	49%
	Arts/Entertainment	6%	4%	5%
	Nature	7%	9%	8%
	Economy	3%	2%	3%
	Psychopathology	8%	9%	8%
	Journey	11%	13%	12%
	Sports	3%	4%	4%
	Cloning	1%	0%	0.5%
	Religion	1%	0%	0.5%
	History	1%	2%	1%
	Engineering	1%	1%	1%
	Chemistry	1%	0%	0.5%
	Popular metaphors	8%	3%	6%
	Country	2%	2%	2%
Total		100%	100%	100%

Pearson χ^2 (13, N= 269) = 7.129, p =0.950

Superordinate category * Scientists Crosstabulation

(An exact significance test was selected for Pearson's chi-square, due to small numbers of count in the cells)

Superordinate * Scientists Crosstabulation

Count

		Scientists			
		Public institution	Private institution	Scientific community/organisations	Total
Superordinate	War	29%	33%	50%	33%
	Arts	10%	11%	12.5%	11%
	Nature	16%	0%	0%	11%
	Economy	3%	0%	0%	2%
	Psychopathology	10%	0%	12.5%	8%
	Journey	6%	11%	12.5%	8%
	Cloning	3%	0%	0%	2%
	Popular metaphors	23%	45%	0%	23%
	Container	0%	0%	12.5%	2%
Total		100%	100%	100%	100%

Pearson χ^2 (16, N= 48) = 14.752, p =0.595

Superordinate category * Scientists Crosstabulation

Superordinate category * Scientists Crosstabulation

Count

		Scientists		
		Natural scientists	Social scientists	Total
super	War	20%	0%	16%
	Arts	13%	0%	11%
	Nature	13%	25%	16%
	Psychopathology	7%	0%	5%
	Journey	20%	25%	21%
	Cloning	0%	25%	5%
	Popular metaphors	27%	25%	26%
Total		100%	100%	100%

Pearson χ^2 (6, N= 19) = 5.663, p =0.637

Superordinate category * Location of public arena anchored Crosstabulation

Superordinate category * Location Crosstabulation

Count

		Location							
		UK	US	Other Europe	International	Asia	Latin America	Australia	Total
Superordin.	War	11	85	3	23	1	1	4	128
	Arts/Entertainment	1	7	1	1	0	0	0	10
	Nature	1	11	0	4	2	0	1	19
	Economy	0	7	0	0	0	0	0	7
	Psychopathology	3	10	2	4	0	0	0	19
	Journey	5	10	1	5	6	0	3	30
	Sports	1	6	0	1	1	0	0	9
	Cloning	0	1	0	0	0	0	0	1
	Religion	0	1	0	0	0	0	0	1
	History	0	2	0	1	0	0	0	3
	Engineering	0	0	1	0	0	0	0	1
	Chemistry	0	1	0	0	0	0	0	1
	Popular metaphors	3	8	0	3	0	0	0	14
	Country	1	3	0	0	0	0	0	4
Total		26	152	8	42	10	1	8	247

(Missing values were excluded)

Appendix 18 - Argumentation analysis

Claimant * Year Crosstabulation

Claimant * Year Crosstabulation

Count

		Year		
		Early phase	Later phase	Total
Claimant	Regulatory Authorities	28%	28%	28%
	Scientific/industrial complex	45%	45%	45%
	Interest groups	8%	6%	7%
	In-house	13%	16%	14%
	Other	6%	5%	6%
Total		100%	100%	100%

Pearson χ^2 (4, N= 410) = 1.998, p =0.736

Public arena claimed * Year Crosstabulation

Arena Claimed * Year Crosstabulation

Count

		Year		
		Early phase	Later phase	Total
Claimed	Regulatory authorities	83%	83%	83%
	Media	2%	4%	3%
	Public perceptions	15%	13%	14%
Total		100%	100%	100%

Pearson χ^2 (2, N= 410) = 1.472, p =0.479

Location of arena claimed * Year Crosstabulation

(An exact significance test was selected for Pearson's chi-square, due to small numbers of count in the cells)

