

**The Social Construction of Dolly
in the Canadian Media**

by

Robin Downey



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ABSTRACT

This thesis examines the social construction of technology by analyzing the nature and implications of cloning as portrayed in the Canadian news media. The specific case is coverage of the cloning of Dolly the sheep. Two levels of theory frame this analysis. (1) Recent social theory on the nature of late-modernity characterizes the general societal context of public attitudes to science and technology. (2) Work in the social construction of technology orients the identification of social groups and actors and points of conflict between their various views of cloning. The discussion surrounding cloning has been carried out in many voices: some scientists speak in ethically neutral terms; ethicists appeal to both natural boundaries and utilitarian considerations. These themes are expressed, in part, by appeals to a set of images or metaphors that are drawn on in different ways by various actors. References to popular fiction and films explore images of Dr. Frankenstein and doubles. Stories about mad scientists and doubles were early markers of boundaries circumscribing the correct use of knowledge and the nature of identity. Cloning can be seen as a site where these various discourses converge in distinct ways in the context of late-modernity.

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Chapter 1

INTRODUCTION

In the late-twentieth century, science and technology are important objects of public discussion and concern. They are seen as having an element of uncertainty built into them, and this is reflected both in the number of often conflicting expert positions that are put forward and in the intensity of ethical debate. In this context of late-modernity, science and technology are subject to conflicting interpretations, involving differing criteria and evaluations of categories such as expertise, identity, and nature.

Disagreements among scientific experts and lack of confidence in these experts by the public have eroded the consensus that scientific and technological developments are always beneficial and signs of progress. Hazards and risks are becoming more prominent and more politicized. Environmental and feminist groups, community organizations, corporations, politicians, scientists, the media and the public often have differing viewpoints of technologies and their effects.

This thesis examines the social construction of technology by analyzing the nature and implications of cloning as portrayed in the Canadian news media. It argues two points. First, Canadian coverage of cloning problematizes the status of experts. Second, this happens, in part, as types of actors draw in different ways on a common set of images or cultural resources.

Two levels of theory frame this analysis. (1) Recent social theory on the nature of late modernity characterizes the general societal context of public attitudes to science and technology (Ulrich Beck, Anthony Giddens, Scott Lash). This literature characterizes "late modernity" in ways that highlight several developments relevant to a study of the social construction of technology: changing views of nature and of "natural" boundaries; the proliferation of types and viewpoints of experts on scientific and technological issues; a corresponding questioning of expertise; and an erosion of the authority of science and of trust in the value of "progress." (2) Work in the social construction of technology (SCOT) considers technology as socially contested and negotiated rather than as a neutral tool with

an objective meaning (Wiebe Bijker). This theory orients the identification of social groups and actors and points of conflict between their various views of cloning. The Critical Theory of Technology extends SCOT (Andrew Feenberg). It underlines the need to look at the ways that technology is contested and how the resulting interpretations of specific technologies can embody the interests of different social groups.

This range of competing views is especially evident in the area of biotechnology. "Biotechnology" has come to refer primarily to genetic engineering techniques, especially when applied in the areas of medicine and agriculture. Biotechnology has been defined as "the use of technology in the application of the biological sciences, especially genetics" (Harris 1998, 3). Other definitions of biotechnology underline its commercial applications: "the commercialization of cell biology"; "various techniques for using the properties of living things to make products or provide services" (Grace, 1997, 2). These new techniques are held to be both a source of potential benefits and risks, and a wide variety of social groups has taken sides in this debate.

Media coverage of biotechnology issues is useful to look at for two reasons. First, it presents and juxtaposes the conflicting views of different groups. For this reason, looking at media coverage of a specific biotechnology issue allows us to characterize the range and interplay of views. Second, the media plays a role in forming a degree of stabilization on contested issues, and this process can be examined to see how the voices and interests of different groups are represented. On the one hand, the media is an actor that, like scientists or ethicists, makes explicit contributions to discussions of technologies. On the other hand, the media plays a more fundamental role by framing the contributions of all other actors. A case study of media coverage of biotechnology allows us to ask if certain views contribute to an emerging consensus, while other views are marginalized. In addition, looking at the contributions of the media enables this study to address the role of references to and images from popular culture in the social construction of technology.

This involves more than a simple content analysis. Nicholas Garnham argues that media studies are often limited by their focus on media institutions, contents, and audience practices (1995). He points to the need to examine the social processes behind these

things, “the process by which those shared meanings, on which social maintenance and reproduction depend, are created, circulated and appropriated” (Garnham, 1995, 362). This thesis attempts to do this by examining the ways that different discourses and the views of different social actors converge in the Dolly story. These different strands of the media coverage will be looked at to see how they reflect the social conditions of late modernity and how they contribute to areas of agreement and disagreement over the significance of the cloning technology.

Hello Dolly

The world news media treated the arrival of Dolly in a manner consistent with the history of science journalism, as a sensational first. On February 23, 1997, the *Observer* broke the news that, for the first time, a mammal had been cloned from an adult cell. Dolly, a Dorset sheep born on July 5, 1996, had been cloned by geneticist Ian Wilmut and his team at the Roslin Institute in Scotland. The technique involved injecting the nucleus of an adult mammary cell into an evacuated ovum at a specific point in the cycle of cell division. When the research was published in *Nature* on February 27, the story had already received world-wide attention. Anticipating a lot of media attention, Ron James (president of PPL Therapeutics, the main financial supporter of the Roslin research) had previously hired a public-relations firm and sent copies of the paper to the British ethics committee, the Committee on Fertilization and Embryo Research, the U.S. biotechnology trade organization, and to U.S. ethicists (Kolata, 1998, 222). Dolly was an important media event from the very beginning. This is a useful technological development to look at because it involved several different actors or social groups and because it received extensive media coverage.

Dolly is an interesting case to look at not only because she was presented as a sensational breakthrough, but because the public discussion of her significance involved an interesting and complex mix of themes and voices. In addition, several types of actors were prominent in the media coverage of Dolly: journalists, academic and industry

scientists, ethicists, religious figures, politicians, business people, and members of the public.



Figure 1 *The Globe and Mail*, Feb. 28, 1997.
(Danziger, Los Angeles Times Syndicate)

Several themes emerged, often embodied in the figure of Dolly herself. She has been portrayed as the sign of a threat and of progress. She was presented as a humanized media star with a unique identity (see Figure 1) and as a symbol of the ultimate erosion of the uniqueness of identity. Her celebrity status has been retained: her wool has been knitted into a sweater that has been displayed in the

British Science Museum; and she has been invited to Dollywood by Dolly Parton, her namesake—an invitation that her agent, Harry Griffin of the Roslin Institute, turned down because it would be embarrassing for Dolly to “get rustled.” Plans have also been made for her preservation at the end of her natural life (Weiss, 1999). She stood for the dangers and promises of science and technology. Nelkin and Lindee have said that “She provides a window on popular beliefs about human nature and the social order, on public fears of science and its power in society, and on concerns about the human future in the biotechnology age” (1998, 148-49).

Another indication of the significance of Dolly is her continuing importance as an icon of new developments in genetic technology. *Nature* has an ad in a recent *Scientific American* that demonstrates that Dolly has retained the public’s interest for more than two years since she was introduced (280/4, April 1999, 48-49). It frames Dolly as one of four great scientific breakthroughs of the last 100 years that were first reported in *Nature*: the discovery of x-rays (1896); a forerunner of the modern fax machine by S. Bidwell (1881); the DNA double helix (1953); and “Dolly the sheep exploded out of our pages to become the only sheep to make headlines worldwide. . . .” The ad says, “don’t wait for the news to filter through to you - make *Nature* your first stop.” A subscription form also has the

picture of the Feb. 1997 *Nature* cover and a page from a later article on the successful cloning of mice: "The cloning furore has continued into 1998 with Cumulina the mouse and her clones." This ad underlines Dolly's importance as the origin of an important and ongoing science story.

The Research Question

To sum up, this is a useful technological development to look at for three reasons: it involved several different actors or social groups with divergent views; it received extensive media coverage; and this coverage linked the specific issue of cloning animals to a wide range of other issues. The purpose of my thesis will be to explore one case, the cloning of adult mammals, in order to address two issues.

More generally, I will examine the issue of the status of technology in late modernity. Addressing these issues will involve looking at the ways that the technology is framed by different social groups and at the "cultural horizon" or background of meanings within which technology is situated (Feenberg, 1995, 10).

More specifically, I ask what sort of issues are raised, what actors debate them, and whether the shape of the discussion as it evolves appears to favour or disfavour the interests of specific actors. This involves examining the ways that this technology is interpreted, what issues are contested, and how they are framed by different actors.

Methods

The main data set consisted of all items mentioning cloning or Dolly in five Canadian newspapers during the two-week period following the initial announcement on Feb. 24, 1997. This was supplemented by selected news magazine articles as well as transcripts of radio and television news reports from the same period.. These sources were chosen to provide a cross-section of Canadian media coverage, using the population of stories that emerged immediately.

This thesis is a case study of the social construction of a specific technology. It analyzes Canadian media coverage of cloning following one technological advance, the success of the technique that produced Dolly. Two complementary methodological approaches are used: grounded analysis and the Social Construction of Technology (SCOT).

Grounded analysis is used as a form of textual analysis to generate the themes and actors to be considered. The most prominent themes and actors, as well as the relations between them, emerged by using four successive coding frames. Preliminary analysis of each one generated more specific categories that were used in the next.

SCOT is used to identify relevant actors and social groups in order to determine how the technology is given meaning through social negotiation. Several types of actors are distinguished in order to identify patterns of framing: journalists, academic and industry scientists, ethicists, religious figures, politicians, business people, and members of the public.

Several additional types of material were used. Popular discussion of related scientific and technical developments from the decades before Dolly provided historical context for the themes and viewpoints in the recent media coverage. Several films and novels were mentioned in the media coverage. Looking at these works provided context for these references. In addition, later media reports about Dolly and cloning, in news papers and magazines, were used to follow more recent developments. This was done to check the conclusions regarding stabilization of the cloning story. They also let us see if the themes and actors prominent in the initial two-week period continued to be prominent. Most significantly, members of the Concerted Action Group for Biotechnology and the European Public were involved in a collaborative effort analyzing European media coverage of the cloning story at the same time that the research for this thesis was being done. The coding frame was generated through this collaboration, and some of the results of research for this thesis were included in that study (Einsiedel *et al.*, In Press). Analysis of the themes was also shaped through discussions with this group (Mortensen, 1999). Fourth, scholarly writings on cloning and related topics provided context and clarification.