Location * Year Crosstabulation

Count

		Year		
		Early phase	Later phase	Total
Location	UK	13%	2%	8%
	US	52%	61%	56%
	Other Europe	5%	4%	4%
	International	18%	20%	19%
	Asia	10%	8%	9.5%
	Latin America	0%	0.5%	0%
	Australia	2%	3.5%	3%
	Other	0%	1%	0.5%
Total		100%	100%	100%

Pearson χ^2 (7, N= 374) = 20.483, p =0.002

Argumentation type * Year Crosstabulation

Type of argumentation * Year Crosstabulation

Count

		Year		
		Early phase	Later phase	Total
Type of argumentation	Technocratic	54%	53%	53%
	Strategic	40%	33%	36%
	Not identified	6%	14%	11%
	Total	100%	100%	100%

Argumentation type * Year Crosstabulation

Argumentation type * Year Crosstabulation

Count

		Year		
		Early Phase	Later Phase	Total
Argumentation type	Technocratic	58%	61%	60%
	Strategic	42%	39%	40%
Total		100%	100%	100%

Pearson χ^2 (1, N= 367) = 0.526, p =0.468

Journal * Argumentation type Crosstabulation

Journal * Type of argumentation Crosstabulation

Count

		Type of argumentation			
		Technocratic	Strategic	Not identified	Total
Journal	Science	52%	50%	75%	53%
	Nature	48%	50%	25%	47%
	Total	100%	100%	100%	100%

Journal * Argumentation type Crosstabulation

Journal * Technocratic/ Strategic Crosstabulation

Count

		Type		
		Technocratic	Strategic	Total
Journal	Science	52%	50%	51%
	Nature	48%	50%	49%
	Total	100%	100%	100%

Pearson χ^2 (1, N= 367) = 0.167, p =0.683

Claimant *Argumentation type Crosstabulation

Claimant * Type of argumentation Crosstabulation

Count

		Type of argumentation			
		Technocratic	Strategic	Not identified	Total
Claimant	Regulatory Authorities	15%	43%	39.5%	28%
	Scientific/industrial complex	56%	29%	39.5%	45%
	Interest groups	2%	15%	7%	7%
	In-house	22%	6%	7%	14%
	Other	5%	7%	7%	6%
Total		100%	100%	100%	100%

Claimant *Argumentation type Crosstabulation

Claimant * Technocratic/strategic Crosstabulation

			Type		
			Technocratic argumentation	Strategic argumentation	Total
Claimant	Regulatory Authorities	Count	33	64	97
		Expected Count	57.6	39.4	97.0
		% within Claimant	34.0%	66.0%	100.0%
		% within Type	15.1%	43.0%	26.4%
	Scientific/Industrial complex	Count	123	44	167
		Expected Count	99.2	67.8	167.0
		% within Claimant	73.7%	26.3%	100.0%
		% within Type	56.4%	29.5%	45.5%
	Interest groups	Count	4	22	26
		Expected Count	15.4	10.6	26.0
		% within Claimant	15.4%	84.6%	100.0%
		% within Type	1.8%	14.8%	7.1%
	In-house	Count	47	9	56
		Expected Count	33.3	22.7	56.0
		% within Claimant	83.9%	16.1%	100.0%
		% within Type	21.6%	6.0%	15.3%
	Other	Count	11	10	21
		Expected Count	12.5	8.5	21.0
		% within Claimant	52.4%	47.6%	100.0%
		% within Type	5.0%	6.7%	5.7%
Total		Count	218	149	367
		Expected Count	218.0	149.0	367.0
		% within Claimant	59.4%	40.6%	100.0%
		% within Type	100.0%	100.0%	100.0%