Chapter 2

TECHNOLOGY IN LATE MODERNITY

Introduction

In the late twentieth century, science and technology continue to have an increasingly profound impact on our lives. However, disagreements among scientific experts and lack of confidence in these experts by the public have eroded the consensus that scientific and technological developments are always beneficial or signs of progress. Hazards and risks are becoming more prominent and more politicized. Environmental and feminist groups, community organizations, corporations, politicians, scientists, the media and the public often have conflicting interpretations of technologies and their effects. These are signs of the times. Theorists like Ulrich Beck and Anthony Giddens argue that these developments are interconnected aspects of late modernity.

This chapter focuses on two related areas. First, it examines the more general issue of the status of technology in late modernity. Addressing these issues will involve looking at the ways that the technology is framed by different social groups and at the "cultural horizon" or background of meanings within which technology is situated (Feenberg, 1995, 10). Second, it lays the groundwork for the examination of media coverage of a specific technological development, cloning. This analysis of media discourse will involve a study of the different issues and actors found in media coverage of this development. This chapter discusses theoretical work that will support the exploration of these issues.

Technology in Late Modernity

Late Modernity. In order to discuss the social construction of technology in today's world, and of cloning specifically, it is necessary to characterize the times we live in. One option would be to say that we live in a postmodern world. From this perspective Jean Baudrillard, for example, suggests that cloning is "The last stage of history and

modeling of the body, the one at which, reduced to its abstract and genetic formula, the individual is destined to serial propagation" (Baudrillard, 1994, 99). For Baudrillard, the clone symbolizes the ultimate erosion of 'real' identity by the proliferation of simulations. However, Baudrillard, like other theorists of postmodernity, has been criticized because "He posits--without really defining or justifying--an absolute break between the previous historical epoch and the postmodern one, and offers a new theory to attempt to conceptualize the new historical era . . ." (Kellner, 1988, 248; cf. Hall, 1996, 133-34).

A more promising theoretical approach is offered by theorists of late modernity such as Ulrich Beck, Anthony Giddens and Scott Lash. Late modernity, reflexive modernity, is characterized by the development of trends implicit in early modernity. Late modernity begins when social and institutional changes reverberate so widely that they have unseen side-effects on social relations, on political discussion and policy, on views of science and technology, and in other areas. This reflexivity of late modernity is "a development immanent to the modernization process itself . . . a condition of, at a certain historical point, the development of functional prerequisites for further modernization" (Lash, 1994, 112-13).

If late modernity is a further development of early modernity, it is important to characterize the general process of modernization that lies behind both. Beck defines it in a way that underlines the relation between technological developments and social change:

Modernization means surges of technological rationalization and changes in work and organization, but beyond that it includes much more: the change in societal characteristics and normal biographies, changes of lifestyle and forms of life, change in the structures of power and influence, in the forms of political repression and participation, in views of reality and in norms of knowledge. In social science's understanding of modernity, the plough, the steam locomotive and the microchip are visible indicators of a much deeper process, which comprises and reshapes the entire social structure. Ultimately, the *sources of certainty* on which life feeds are changed. . . . (Beck, 1992, 50n.1, emphasis in original)

This view of modernization, and of late modernity, is useful because it situates views of science and technology in a broad social and historical context. This is because theories of

late modernity see the present as continuous with previous developments. Theories of postmodernity, on the other hand, focus on discontinuity and the radical newness of the present. For this reason, they are less helpful in making sense of two aspects of the media coverage of cloning: the roles played by past arguments and images, from Frankenstein to eugenics; and the kinds of social changes pointed to by Beck that help to contextualize the social construction of cloning. Works by Beck, Giddens and Lash on the characteristics of late modernity offer a frame for discussing the ways that technology is seen by different actors and social groups and how these different views reflect broader social changes (see, for example, Beck 1992, 1994, 1998; Giddens 1994a, 1994b, 1998; Lash 1994). One of the main characteristics that Beck and Giddens point to is that views of science and technology have changed. The remainder of this section will sketch this view of the context of technology in the late twentieth century.

Beck, in *Risk Society*, provides a social theory which identifies a number of trends which he suggests are specific to reflexive modernization: individualization, as individuals are increasingly set loose from traditional social structures; pluralization and delegitimization of science, as science comes into question by many different actors; and related to these, the proliferation of institutions and local arenas of politics which arise out of this new social climate. Beck sees a transition from industrial society to risk society, and he holds that "reflexive modernization" is the main process in this shift. For Beck, the reflexivity of modernity comes from "unseen side-effects" of modernization (1994, 8). This transition from early to reflexive modernity takes place through an "unreflected, quasi-autonomous mechanism" (Beck, 1994, 6). Science and technology are part of a general process by which human actions are now recognized to have large-scale, often global consequences.

Beck describes two stages in the development of risk society (1998, 12-13). The late twentieth century is in a transitional phase between these two phases. In the first phase, risks are systematically produced, but they are not at the center of political debate because science and technology are still seen largely in terms of progress and benefits. The first phase is characterized by the production of goods that are seen in terms of their uses

but not their unintended effects. The second phase is characterized by the dissolution of industrialization and tradition and by the production of risks rather than goods. Giddens and Beck call this manufactured uncertainty: "manufactured uncertainty means that the source of the most troubling new risks we face is something most of us would regard as unequivocally beneficial—our expanding knowledge" (Beck, 1998, 13).

One of the important developments of late modernity is a changing view of nature. Giddens argues that technological developments have changed ideas about what is 'natural' (1994b, 189-90). What used to be seen as natural has become subject to control and to decision-making, and this opens up new areas for ethical and political debate. Beck agrees with Giddens that we now worry more about what we do to nature than about what nature could do to us. For Beck this is "where nature ends" (Beck, 1998, 10). Giddens says that there are two shifts: "*the end of nature* and . . . *the end of tradition*." (Giddens, 1998, 26, emphasis in original).

Beck and Giddens suggest that the erosion of traditional social structures is characteristic of late modernity. This is "when tradition ends, when, in all spheres of life, we can no longer take traditional certainties for granted" (Beck, 1998, 10). Beck argues that modernization leads to social agents becoming more independent from social structures, and this process of individualization means that individuals shape modernization more and also face more uncertainty (Lash and Wynne, 1992, 2-4).

For Beck, belief in the objectivity of science formerly gave experts the role of determining risks. However, the effects of modernization are no longer foreseeable or controllable, whether in terms of environmental problems or individual economic uncertainty. Trust in scientific expertise has been eroded as reflexive modernization has affected science as well: as science expands it involves a critique of itself and of the roles of experts. This critique of science brings reflexivity into social and political relations between experts and social groups over issues of risk (Lash and Wynne, 1992, 4). The result is the undermining of the appeal to science as a source of expertise. The status of scientific experts is questioned.

Giddens makes a similar point: modernity is characterized by the disembedding of

expertise from traditional social structures. Class, gender and even institutional location are much less likely to count as guarantees of trustworthiness in experts. Late modernity is characterized by a further development, a proliferation of multiple authorities (1994a, 87). News reports of scientific or technological developments, like cloning, present many types of experts with varying opinions. This proliferation is related to "a disenchantment with all experts" and to the erosion of the authority of science (Giddens, 1994a, 87).

Giddens emphasizes the importance of trust in a society where individuals are becoming disembedded from traditional social structures. Individuals face more uncertainty as they are cut free from traditional social structures, and they need to trust each other more. This is also happening at the level of institutions, especially as computers and information technology break down hierarchical structures (Giddens, 1994b, 187). This development means that trust must become more active because it can no longer just be taken for granted based on the traditional status of experts. The disembedding of individuals from traditional social institutions and the critique of science and expertise have resulted in increased contingency. Trust is more necessary in the face of this contingency. Traditional roles like 'scientist' are no longer enough to guarantee that claims to be an expert will be recognized. So, at one level, trust is a measure of public confidence in science as a source of expert knowledge regarding the effects of science: "it is not knowledge *per se*, but confidence in institutions and the credibility of information, that is at issue [in] . . . the social authority and credibility of science" (Lidskog, 1996, 49-50).

The reflexivity of late modernity involves the multiplication of experts, social movements, transnational organizations, and other organizations. Lidskog calls these intermediary links (1996). He raises the possibility that these intermediary links undermine the traditional status of experts by allowing different social groups to form their own interpretations of science: "Maybe science and experts are not so important as it is assumed? Or maybe these intermediary links are important not only in transferring the view of science to lay people but also in developing alternative perspectives?" (Lidskog, 1996, 45). The multiplication of experts, social groups, and organizations leads to competing views of science and technology.

The media plays an important role in this proliferation of experts in late modernity. Late modernity is characterized by an erosion of the status of experts at the same time that we seek out experts to make sense of the unseen side-effects of modernization: “In such a world of increasing social fragmentation and specialization, we are all dependent on experts. But the figure of the expert is now a deeply ambivalent one in our culture” (Garnham, 1995, 380). This “dethroning of the expert” applies to the media as well, but in an ambivalent way (Garnham, 1995, 381). On the one hand, the media present conflicting views of experts, contributing to the erosion of their expertise. On the other hand, media intellectuals claim expertise themselves, and their status as experts comes under critique. As a result, media coverage of a story like Dolly involves not only conflicting views of scientists and ethicists; the expertise of media intellectuals is also contested. This view raises the issue of how experts interpret technologies. The way the media frames the claims of experts and the conflicts between experts is relevant to how consensus is constructed.

Scott Lash adds to the characterization of late modernity by noting that there is another dimension of reflexivity beyond the conceptual one explored by Beck and Giddens (Lash, 1994). He draws attention to the aesthetic dimension of reflexivity. He argues that the increased freedom of individuals from social structures in late modernity is matched by new dimensions of structure that constrain them. However these structures are of a new sort and need to be looked at with new theoretical approaches: “neither the social (economic, political and ideological) structures of Marxism, nor the (normatively regulated and institutional) social structures of Parsonian functionalism, but instead an articulated web of global and local networks of *information and communication structures*” (Lash, 1994, 120-21, emphasis in original). Both conceptual knowledge and symbols flow through these information and communication structures (Lash, 1994, 135). Lash holds that late modernity is reflexive along both these dimensions, the first in the sense explored by Beck and Giddens, and the second in the sense of an aesthetic reflexivity. Culture, especially popular culture, can offer a critique of the developments of late modernity in the images and symbols that it presents. This suggests that it would be useful to examine

popular culture references and images in addition to clearly framed arguments and positions. With regard to the media coverage of cloning, Lash's view of late modernity justifies paying attention to such things as references to novels and film and images like photographs and cartoons.

To sum up, the reflexive nature of late modernity means that traditional views of nature and traditional social structures have been eroded. One of the main effects of this has been that trust in scientific expertise has declined. The erosion of traditional social structures has resulted in a more fragmented set of social groups with less trust in traditional scientific expertise and with the potential to develop their own independent views of science and technology.

Technology as Value-laden. Disagreement over the meaning of science and technology and criticism of scientific experts raises an important question: are science and technology value neutral or value-laden, simply tools or inherently political? Andrew Feenberg calls these two perspectives the instrumental and substantive views of technology.

The instrumental theory of technology holds that technology consists of tools that are value-neutral in themselves but that can be used in good or bad ways. For example, a recent discussion of the ethics of cloning frames the technology explicitly as "the new cloning tool" (Spier, 1999, 19). The instrumental theory is pro-technology. It asks how it will be used but sees no inherent problem with technology itself (Feenberg, 1991, 6). From this perspective, we control technology for our own ends.

The substantive theory, according to Feenberg, holds that technology is a cultural system that becomes autonomous and makes the whole world an object of control. From this perspective, technology controls us. Max Weber argued that universal processes of rationalization were resulting in an "iron cage" in the modern West (Weber, 1958, 181). Jacques Ellul pinned much of the blame on technology:

The more technical actions increase in society, the more human autonomy and

initiative diminish. The more the human being comes to exist in a world of ever-increasing demands (fortified with technical apparatus possessing its own laws to meet these demands), the more he loses any possibility of free choice and individuality in action. (Ellul, 1990, 66; cf. Feenberg, 1991, 7)

The substantive theory of technology is anti-technology, because it sees technology as inherently linked to objectification and domination. It sees technology as an integral part of making the modern world the complex and controlling place that it is.

Accepting that technology is necessarily political does not mean seeing it as an inescapable instrument of domination or as part of an iron cage. Discussions of the role of technology are limited if we hold that technologies are just tools that can be used for good or bad, but they are also limited if we hold that technology is so tied up with economic, political and social systems that we can't change it or escape its effects on us (Feenberg, 1991, 5ff.). Feenberg and others argue for a middle ground where we accept that technology is value-laden but that its meaning and social effects are not determined. Feenberg's "critical theory of technology" holds that technology's meanings and social effects are contested (1991, 1995). Feenberg argues against this view from a Marxist or Critical Theoretical perspective by trying to show that technology has an inherently political dimension: "The values and interests of ruling classes and elites are installed in the very design of rational procedures and machines . . ." (1991, 14). More generally, he underlines the importance of examining the way technology is socially constructed.

From this perspective, we can ask questions about how technology relates to broader social, cultural, and political issues. Charles Taylor calls for "an alternative enframing of technology," one that frames technology "as open to contestation, as a locus of probably unending struggle" (Taylor, 1991, 107). This view accepts that "technology is a scene of social struggle" (Feenberg, 1995, 8). If this is true, then it is valuable to examine the different interpretations of technology made by different social groups.

Technology and the development of new technologies can be seen as inherently political, open to interpretation and contestation from different groups in society. Wiebe Bijker asks, "Whose politics do artifacts have?" (Bijker, 1995b, 237). Answers to this

question can take different theoretical and practical directions. Technologies can be political in different ways (Winner, 1985). On the one hand, certain features of a technological device or system might be flexible and open to different arrangements, and in this case different social agents might contest which is to be chosen. For example, even things like buses, sidewalks and plumbing fixtures make it harder for some people, like the handicapped, to get about than others (Winner, 1985, 30). On the other hand, certain kinds of technologies, like nuclear weapons, have intractable properties that make the question of whether or not to adopt them very important. The political issue in the first case is what shape the technology will take, and in the second case it is whether the technology will be adopted at all.

Beck's work expresses a middle position, like Feenberg's. On the one hand, Beck accepts the moral and political implications of science and technology. On the other hand, he argues that risk society is characterized by openness and contingency rather than the "prison house of technical knowledge" that other critical theorists envisioned (Beck, 1998, 11). Beck and Giddens add an important piece to the picture here. They draw our attention to the changing social context against which Feenberg's view of technology makes sense. Their work can explain how Feenberg's middle position on technology is becoming more important because it fits with the social conditions of late modernity, as individuals and groups become disembedded from traditional social structures.

Democratization of Technology. Moral and political discussion in late modernity takes place more and more at what Beck calls the level of sub-politics. A greater variety of social groups, for example, contest the meaning of scientific and technological developments. This raises the question of whether this represents a process of democratization, as more voices enter into politicized public debate.

Feenberg argues that the democratization of technology is a real possibility. He argues it is possible to reframe technology, disentangling it from forms of capitalist domination. Feenberg is doing Critical Theory. Following the Frankfurt School, he argued for looking at capitalist society in a way that makes it possible to criticize it from within.

On the one hand, he looks at the ways that technology is linked, in capitalist society, to forms of domination. On the other hand, he argues that technology is fundamentally ambivalent and so it has the potential to be something else than "the vehicle for a culture of domination" (Feenberg, 1991, 8). Feenberg uses the computer as his main example of how technology is ambivalent: "the computer is neither good nor evil, but both" (1991, 91). On the one hand, it is structured in a way that resembles mechanistic rationalization, and it could be used to strengthen hierarchical structures of control. On the other hand, computers could also undermine the hierarchy of domination because they let people connect with each other in new ways. Without focusing on Marxist aspect of Feenberg's work, it is still useful to examine his view of technology as a place of struggle between different social, cultural and political forces. His views help us to look at the ways that new technologies are being shaped and contested today.

Feenberg draws attention to how the social and the technological are related. His idea of technical code is central to this. For Feenberg, the technical code of capitalism is a set of rules implicit in people's attitudes and behaviour (1991, 80). The technical code consists of the taken-for-granted views about the ways specific technologies are perceived and used. The technical code implicitly rules certain views and uses of a technology as acceptable and others as out-of-bounds. This favours certain groups in society: the technical code "expresses the 'standpoint' of the dominant social groups at the level of design and engineering" (Feenberg, 1995, 22). It plays an ideological role in capitalism:

Capitalist cultural and technical requirements are thus condensed in a 'technological rationality' or a 'regime of truth' which brings the construction and interpretation of technical systems into conformity with the requirements of a system of domination. . . . Capitalist hegemony, on this account, is an effect of its code. (1991, 79)

This idea of a technical code suggests that one of the goals of studying a specific technology should be to bring out how certain views and uses are constructed as acceptable or unacceptable.

This suggests that the social construction of technology is not simply an unbiased

open discussion between different groups. This would be utopian: "technical . . . democracy is the utopia of a responsible modernity, a vision of society in which the consequences of technological development and economic change are debated before the key decisions are taken" (Beck, 1998, 21). It is important to pay attention to open debate about technology, to see if the debate is affected by the way the technology is framed, and to ask if this is to the advantage of any particular group.

Some feminist theorists also argue that science and technology are both ideologically loaded and potentially liberating. They suggest that technology can perhaps be made open to redefinition and democratization. Sandra Harding has argued that we should move beyond the critique that science is gendered and suggests that we should begin to envision "truly emancipatory knowledge seeking" (Harding, 1986, 19). Donna Haraway also does not see science as necessarily patriarchal, recognizing constraint but leaving an opening for change. She encourages feminists to use science not just to work against it: "taking responsibility for the social relations of science and technology means refusing an anti-science metaphysics" (Haraway, 1991, 181).

Part of this approach is the view that knowledge is constructed in specific contexts. As a result, different groups have different knowledges and 'truths' about science and technology. Haraway suggests that we need to focus on "situated knowledges" that are part of any point of view (1991). Feenberg notes that feminist "successor science" projects based in standpoint epistemologies are parallel to his critical theory of technology (1991, 170). Recognition of different standpoints helps us to understand how technology can be democratized (Feenberg, 1995, 20)

The democratization of technology is especially relevant in the context of late modernity. This involves paying attention to the different voices in discussions about science and technology, and how the interests of different groups are reflected in the discussion. This becomes more complex in late modernity because of changing views of scientific expertise and more uncertainty about risks. As uncertainty prevails, so does our need to plan for it (Coote, 1998, 129). This involves paying attention to the complexities of the social construction of technology. Rather than accepting that new technologies,

such as cloning, are either dangerous tools of domination or unambiguous signs of progress, it is important to find ways to take account of the proliferation of views in today's society.

Sub-politics, Social groups and Identity. These discussions of reflexive or late modernity are relevant because they emphasize that individualization or disembedding has left agents and social groups in a new position. They are more free from traditional social structures and play a bigger role in society because they reflexively critique it more. Most relevant, the role and status of science has come under more criticism by various social groups (Beck, 1992; Giddens, 1994a).

In late modernity, traditional social categories, for example classes and gender roles, are eroded, and individuals choose the "group or subculture one wants to be identified with" (Beck, 1992, 88). In risk society, new social movements, for example, ecological and feminist groups, are both expressions of new risk situations and the result of "the search for social and personal identities and commitments in detraditionalized culture" (Beck, 1992, 90). In contrast to "the traditional categories of large-group societies," everyone must choose varied groups which they identify with (Beck, 1992, 88). So, in late modernity, "[p]eople are struggling to reconcile conflicting identities, fostered in different if overlapping networks" (Lash and Wynne, 1992, 7).

For this reason, it is important to look at less traditional types of experts and the reasons that they are recognized as experts. Because the social and institutional landscape has become more complex, people are looking in a wider variety of places for knowledge and expertise. As Steven Yearley points out, for example, environmental organizations both reflect and encourage the proliferation of sites of expertise (1996, 187). He says that although environmental organizations use science as a source of legitimation, some "have been attracted to versions of the green argument which are founded on non-scientific forms of authority" (Yearley, 1996, 174). Thus, although science serves as the main legitimating force, moral and ethical justifications become just as important in environmentalism (Yearley, 1996, 175).

Beck addresses the relation between the erosion of traditional social structures and the proliferation of experts in a more specific way. He argues that political developments are happening more at the level of "sub-politics" than at the level of the state. That is, there are many more types and levels of discussions and appeals to expertise than previously. The risks of new technologies and the interests of those adversely affected by them have become politicized. Much of this takes place under the concepts of risk and trust. As Brian Wynne says, "credibility and trust . . . represent underlying . . . tacit processes of social negotiation" (Wynne, 1996, 41). Individualization and erosion of trust in experts result in the moral and social effects of risk becoming politicized at different levels in society. Again, this underlines the importance of examining the range of actors and discourses that converge in discussions of a specific technology like cloning.

Moral and Ethical Risk Definitions. This section looks at how risks which are defined as moral or ethical by the public are at issue in late modernity. These types of risk emerge when the broader social and cultural context of risk issues is taken into account.

Both Giddens and Beck have pointed to the significance of moral and ethical risks in late modernity. Giddens argues that technological developments have changed ideas about what is 'natural' (1994b, 189-90). The view that science and technology are value-neutral tools that act on an objective natural world becomes less tenable as the effects of scientific progress become more widespread and ambivalent. What used to be seen as natural becomes subject to control and to decision-making, and this opens up new areas for ethical and political debate.