Pearson χ^2 (4, N= 367) = 75.261, p =0.000

Scientists * Argumentation type Crosstabulation

Institution * Argumentation type Crosstabulation

			Argumentation type		
			Technocratic	Strategic	Total
Institution	Public Institution	Count	67	25	92
		Expected Count	67.8	24.2	92.0
		% within Institution	72.8%	27.2%	100.0%
		% within Argumentation type	54.5%	56.8%	55.1%
		% of Total	40.1%	15.0%	55.1%
	Private Institution	Count	21	1	22
		Expected Count	16.2	5.8	22.0
		% within Institution	95.5%	4.5%	100.0%
		% within Argumentation type	17.1%	2.3%	13.2%
		% of Total	12.6%	.6%	13.2%
	Scientific community/organisations	Count	35	18	53
		Expected Count	39.0	14.0	53.0
		% within Institution	66.0%	34.0%	100.0%
		% within Argumentation type	28.5%	40.9%	31.7%
		% of Total	21.0%	10.8%	31.7%
Total		Count	123	44	167
		Expected Count	123.0	44.0	167.0
		% within Institution	73.7%	26.3%	100.0%
		% within Argumentation type	100.0%	100.0%	100.0%
		% of Total	73.7%	26.3%	100.0%

Pearson χ^2 (2, N=167) = 7.005, p =0.030

Scientists * Argumentation type Crosstabulation

scientists * type of argumentation Crosstabulation

Count

		type of argumentation		
		Technocratic argumentation	Strategic argumentation	Total
scientists	Natural scientist	65%	44%	58%
	Social Scientist	35%	56%	42%
Total		100%	100%	100%

Pearson χ^2 (1, N= 73) = 2.851, p =0.091

Location of arena claimed * Argumentation type Crosstabulation

(An exact significance test was selected for Pearson's chi-square, due to small numbers of count in the cells)

Location claimed * Argumentation type Crosstabulation

Count

		Argumentation type		
		Technocratic	Strategic	Total
Location claimed	UK	4%	16%	9%
	US	64%	49%	58%
	Other Europe	5%	2%	3%
	International	12%	21%	16%
	Asia	19 10%	15 11%	34 10%
	Latin America	0.5%	0%	0%
	Australia	3.5%	1%	3%
	Other	1%	0%	1%
	Total	100%	100%	100%

Pearson χ^2 (7, N= 332) = 25.709, p =0.000 (Missing values were excluded)

Appendix 19- Argumentation analysis

Types of argumentation * Seniority Crosstabulation

Argumentation type * Seniority Crosstabulation

Count

		Seniority		
		Senior	Junior	Total
Argumentation type	Technocratic	76%	79%	77%
	Strategic	24%	21%	23%
Total		100%	100%	100%

Pearson χ^2 (1, N= 363) = 0.349, p =0.555

Type of argumentation * Gender Crosstabulation

Argumentation type * Gender Crosstabulation

Count

		Gender		
		Male	Female	Total
Type	Technocratic	79%	74%	77%
	Strategic	21%	26%	23%
Total		100%	100%	100%

Pearson χ^2 (1, N= 363) = 0.953, p =0.329

Type of argumentation *Institution Crosstabulation

Argumentation type * Research institution Crosstabulation

Count

		Research institution		
		Academic institution	Government research Institution	Total
Argumentation type	Technocratic	77%	80%	77%
	Strategic	23%	20%	23%
Total		100%	100%	100%

Pearson χ^2 (1, N= 363) = 0.540, p =0.462

Type of argumentation * Specialisation Crosstabulation

Argumentation type * Specialisation Crosstabulation

Count

		Specialisation				
		Human SCNT	Animal SCNT	hES research	other	Total
Argumentation type	Technocratic	66%	76%	80%	83%	77%
	Strategic	34%	24%	20%	17%	23%
Total		100%	100%	100%	100%	100%

Pearson χ^2 (3, N= 363) = 6.796, p =0.079

Type of argumentation * Nationality Crosstabulation

Argumentation type * Nationality Crosstabulation

Count

		Nationality		
		UK	Foreigner	Total
Argumentation type	Technocratic	80%	74%	77%
	Strategic	20%	26%	23%
Total		100%	100%	100%

Pearson χ^2 (1, N= 363) = 1.603, p =0.205