There are some risks which raise ethical issues for the public, for example genetic technologies. The public and traditional institutions often take different stances, and different views of risk enter the debate. For example, medical experts see the public as "lagging hopelessly behind the developments, and thinking in terms of moral and social consequences which are alien to the thought and action of medical people" (Beck, 1992, 208). Moral risks are external to "the sub-politics of medicine," and they do not play a role in the decisions about medical risks (Beck, 1992, 209). According to Beck, moral and

ethical risks cannot be reduced to the sort of policy decisions made by traditional institutions: "Risk issues cannot be converted into issues of order, because the latter suffocate, so to speak, from the immanent pluralism of risk issues and metamorphose surreptitiously behind the façades of statistics into moral issues, power issues and pure decisionism" (Beck, 1994, 9-10).

Other work has also emphasized that moral and ethical aspects of risk emerge from a broader social context. Brian Wynne argues that risks are socially constituted and "dependent upon the *social commitments* (e.g. values, biases, experiences) of all the parties . . . [that] shape the risk debate" (Powell *et al.*, 1997, 181, emphasis in original; cf. Wynne, 1992, 291). Powell *et al.* stress that any form of risk communication that advocates a trade-off of risks and benefits is neglecting social and ethical issues; in the public's view, these issues are embedded in certain technologies such as biotechnology (1997, 180). This sentiment is echoed in a study by Wolfgang van den Daele. He concludes that

Societal perception of the risks posed by new [genetic] technologies is not primarily a problem of appropriate, objective cognition. It is a topos of semantic policy . . . concerned with shifting the relevant concepts of damage, burdens of proof, and definitions of values meriting legal protection. (van den Daele, 1993, 173)

Van den Daele implicitly supports the social constructivist position according to which risks are socially defined and he suggests that it is newer technologies that require broader definitions of risk. This sort of approach looks at how risks are socially constituted, and it leaves more room to include values, which largely fall outside of the more objective approaches to risk communication.

Summary. This section has mapped out the status of technology in late modernity. Technology has been reassessed by theorists in recent years. A middle ground has been developing that positions itself between the view that technology is a value-neutral tool and the view that technology is an inescapable mechanism of domination. This middle view emphasizes that technology is value-laden and socially constructed, and it seeks to

understand what values and agents are involved in struggles over the meanings of technology. Different social groups have different interpretations of technologies, and these interact with each other against a complex background of meanings. In late modernity those who may play a role in negotiating the social meaning of a technology are likely to have conflicting identities and positions. This is due to the developments pointed out by Beck and Giddens: individualization of social relations, the pluralization and delegitimization of science, and the proliferation of institutions and local arenas of politics. Views of science and technology are contested by increasingly disembedded individuals and groups. That is, technologies are socially constructed at a sub-political level in late modernity, by actors and groups at a level of institution more local than that of government. The issue of the democratization of technology, then, is not simply an issue of who holds the tools but of which voices are included in the discussion that negotiate and construct the perceptions and uses of new technologies. In this context, issues of risk and trust, especially ethical risks, become especially important.

The Social Construction of Technology

The critical theory of technology which gives a broader theoretical view, may also be linked to the social construction of technology. The combination of both critical and constructivist views of technology will provide some resources for looking at how technological developments are related to broader social, cultural, and political issues.

Feenberg suggests that in interpreting technology, we need to recognize that "technical objects have two hermeneutic dimensions"; he calls these their "*social meaning* and their *cultural horizon*" (Feenberg, 1995, 9, emphasis in original). Both these dimensions of technology fit into Feenberg's concept of a technical code (Feenberg, 1995, 14). The social meaning consists of various interpretations of the applications and other aspects of a given technology. The social meaning goes through a process of stabilization. He suggests that the social constructivist approaches are a good way of looking at the negotiated social meaning of a specific technology (Feenberg, 1995, 9). The second

hermeneutic dimension, the cultural horizon, is related to "culturally general assumptions that form the unquestioned background to every aspect of life" (Feenberg, 1995, 10).

Feenberg is interested in cultural norms that exercise "control functions" over labour under capitalism (Feenberg, 1995, 10). For the purposes of this thesis, the cultural horizon will be taken in a broader way, looking at cultural norms and themes beyond those that play a hegemonic role.

Wiebe E. Bijker's studies of the social construction of technological artifacts like the bicycle or the fluorescent light provide a method for looking at how different social groups struggle over the meaning and uses of technologies (Pinch and Bijker, 1987; Bijker, 1992; Bijker, 1995a; Aibar and Bijker, 1997). Bijker makes a distinction between three types of technology: physical artifacts, human activities, and knowledge (1995b, 231). He also notes that there are "social technologies," such as management systems, in addition to hardware (1995b). These definitions show how recent studies of technology are paying more attention to social factors. Bijker points to "social shaping models" as important recent attempts to look at how technology is socially contested (1995b, 241; cf. MacKenzie and Wajcman, 1985).

The starting point of Bijker's method is interpretive flexibility. This refers to the idea that technology and technological artifacts are open to more than one interpretation (Pinch and Bijker, 1987, 27). Bijker gets this idea from the empirical program of relativism, an approach in the sociology of scientific knowledge that emphasizes how scientific developments go through a period where different interpretations of the "truth" compete (Pinch and Bijker, 1987, 27). In terms of technology, this idea means that different social groups see the same technological artifact in different ways, emphasizing different problems and different solutions to these problems. According to the social construction of technology, the development of a new technology is not linear where research is turned into a product in a straightforward way. A complex process of competition between different social groups results in certain aspects of the technology becoming established: "the developmental process of a technological artifact is described as an alteration of variation and selection" (Pinch and Bijker, 1987, 28).

There are three stages in Bijker's methodological approach to studying this process. The first stage is to establish the interpretive flexibility of the technological artifact and to explore the different social groups and interpretations that are involved (Pinch and Bijker, 1987, 40). This looks at the multi-dimensionality of different actors and artifacts within competing technological frames. Interpretive flexibility is established by showing that "different social groups have radically different interpretations of one technological artifact" (Pinch and Bijker, 1987, 41).

The first step in this stage for the researcher is to identify and describe the social groups in detail (Pinch and Bijker, 1987, 3-4). The second step is to follow social groups and actors in what Bijker calls "historical snowballing" (Bijker, 1992, 77). Different social groups might be discovered through this process than were originally thought of. Next, the researcher finds the problems that each group saw in the technological artifact. Finally, Bijker suggests that areas of conflict be addressed by examining conflicts and solutions as seen by different social actors or groups (Pinch and Bijker, 1987, 34-35). Areas of conflict include technical requirements, moral conflicts, and different solutions to the same problem (Pinch and Bijker, 1987, 35).

The second stage is related to stabilization of the technology and its closure. At a certain point, one of the variations of the technological artifact become dominant and this form becomes the standard version of the object. Closure is recognized through, for example, much larger numbers of a particular model of bicycle being produced and sold than of other models (Pinch and Bijker, 1987, 39-40). There are different mechanisms of closure. For example, closure by redefinition of the problem happened in the case of bicycles when air tires became standard. The problem of tires was one of stopping vibrations, and the air tire was not initially dominant because vibration wasn't a problem for everybody. When speed became the problem, the air tire became dominant because it was the fastest (Pinch and Bijker, 1987, 44-45). Another mechanism of closure is rhetorical closure in which problems are made to disappear by getting social groups to see the problem as solved even if it isn't (Pinch and Bijker, 1987, 44; cf. Aibar and Bijker, 1997, 16).

The third stage attempts "to relate the content of a technological artifact to the wider sociopolitical milieu" (Pinch and Bijker, 1987, 46). This stage recognizes that the social, cultural and political situations of different groups will shape their interpretations of technology. This does not mean that Bijker wants to look at the hidden meanings of artifacts. He says that the way social groups talk about technological artifacts should be taken at face value:

an important starting point is to let the actors speak for themselves. . . . This ethnographic approach deliberately focuses on meanings attributed to artifacts and does not take the route of imputing hidden interests to social groups as, for example, Marxist structuralism or Parsonian functionalism would do (Bijker, 1992, 78, 77).

The heart of Bijker's method is this focus on the interpretations that different social groups have of technologies.

Bijker's concept of "technological frame" is the key to his method. The idea of technological frame expresses the interpretation that a social group has of a technology: it links "the thinking and actions of individual actors to the social processes constituting the relevant social groups"; a technological frame "provides the vocabulary for social interaction, the forming of social groups and the constitution of a world" (Bijker, 1995a, 103, 195).

Social groups are defined by their relation to a specific technology. If no technological frame develops around a specific technology, then there is no social group (Bijker, 1995a, 123). So the idea of social groups used here does not refer to groups that are recognized in society in general. This is important to keep in mind when discussing 'the scientific community,' which is not necessarily a single community or network. The list of social groups for this sort of analysis emerges from the study of discussions and interactions around the technology.

The technological frame arises from interactions of actors of a specific social group around a specific technology and it also structures those interactions (Bijker, 1995a, 123). On the one hand, a technological frame "needs to be sustained continuously by actions and interactions"; on the other hand, technological frames "guide thinking and interaction"

(Bijker, 1995a, 193, 191).

A technological frame includes all the elements that lead social groups to have different interpretations of technologies. Bijker includes a number of elements in his tentative list: goals, key problems, problem-solving strategies, requirements to be met by problem solutions, current theories, tacit knowledge, testing procedures, design methods and criteria, users' practice, perceived substitution function, and exemplary artifacts (Bijker, 1995a, 123-25). The last three are the most important when considering social groups of nontechnologists (Bijker, 1995a, 124). It is important to note that this list includes cognitive, social and material elements (Bijker, 1995a, 126).

The concept is designed to look at the way different social groups and different technological frames compete with each other. Technological frames influence the way that social groups see technologies, and so they influence the design of technologies (Bijker, 1992, 98). Technological artifacts also influence technological frames as technological artifacts develop and stabilize within social groups (Bijker, 1992, 98). The way that this idea works in these two directions makes it useful: "the concept 'technological frame' [is] a hinge between the social impact and the social shaping perspectives on technology " (Bijker, 1992, 98).

Technological frame is a useful concept because it looks at technologies from the point of view of the different social groups that develop and defend different interpretations of specific technologies: "The result is a model not of the interests or commitments of specific social groups but of the *patterns* that arise when social groups are constituted and interact with one another in a range of different structural circumstances" (Law and Bijker, 1992, 303, emphasis in original). It is a theoretical concept used to order data, and it is most useful for looking at situations of controversy and instability (Bijker, 1995a, 124). It makes it possible to study the ways that technologies change and also the reasons that they find levels of stabilization (1995a, 192).

Bijker's idea of technological frame does not go as far as Feenberg's idea of technical code, although both concepts are useful for looking at connections between social and technical developments. Bijker's idea of technological frame helps more with looking

at the ways that technological developments are affected by struggles between different social groups at a smaller scale. Feenberg's idea of technical code helps us to pay attention to the broader ideological aspects of technology. However, the basic idea of both concepts is that technological and social changes are inseparable. As Law and Bijker put it, "Technology is never purely technological: it is also social. The social is never purely social: it is also technological" (Law and Bijker, 1992, 305).

Bijker's approach to studying the social construction of technology has some limitations, but it is very relevant despite this. One criticism that has been made of his method is that it is difficult to identify social groups and technological frames (Moon, 1997, 129). Different researchers might divide up the actors or define their technological frames in different ways. This problem is addressed here, as Bijker suggests, by allowing the list of actors to emerge in successive levels of coding. While Bijker's approach has been to look at technological development in its entirety, it is possible to apply this method to cases where the technology has not reached the stage of stabilization or closure. This is the case with Dolly and the technology of nuclear somatic transfer. However, given that much of Bijker's focus is on closure, a study of current technologies would not draw to the same extent on this part of his work. For the present study, Bijker's focus on social groups is the most useful aspect. His concept of interpretive flexibility helps us examine the situation, prominent in late modernity, where different social groups have radically different interpretations of a given technology

According to Aibar and Bijker, technology plays a role in the power strategies of social groups, and it has an effect on the relationships between those groups: "different strategies deployed by the contending technological frames redefine . . . the power relations of the relevant social groups" (Aibar and Bijker, 1997, 21). They suggest that technology is more than a medium for power strategies, but they seem to see power as belonging to the groups or to the technological frames. This raises the question of whether Bijker pays enough attention to the ways that social and political factors shape the social construction of technology. He sees the issue of relating "the content of a technological artifact to the wider sociopolitical milieu" as a phase that comes after analyzing the social groups and

their different interpretations (Pinch and Bijker, 1987, 46). However, it's possible that the sociopolitical milieu shapes the social groups and technological frames more deeply.

The social constructivist approach offers a theoretical frame which allows us to look at how technology is socially negotiated. However, the social construction of technology is guided not only through the discussion between actors that we see on the surface of the issue, but, as Bijker himself points out, we must also pay attention to the broader sociopolitical milieu. In order to do this with a technology that is still developing, such as cloning, it is useful to combine it with a larger theoretical framework.

Conclusion

This chapter has looked at a variety of literatures to try to understand how technology is constructed in late modernity. The shifts analyzed by Beck and Giddens are especially relevant and help to contextualize the study of technologies which are developing now, such as cloning. These shifts include changing views of nature, the erosion of science as a legitimating force, the proliferation of experts, individualization and changing views of trust. In late modernity, the identity of social groups and individuals is also changing. In this context, technology has become more politicized, and this takes place at the level of sub-politics. Bijker's approach provides us with a method to identify the actors, technological frames and arguments, the critical theory of technology helps us to understand technology as value laden, socially constructed, and having potential for democratization. However, when analyzing technologies which are still developing, Bijker's narrow social constructivist approach may be too limiting as it does not allow us to look at the wider social and political milieu until after there has been closure. Feenberg allows us to supplement Bijker's approach to understand how technologies embody larger cultural and political meanings. Feminist theory also fits well with Feenberg in that both argue for a middle ground which opens discussion about technology from varied groups. Also because some feminist theorists focus on reproductive technologies, it offers resources that are specific to the case of cloning.

Chapter 3

CLONING IN HISTORICAL CONTEXT AND CULTURAL DISCOURSES

Introduction

Cloning is a construct of various converging cultural discourses, scientific and popular, fact and fiction. In the media coverage of Dolly, science and culture intersect to shape the social meaning of the clone. When scientists, reporters, ethicists, lawyers, government officials, business people or members of the general public mention "Dolly," they refer to more than a Finn Dorset sheep in a pen outside Edinburgh. They are talking about a clone. Dolly herself is a product of the efforts of scientists and industry, raising issues of experimentation and knowledge, profit and progress. As the first clone of an adult mammal, she is seen by many to represent an experimental extension of techniques of artificial reproduction that opens the door to cloning human beings. This raises a host of ethical and religious issues centering on the nature and status of humanity and individual identity. The figure of Dolly, the cloned sheep, as presented in Canadian newspapers, brings these and many other issues into confrontation with each other.

It is useful to examine several different discourses that set the context for the media coverage of cloning and which were drawn on by the different actors taking part in the debate. These discourses have been prominent in different ways for much of the twentieth century. Cloning is a scientific technique with several important steps leading to Dolly. Ethical, religious and feminist discourses have commented on the development of cloning and related technologies as they were developed. Cultural discourses reflected and contributed to popular perceptions of science and new technologies: the Frankenstein monster, mad scientists, doubles and mass produced humans appear in novels and films, many of them cited in the media coverage of Dolly.

In the media coverage of cloning, we can look for certain tendencies of late modernity emerging, including the criticism and distrust of science and the increasing importance of issues of risk and uncertainty. In the last decades, public discussions of the

impact of science and technology have adopted a more critical tone to report these issues. Rachel Carson's book, *Silent Spring*, is often seen as a turning point (1962). We can see this ambivalence regarding scientific progress in a headline in the *Toronto Star*'s breaking news of Dolly: "Genetic Marvel or Ethical Nightmare." The wheels of progress are still in motion, but wheels can lead to good or bad destinations; they can crush as well as carry.

Stories, such as *Frankenstein*, which have been used throughout history to frame various scientific events, become more relevant as scientific advances are made in the biosciences. While *Frankenstein* is a well used metaphor for biotechnology, and particularly cloning, genetic essentialism also exists in popular discourse and misconceptions about issues of identity arise when applied to cloning. However misconstrued, this discourse is essentially more attached to positivist positions. Somewhere in between these converging discourses, ethical dimensions of risk are constructed.

In order to make sense of the many strands that shape discussions of Dolly, it is useful to look back over the development of relevant themes over the course of the twentieth century and over pre-existing myths and stories. These themes from popular culture and discourse were drawn on in the media coverage. In addition to the metaphors from *Frankenstein* or *Brave New World*, there is another significant cultural construct: our fascination with the copy, the freakish, the side show. These are metaphors which find their roots in myths and, in the twentieth century, are often expressed within the frame of industrialization.

Previous developments in reproductive technologies, in cloning specifically, and in the cultural discourses that portray science, technology and the copy all play an important role in discussions of Dolly. They have provided thematic raw material for the many voices that make up the recent debate over cloning.

History of Cloning

J.B.S. Haldane, in a speech published in 1963, was one of the first to use the term "cloning" (Kolata, 1998, 71). The science of cloning was older than the introduction of the term. The idea of cloning as a realistic scientific procedure dates to 1938, when Hans Spemann proposed a "fantastical experiment": "the introduction of an isolated nucleus into the protoplasm of an egg devoid of a nucleus" (cited in Kolata, 1998, 61). The history of cloning is a story of small steps in developing laboratory techniques for achieving this goal. Almost all of these steps have involved experimental work with animals not with humans.

Embryonic clones were produced for the first time in 1952, the year before Watson and Crick announced their discovery of the structure of the DNA molecule (Kolata, 1998, 61f). Robert Briggs and Thomas J. King, at the Institute for Cancer Research and Lankenau Hospital Research Institute in Philadelphia, cloned frogs by adding the nuclei from blastula cells to unfertilized eggs from which the nuclei had been removed. Attempts to repeat the experiment soon established that many species of frogs could be cloned in this way but that the chances of success dropped dramatically as older embryo cells were used: it was easy to create clones using cells from early frog embryos but almost impossible with cells from tadpoles.

In 1962, John Gurdon, working at Oxford University, succeeded in producing cloned frogs by using cells taken from the intestines of adult frogs. It is possible that the experiment was flawed, that the cells taken from the adult frogs' intestines were immature cells and not mature adult cells. In addition, the clones produced never developed past the tadpole stage. However, this research quickly entered biology textbooks as a watershed, representing the first cloning of an adult organism (Kolata, 1998, 68).

A series of important advances occurred in the 1980s and 1990s (Silver, 1997, 99-101). In 1983, Davor Solter and Jim McGrath, at the Wistar Institute in Philadelphia, established a general procedure for using nuclear transfer technology in mammals. This work on mice made the cloning of mammals more efficient and reproducible, promising benefits for both scientific research and agriculture. Cloned mice currently offer a standard

genetic basis on which to conduct controlled scientific experiments. For agriculture, cloning could make it possible to reproduce individuals animals with desirable traits.

In 1986, Steed Willadsen, working at the ARFC Institute of Animal Physiology in Cambridge, England, extended this work by implanting donor nuclei in nuclear-free unfertilized eggs where Solter and McGrath had used one-celled embryos. In 1994, Neal First at the University of Wisconsin cloned cows from donor cells drawn from older embryos. Each of these advances represented another step closer to Dolly. A mistake in laboratory procedure during First's experiment raised the possibility that inducing a pause in cell growth during a specific type of hibernation phase in the cell division process might make it easier to clone mammals. Keith Campbell and Ian Wilmut at the Roslin Institute decided to explore this possibility with sheep. In the summer of 1995, Megan and Morag, two cloned sheep, were born. The experiment that produced them was important because they were produced not from original cells isolated from early-stage embryos but from cultured cells grown from the original embryonic cells (Wilmut, 1998). This was an important step on the path to possibility of cloning on a large scale. The understated title of the article announcing the creation of Megan and Morag emphasized the importance of this step: "Sheep Cloned by Nuclear Transfer from a Cultured Cell Line" (Campbell *et al.*, 1996).

In 1993, Jerry Hall and Robert Stillman, at George Washington University, separated the developing cells of early human embryos and succeeded in getting each to continue developing on its own (Silver, 1997, 98). This development, through it represented a small step in terms of progress towards cloning adult mammals, received dramatic and sensational front-page media coverage: "Scientist Clones Human Embryos, and Creates an Ethical Challenge" (cited in Silver, 1997, 278n98-99).

Dolly was created by removing the contents of a mammary cell of an adult sheep and injecting it into an enucleated unfertilized egg (Wilmut *et al.*, 1997). Electrical impulses were applied to fuse the egg and its new contents and to start the process of cell division. The resulting embryo was transferred after six days to a ewe who, in the case of Dolly alone among 277 attempts, eventually gave birth to the clone. It is possible that

some of Dolly's genetic material came from the mitochondrial DNA of the evacuated egg. That is, Dolly might not be a perfect copy of the animal whose mammary cell provided the nucleus for the new cell from which she developed.

The importance of Dolly lay in the fact that she was cloned using an adult not an embryonic cell. Dolly's ability to reproduce normally was proven when she gave birth to a healthy lamb, Bonnie, on April 13, 1998 ("Dolly Becomes a Mom," CH April 24, 1998, A14). This technology pointed to several potential applications of nuclear transfer, including producing pharmaceuticals, providing organs for transplants, and developing more productive herds of agricultural animals.

The history of cloning research is made up of a series of laboratory experiments with the genetic material of animals. Discussions of cloning since Dolly, however, often focus on the possibility of human cloning. For this reason it is useful to sketch the history of developments in human reproductive technologies.

In the last forty-five years, since James Watson and Francis Crick discovered the structure of the DNA molecule in 1953, the development of human reproductive technologies has reached many important milestones. In 1969, James Shapiro and Jonathan Beckwith isolated the first gene, a development seen by many as "a herald of a new genetic age" (Kolata, 1998, 108). In 1978, the birth of Louise Brown, the world's first test-tube baby, marked the beginning of the "infertility revolution" (Kolata, 1998, 10). By 1994, almost forty countries had *in vitro* fertilization (IVF) programs and an estimated 150 000 births had resulted worldwide from this technique (Silver, 1997, 69; cf. Basen, 1993b, 126). In the early 1980s, sex selection techniques were developed, allowing for increased chances that a fetus conceived through IVF techniques would be of the desired sex and allowing for early detection of the sex of a fetus. By 1987, a clinic in Scarborough, Ontario, was offering these services (Thighbone, 1993, 141). In 1984 an Australian woman bore a child that was genetically unrelated to her, the product of IVF techniques; by 1990 Americans Christina Calvet and her husband paid Anna Johnson \$10 000 to carry their child (Schwartz, 1996, 342). By the mid-1980s the Repository for Germinal Choice in Escondido, CA, was offering "designer babies" developed from the frozen sperm of

Nobel prize winners (Schwartz, 1996, 522n93).

The history of cloning and human reproductive technologies consists of a series of small incremental steps. From this perspective, as Stephen Jay Gould notes, Dolly does not represent a dramatic breakthrough:

First, Dolly breaks no theoretical ground in biology, for we have known how to clone in principle for at least two decades. . . . Second, my colleagues have been able to clone animals from embryonic cell lines for several years, so Dolly is not the first mammalian clone, but only the first from an adult cell. (Gould, 1998, 45)

In fact, however, the cloning of Dolly was received as a very dramatic breakthrough, especially in terms of its ethical significance.

Discourses Around Scientific Developments in Cloning

Ethical and Religious Views

These scientific developments were often surrounded by ethical and religious debates. Ethical debates over cloning became prominent with Briggs and King's work on frog embryos in 1952 (Kolata, 1998, 71). Ethical discussions of cloning were prominent in the late 1960s and early 1970s, when ethicists were accused by scientists of scaremongering, painting scientists as Franksteins, and contributing to an anti-science backlash: "Now, with the birth of Dolly, the ethicists were vindicated" (Kolata, 1998, 4).

In 1966 and 1967, Joshua Lederberg, Nobel laureate geneticist, wrote an article in the *American Naturalist* and a column in the *Washington Post* suggesting that human cloning might offer genetic advantages (Kass, 1998, 5). This sparked a debate on the ethics of human cloning with people like geneticist Theodius Dobzhansky, philosopher Hans Jonas, and theologian Paul Ramsey arguing against cloning human beings (Kass, 1998, 8). The years from 1972-1974 also saw a flurry of papers and editorials considering the ethical implications of cloning (Kolata, 1998, 90-91).

The arguments of two influential ethicists, Paul Ramsey and Joseph Fletcher, can be seen as framing the debate over the ethics of cloning. Ramsey argued that cloning and other genetic technologies transgressed limits that humanity should respect: "Men ought not to play God before they learn to be men, and after they have learned to be men they will not play God" (cited in Cole-Turner, 1997, xi). Fletcher replied that genetic technologies give humans the valuable opportunity to take control of their own procreation: "The future is not to be sought in the stars but in us, in human beings. . . . This is the direction of the biological revolution--that we turn more and more from creatures to creators" (cited in Cole-Turner, 1997, xii).

Religious arguments are almost invariably against cloning, and they take a number of different approaches. The Church of Scotland holds that animal cloning could be acceptable for some research and transgenic applications, but not in routine animal production: "The approach that, whatever use we find for animals, we could clone them to do it more efficiently brings the mass production principles of the factory too far into the animal kingdom" (cited in Bruce, 1997, 8). Human cloning, according to the Church of Scotland, is "ethically unacceptable as a matter of principle"; it is a "violation of the uniqueness of human life" (cited in Peters, 1997, 16). Theologians argue that human cloning might undermine the dignity of children or lead to racist eugenic practices (Peters, 1997; Paris, 1997). Protestant theologian Abigail Rian Evans argues against human cloning because it would foster a reductionist view of human nature, undermine the structure of their family, and threaten to deify technology: "It is not so much that we play God when we practice high-tech medicine, but that technology becomes our god" (Evans, 1997, 33).

The Royal Commission on New Reproductive Technologies produced what is probably the most important Canadian statement on the ethics of cloning and related issues, although it has not resulted in legislation to date (Royal Commission, 1993). The Commission acknowledged the tension between fear and trust of progress:

For many Canadians, genetic research and the application of genetic technology

embody a basic human conflict—the drive to expand the boundaries of knowledge and apply it for the benefit of mankind, contrasted with the equally real feeling that some mysteries of life should not be tampered with. (1993, 729)

The Commission distinguished human embryo research from animal embryo research, and they classified cloning along with other technologies that would be unethical if applied to human beings: “Certain kinds of research, such as cloning . . . violate basic norms of respect for human life and dignity. These are unacceptable and should be prohibited. We found widespread agreement on this among Canadians” (1993, 636-37, cf. 618). They recommended that “Human zygote/embryo research related to ectogenesis, cloning, animal/human hybrids, and the transfer of zygotes to another species be prohibited, under threat of criminal sanction” (1993, 637).

The Royal Commission’s position was that the use of new reproductive technologies, including cloning, should be allowed only if they are “ethically acceptable and socially desirable” (1993, 744). Their ethical approach was not choosing a single ethical theory, like utilitarianism or natural law. The Commission used the Ethic of Care and a set of guiding principles within that perspective. The Ethic of Care focuses on “helping human relationships to flourish by seeking to foster the dignity of the individual and the welfare of the community” (1993, 52). The guiding principles were individual autonomy, equality, respect for human life and dignity, protection of the vulnerable, non-commercialization of reproduction, appropriate use of resources, accountability, and balancing individual and collective interests (1993, 52ff.). The Commission noted that the goals of embryo research are very different in the cases of animals and humans:

In farm animals, the objective is not to circumvent infertility but to produce as many offspring as possible from a valuable selected animal or group of animals, with the goal of benefitting producers and consumers. . . . It is essential that the values underlying the use of these technologies in animals not be transferred along with the technologies. (1993, 619-20).

They argued that the commercial values and commodification of organisms prevalent in animal cloning should not be transferred to humans. This is because even zygotes should

be respected because they stand in a relation to the human community and because cloning would violate the human dignity implicit in this relationship. These arguments are similar the religious views discussed above. The Commission foresaw no justifiable reason for human cloning: "Even if it were possible in human beings, this technique would have no foreseeable ethical application" (1993, 741). The Commission recognized the ethical value of using new reproductive technologies as treatments for infertility, however they did not directly address the possibility that cloning could be used in this way. This is just what Richard Seed, for example, has proposed in the wake of Dolly. But this potential objection seems to be met by one of their principles: they held that a new reproductive technology should not be allowed if it "provides no benefit that cannot be achieved in other, ethically acceptable ways" (1993, 741).³

To sum up, the possibility of human cloning raises a number of ethical issues: kinship and family, solidarity with the human community, individual identity, relations between science and society, and many others. While some ethicists have been strongly against human cloning, others see little or no harm in it. At one extreme, ethicists raise the possibility that cloning could be a "reproductive right," and that the only limitation on cloning should be protecting autonomy so that no one is cloned against their will (Kolata, 1998, 19-20). At the other extreme, for the Vatican, for example, cloning crosses a boundary and represents "the ultimate in hubris, an attempt by humans to be their own creators" (Kolata, 1998, 34).

3

The Commission was not in a position to distinguish between cloning using embryonic and using adult cells because the technique used to produce Dolly had not been developed yet. They distinguished between cloning in animals and human based on a view of embryonic cloning that does not apply to the technique used with Dolly: "An important difference in humans is that the qualities of the zygote that could give rise to these multiple 'copies' cannot be known in advance" (1993, 741). In some ways, science and technology have moved beyond the Royal Commission's report. Another minor example is where they say that cloning "does not work in mice" (1993, 741). Ryuzo Yanagimachi and colleagues at the University of Hawaii at Honolulu recently cloned mice using cells from adult donors (Wilmut, 1998, 62).

Feminist Views

Feminist arguments against human reproductive technologies raise other ethical issues. The role of industry in the development of reproductive technologies is a source of concern from this perspective. Gena Corea points out that public discussion surrounding reproductive technologies is largely controlled by industrial interests: "reproductive engineering is being engineered" (1993, 19). Often missing from this discussion is the inclusion of possible risks and recognition of ethical issues (Basen, 1993a, 29).

One of the greatest risks that we face on this view is the inevitable commodification of fetuses, specifically for experimentation in the field of biomedicine (Basen, 1993a, 31). Because reproductive technologies were perfected with animal research directed by the agricultural industry, technological values are becoming the values of human reproduction: economic interests will lead to human procreation becoming "another industrial process" (Basen, 1993b, 131).

These critiques are rooted in a deeper critical perspective. Like Feenberg, many other theorists see science and technology as value-laden and contested: "Struggles against racism, colonialism, capitalism, and homophobia . . . counterculture movements . . . contemporary ecology and antimilitarism movements have all produced pointed analyses of the uses and abuses of science" (Harding, 1986, 16). These perspectives have pointed to science and technology as value-laden and socially constructed. More specifically, feminist theorists have developed 'standpoint epistemologies' that emphasize the relative nature of scientific rationality: scientific facts, theories and truths are value-laden, reflecting the interests of those social groups with more power in the area of science (Longino, 1990, 10-12). As Feenberg notes, this view of science parallels his view of technology (1991, 170). Feminists theorists underline the need to ask questions about the power and interests of the different social groups involved in the social construction of technology.

Cultural Discourses

Scientific and popular conceptions of cloning differ greatly. Gregory Pence, in his recent book on human cloning, prefers the term "nuclear somatic transfer" to "cloning." He suggests that the word "clone" is too laden with presuppositions: "At this point in human history and with the legacy about human cloning we have from movies and popular fiction, to refer to people originated by cloning as 'clones' or 'a clone' is to drastically bias the discussion at the outset in the worst possible way" (Pence, 1998, 49). This underlines the idea that some scientific discussions of cloning may insist on their own terms and language, distancing the technology from popular perceptions and discussions.

Popular conceptions of cloning are important, however, for understanding the social construction of cloning. Scientific views are only one voice in the struggle to define the significance of Dolly. Representations in film, fiction, cartoons and jokes are an important part of the story: "If we want to understand the origin of the vocabulary in which present-day debates about science are conducted, we need to attend . . . to the history of science in popular culture" (Turney, 1998, 3).

Various themes appear in the popular culture aspects of the media coverage: human cloning as threat to identity and traditional social structures; science as unethical and out of control; identity defined in terms of DNA. These themes are expressed in images and myths, often with a long history, that help shape discussions of Dolly.

Mad Scientists and Copies in Popular Culture. Images of mad scientists and Frankenstein's monster are prevalent images in many popular accounts of science. They are related to concerns over the limits and dangers of science.

The figure of the mad scientist expresses worries about the dangers of power and knowledge that have been a part of western culture for a long time: the Bible, Greek myths, medieval folk tales and early modern literature all provide examples (Kolata, 1998, 84). Different views of the character of the person seeking dangerous knowledge are shown in the legend of Faust, the story of a student of occult sciences who sells his soul to the devil

for knowledge and power. This legend was popularly presented by Johann Spies in 1587, Christopher Marlowe in 1594, Goethe in 1832, and others (Toumey, 1992, 418).

In the last century and a half, the theme of the mad scientist itself has become more prominent. The image has been common in such fictional works as Mary Shelley's *Frankenstein* (1818), Robert Louis Stevenson's *The Strange Case of Dr. Jekyll and Mr. Hyde* (1887), H.G. Wells' *The Island of Dr. Moreau* (1896), Ian Fleming's *Dr. No* (1958), William Goldman's *Marathon Man* (1974) and others. Many films have also drawn on this image: *The Golem*, *Metropolis*, the *Frankenstein* films, *The Cabinet of Dr. Caligari*, *The Invisible Ray*, *Dr. Strangelove*, *The Manchurian Candidate*, and many others (Toumey, 1992).

Images of the mad scientist often portray scientists as unethical (Kolata, 1998, 85). Mad scientist stories function as critiques of science: they depict science "ambiguously, illogically, and mysteriously, in other words, irrationally" (Toumey, 1992, 414; see also Pence, 1998, 55).

The mad scientists image has also figured prominently in debates on nuclear technologies. The film *Dr. Strangelove* shows how the figure of the mad scientist was used to symbolize anxieties about science and technology. In its cynical portrayal of military control of nuclear weapons, the film created an almost mythical world into which audiences could project their fears and perhaps move past the paranoia -- as the subtitle, *How I Learned to Stop Worrying and Love the Bomb*, suggests. Although the film begins with a disclaimer that none of the characters are meant to portray actual people, the character referred to in the title appears to resemble the scientist Edward Teller, known as the father of the atom bomb. In his push for bigger and hotter bombs, he was loved by some and considered "a mad bad scientist with a funny foreign accent" by others (Nadelson, 1995, 10).

Kubrick used the icon of the mad scientist as a commentary on the Cold War and the issues of developing more destructive nuclear weapons. This film was a also way of bringing a cultural neurosis to the surface (Wolfe, 1976, 60). He says that "*Dr. Strangelove* expands the notion of nuclear extinction . . . until we see in it all the elements

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Figure 2. *Mary Shelley's Frankenstein* (1994)

of paranoia and political insanity that characterized the fifties" (Wolfe, 1976,61). The figure of the mad scientist expressed fear of scientific and technological developments at the same time that it helped calm these fears by ridiculing and distancing the threat through humour.

Mary Shelley's Frankenstein: or, The Modern Prometheus [1818] has also provided a metaphor for science and technology for over a century and a half and has been reproduced in several Hollywood films (see Figure 2) . The story tells of another student of the occult sciences who creates a monster using electricity and dead body parts and who is eventually murdered by his creature. The novel is not only a gothic horror story; it "has long been a versatile frame for interpreting our relationship with technology" (Turney, 1998, 2). This image of the monster has long been a symbol of dangerous knowledge in Western culture (Weart, 1988, 55). This image persists in literature about science, and it has served as "an effective weapon against science" (Weart, 1988, 56). It provides us with a way to express fears raised by certain scientific and technological developments, for example nuclear weapons and, more recently, biotechnology. Such monster myths, particularly that of Frankenstein, are strongly rooted in our culture and become more prominent as "biological manipulation" takes hold (Turney, 1998, 220).

Metaphors of the double and copy have also often been used to describe cloning. Several myths and images exist which deal with the topic of the double: magical copies, doppelgängers, Siamese twins, androids, replicants and others. However, in the context

used to describe cloning. This section will consider the issues of the copy more generally, then consider two influential examples from popular culture: *Brave New World* and *R.U.R.*

Images and myths of doubles and copies are very old. Siamese twins have been objects of special fascination from before the time of recorded history (Schwartz, 1996, 48f). The image of the doppelgänger dates from the late eighteenth century: it concerns mirror twins whose fates are linked; meeting with this sort of double predicts tragedy (Schwartz, 1996, 64).

The history of images of the double is not a neutral one. Wendy Doniger examines myths about "prescientific clones": these myths involve the natural and magical cloning of twins, and they often present doubles as symbols of sexuality, death and bureaucracy. Doniger concludes that mythological views of the double have been almost entirely negative: "mythology comes down strongly against cloning" (Doniger, 1998, 135).

Mechanical reproduction has been a prominent feature of the industrial revolution. Machines for producing faithful reproductions of text and images have been around, in different forms, since almost the invention of the printing press; carbon paper was in common use from the 1880s (Schwartz, 1996, 222-23). Closer to the human body, mannequins became more common beginning in the eighteenth century; by the twentieth century they were mass-produced and used as dummy figures in the World Wars, becoming the object of a Surrealist art exhibition in 1938 (Schwartz, 1996, 118, 120). Common technologies of reproduction, photography and photocopying, further exemplify copying as a feature of our world. Despite this, we remain discomfited at the idea.

Theorists of postmodernity emphasize this aspect of popular images of cloning. Jean Baudrillard suggests that cloning is "the last stage of history and modeling of the body, the one at which, reduced to its abstract and genetic formula, the individual is destined to serial propagation" (Baudrillard, 1994, 99). Baudrillard, citing Walter Benjamin, suggests that cloning has the same effect as the mass reproduction of art: the loss of an aura of originality in the reproduction (Baudrillard, 1994, 99; cf. Benjamin, 1968). The body in an era of cloning becomes genetic information and material for potential mass reproduction.

This mass production of images has a moral effect: "images of others can be the basis of the recognition of moral duties," but mass production dehumanizes these images (Tester, 1995, 471). Because media representations and other technologically produced images are not rooted in a specific social and cultural life, they lose "their ability to be morally compelling or even morally authoritative" (Tester, 1995, 480). The mass media have "changed out understanding of our moral obligations towards others" (Tester, 1995, 471).

Images of the clone are portrayed in ways that make "technological production of identity" a contradiction in terms. The threat is that identity would be undermined if humans were as easily reproduced as mannequins, dummies, or the instant clones of fiction and film. This tendency was satirized in Aldous Huxley's *Brave New World* (1932). Huxley describes the world After Ford, in which mass-produced children are raised to become adults with little freedom and with largely scripted identities, a dystopian view that largely reflected its times.

The influential early twentieth-century play *R.U.R.* similarly expressed a deep unease with the mechanization and industrialization made possible by modern science and technology. *R.U.R.*, by Karel Capek, was first performed in Czech in 1921. It was immediately translated into English and became very popular after performances in London and New York ("Reader's Supplement," 1969, 5-11.). The play tells a story of the creation and exploitation of artificial labourers, factory-made from organic parts, that rise up and kill all of humankind. The fact that the play was so popular suggests that it struck a chord, and we can perhaps look at the metaphor of the robot for an explanation of this.

The word 'robot' comes from the Czech for 'forced labour.' In *R.U.R.*, the robots are made by mass producing components which go to "the fitting-shed, where all the parts are put together, like motor cars" (Capek, 1961, 15). But the robots are not only the products of an assembly line, they are the dehumanized workers who run the factory. They have been designed to be cheap and efficient workers: "Man is too complicated, . . . a good engineer could make him more simply . . ." (Capek, 1961, 8-9). Mass production and the industrialization of labour processes combine to form a system that encompasses the idea

of human as artificially produced machine (cf. Purcell, 1994, 113).

The main theme of *R.U.R.* is the dehumanizing effects of modern systems of labour that result from the application of new technologies and principles of organization: "Like Mary Shelley, Capek uses a biologically based image to dramatize the relations between people and their technology, but this time the setting is industrial. . . . *R.U.R.* is the marriage of the artificially created humans with the production line" (Turney, 1998, 97). Discussions of cloning echo these concerns, expressing fears of mass production of people with predetermined identities.

Cloning and Identity in Films. Copies, doubles, clones and replicants have appeared in films since the early days of cinema. Hollywood's Frankenstein films, for example, followed in the footsteps of two early German films, *The Golem* (1914) and *Homunculus* (1916). These films present many images, including the mad scientist and the dangers of technology, discussed above. This section focuses on another aspect of these films, how they raise issues of true vs. false identity. Films about clones and copies reflexively examine the nature of identity and how it is threatened.

For Norman Denzin, science fiction films are part of "a counter-body of subversive texts which suggests that things aren't the way they appear to be. . . . Such films self-consciously critique society's simulated representations of itself" (Denzin, 1991, 145). Denzin points out that American cinema often tries to deal with controversial or problematic issues "inside a melodramatic structure which represses while it valorizes and contains that which it presents" (Denzin, 1991, 144). Science fiction films (among others) raise disturbing issues, but they do so in ways that isolate and contain the threat these issues present.

Films of clones and doubles are good examples of this strategy of portraying a



Figure 3. *Multiplicity* (1996)

problematic issues "inside a melodramatic structure which represses while it valorizes and contains that which it presents" (Denzin, 1991, 144). Science fiction films (among others) raise disturbing issues, but they do so in ways that isolate and contain the threat these issues present.

Films of clones and doubles are good examples of this strategy of portraying a threat in a safe manner. Common ideas of identity are reaffirmed at the same time that they are called into question. The films make clear exactly who is the copy and who is real in different ways. This allows stereotypical views of identity to be insulated from the threat of the copy.

Multiplicity is a good example of this. In the film, Doug, a building contractor pressed for time by work and family responsibilities, has himself cloned twice. Then the clones make a clone of one of themselves in order to make their life easier. The clones have numbered tattoos, specific roles, and unique personality traits that give them distinct identities. For example, the first clone takes on the responsibilities of the original's job and is characterized as a macho construction worker, and the second clone becomes an effeminate house husband. In other words, the identity of the protagonist is never in doubt. The idea of what it is to be real and what it is to be a clone is highlighted by the arrival of the third clone, a mentally challenged copy of the first clone, that is, a defective copy of a copy. These characterizations establish the difference between who is real and who is not, shielding the original from any serious challenge to his identity. The narrative structure of the film insulates the real Doug from this threat in an even more basic way. The original gets the wife, house and family, a typical comedic ending that

Identity is also a central issue in the *Invasion of the Body Snatchers* (1956) and its 1978 remake. In both films there are shots that show alien doubles emerging from pods as the original humans look on. Identity is problematized as the protagonists notice differences between human originals and the alien doubles that are replacing them, but no one else seems to notice. The 1978 version takes this paranoia furthest by turning the central character Matthew (Donald Sutherland) into an alien double. However, the viewer recognizes that Matthew has been copied by seeing his double through the eyes of a minor character, though it seems impossible that she herself could have remained uncopied. For dramatic effect, the film needed to emphasize the triumph of the doubles from the point of view of an original. As Denzin notes, even Hollywood's subversive films end up reasserting that there is a reality, not just representations (Denzin, 1995). This concluding sequence of the second *Invasion of the Body Snatchers* film affirms identity despite the pervasiveness of the copy.

Boys From Brazil achieves something similar through the use of an original which is not in the movie but is present in everyone's memory, Adolph Hitler. All of the clones seem identical, carefully sculpted by Dr. Josef Mengele to be Hitlers by choosing environments for them that would match Hitler's own youth. In the end, Mengele dies at the hands of one of the clones. This ironic end to Mengele's life makes the audience suspect that the experiment has indeed worked; the original might still exist through these clones.

Cloning in Popular Fiction and Non-Fiction. Cloning has been a theme in popular fiction and non-fiction almost since the development of cloning techniques. It is useful to look at these accounts of cloning because they formed part of the background of views and attitudes that were drawn upon, often explicitly, in the media coverage of Dolly.

J.B.S. Haldane (one of the first people to use the word "clone," in the early 1960s)

was envisioning the potential of artificial reproduction as early as 1923: "If reproduction is once completely separated from sexual love, mankind will be free in an altogether new sense. . . . We can already alter animal species to an enormous extent, and it seems only a questions of time before we shall be able to apply the same principles to our own" (Haldane, 1925, 68-9). Popular accounts of cloring began to appear in the late 1950s and 1960s. One of the first public accounts of Briggs and King's pioneering 1952 work on embryonic cloning was in Jean Rostand's non-fiction book *Can Man Be Modified*, written in 1956 and published in English in 1959 (Turney, 1998, 139-43). Rostand concluded that, "this new technique of generation would in theory enable us to create as many identical individuals as might be desired. A living creature would be printed in hundreds, in thousands of copies, *all of them real twins*. This would, in short, be *human propagation by cuttings*. . ." (cited in Turney, 1998, 140).

In 1968, another book appeared, similar in many ways to Rostand's book of a decade before, *The Biological Time Bomb* by Gordon Rattrap Taylor (Taylor, 1968; cf. Turney, 1998, 155-59). Alvin Toffler's 1970 bestseller, *Future Shock*, had a brief sensationalistic account of the possibility of human cloning. In Toffler's book we can see some of the discourse that appears in later media accounts of cloning: "biological carbon copies"; "Albert Einstein bequeathing copies of himself to posterity. But what of Adolph Hitler?" (Toffler, 1971, 197-98).

Discussions of the possibility of human cloning became more prominent in the mass media in the early 1970s. James Watson, the co-discoverer of the structure of DNA, warned of the coming of "Clonal Man" and asked, "do you want this or not?" (Kolata, 1998, 83). In 1972, Willard Gaylin, cofounder of the Hastings Centre, wrote of the potential of making "Exact copies of Human Beings" and invoked "The Frankenstein myth" (Kolata, 1998, 85). Science fiction stories that exploited the idea of cloning also began to proliferate in the early seventies, influenced to a large extent by the publication of Taylor's

book, *The Biological Time Bomb* (Dann and Dozois, 1998, 1; Kolata, 1998, 113-15).

Another chapter in the evolving public awareness of human cloning occurred with the publication of David Rorvik's book *In His Image: The Cloning of a Man* in 1978 (Rorvik, 1978; Kolata, 1998, 93f). The book was presented by its author as a work of non-fiction, and it described a millionaire's successful efforts to have himself cloned. *In His Image* became a best-seller, and, although its publisher later admitted that it was fictional, it helped spark a renewed debate regarding the potentialities and dangers of cloning.

All of these works served as a means by which the public became attuned to the significance and potential impact of cloning. It is not surprising that many of them are mentioned explicitly in the media coverage of Dolly.

Conclusion

This chapter has explored the historical context of cloning in the arenas of science and popular culture. A number of discourses converge in the attempt to make sense of Dolly. From the point of view of scientific research, 'cloning' refers to just one aspect in a long series of laboratory experiments with the genetic material of animals. However, ethical and religious discussions often see cloning as a development with radical and disturbing implications. Concerns have also been raised by feminists about the application of new reproductive technologies to humans. The various debates often draw on images with a long history in popular accounts of science: mad scientists and Frankenstein monsters, copies and industrial reproduction, science out of control, and control over identity. To understand the social-construction of the technology of cloning, it is important to pay attention to these varied threads of discussion.

Chapter 4

METHODOLOGY

This thesis is a case study of the social construction of a specific technology. More specifically, it is a media analysis of cloning. Two steps are taken in the methodological design of this study: grounded analysis and the use of a theory with certain methodological implications, Social Construction of Technology (SCOT).

Grounded analysis is used as a form of textual analysis, to generate the specific themes that are analyzed in the media coverage. SCOT is used to identify relevant actors and social groups and to determine how the technology is given meaning through social negotiation.

Dolly as a Case Study

The decision to do a case study reflects both the nature of the research question and the choice to approach this question through an analysis of the media. Case studies of a single-case are most useful where the case is rare or unique, tests an existing theory, or reveals something important (Yin, 1994, 44). Media coverage of Dolly meets each of these three criteria. Dolly is the first ever clone of an adult mammal and her birth received immediate worldwide press coverage. In this sense, it is a unique and significant event and worthy of examination. Second, coverage of Dolly and of the issues raised by cloning provides a useful case to test theories regarding the status of technologies in late modernity. Third, the case has the potential to reveal something important about interactions between scientific and cultural discourses surrounding cloning.

The decision to do a case study is justified for an additional reason. A single-case study is especially useful for examining an issue "within its real-life context, especially when

the boundaries between phenomenon and context are not clearly evident" (Yin, 1994, 13). Examining the social construction of technology in late modernity using a media analysis is an example of this. The phenomenon, the technology of cloning, is difficult to separate from the context, background views of science and of its social and ethical implications. Looking at a single case in depth makes possible an extended engagement with the interrelations between perceptions of cloning and the background issues and perceptions that are drawn upon. It offers a promising means of examining a complex set of issues in context: "the case study allows an investigation to retain the holistic and meaningful characteristics of real-life events" (Yin, 1994, 3).

Sample

The two-week period immediately following the breaking of the story on Feb. 23, 1997 provided the time frame for the sample that was used. Four English-language and one French-language daily papers were selected for analysis: the *Globe and Mail* (GM), *The Toronto Star* (TS), the *Calgary Herald* (CH), *The Calgary Sun* (CS), and *Le Devoir* (LD).⁴ All items mentioning Dolly or cloning for the thirteen-day period from Feb. 24 to March 8 were coded. One hundred and nine items were closely read and coded: thirty-six in GM, twenty-three in TS, twenty-four in CH, sixteen in CS, and ten in LD. These newspapers were selected to provide a non-random cross-section of newspapers in this country. GM, which calls itself "Canada's National Newspaper," is a nationally distributed opinion leader. At the other extreme, CS is a tabloid format paper with a generally blue-collar readership. In between these extremes are TS and CH, the former a very large metropolitan daily and the latter a moderate size city daily. LD is an opinion leader in

⁴

Le Devoir was read in a translation provided by Marie Claude Gratton.

Quebec. Each newspaper had a wide variety of items, ranging from factual coverage of the science and technology involved to humorous commentary, jokes, and cartoons.

This material was supplemented by transcripts of news coverage during the same two week period on Canadian television (CBC: five items; CTV: two items), and radio (CBC: four items).

Issues of three magazines with large Canadian circulations were also included: *Maclean's*, *Canadian Time*, and *People*. The first two are important news magazines in Canada, and the third, also widely distributed in Canada, offers characterizations of prominent actors and a human interest angle. All three issues were published on March 10, 1997. Ten articles were coded: three in *Maclean's*, six in *Canadian Time*, and one in *People*. The cloning story was the cover story in *Time*. *Maclean's* had a small lead-in on the cover; the cover story was the financial troubles of the Eatons retail chain. *People* made no mention of the story on its cover: the cover story was the break-up of Farrah Fawcett and Ryan O'Neal. All three magazines had leads, including photos of Dolly, in the table of contents. The significance of the decision whether or not to make Dolly the cover story during the week of her announcement is underlined by the failure of an important U.S. news magazine to do so. *Time* and *Newsweek* went with Dolly on their covers, but James Fallows, editor of *U.S. News & World Report*, resisted pressure to do so, and he later regretted missing the chance to feature "the most important story of the last two or three decades" (Kolata 1998, 33).

The analysis will examine the set of items as a whole rather than by media. Actors and themes will be characterized with reference to the entire range of material sampled from the two-week period. As a result, differences between media will be secondary.

Procedure

Grounded Analysis. Coding and interpretation of data proceeded in an interrelated manner, using a form of grounded analysis (Strauss and Corbin, 1990). With this sort of approach, data collection and analysis are reciprocally related. Categories for analysis are generated and refined in constant dialogue with the data.

Initial categories for coding the articles were developed through a close reading of all newspaper articles. Comparison, conceptualization and categorization led to a set of categories that were used as a basis for comparing the concepts found in the different articles (see Appendices). This initial step of conceptualizing the data corresponds with the process of "open coding," as used in grounded theory. In open coding, "the data are broken down into discrete parts, closely examined, compared for similarities and differences, and questions are asked about the phenomena as reflected in the data" (Strauss and Corbin, 1990, 62).

Possible relationships between the categories began to emerge during this work. This continuing process of refining through open coding took place partly in dialogue with other researchers doing similar work. Members of the Concerted Action Group for Biotechnology and the European Public were concurrently involved in a collaborative effort analyzing European media coverage of the cloning story in Austria, Britain, Finland, France, Germany, Greece, Italy, the Netherlands, Poland, Sweden and Switzerland.

Reflection on the initial categories of coding led to a second set of categories, each integrating the properties and patterns that emerged from working with the previous set of categories. This involved three steps: identifying the story line, determining the core and sub-core categories, and relating other categories to the core category (cf. Strauss and Corbin, 1990, 116f.). Analysis of metaphors and visual images was also developed further at this point. The final categories served as a tool for analyzing the rest of the data

collected from news magazines, radio and television.

Social Construction of Technology (SCOT). Drawing on SCOT, social groups were identified from the data and convergent themes and conflicting views of the technology of cloning were tracked and examined. As noted above, SCOT is a theoretical perspective not a methodology. However, it is a theory with very specific methodological implications. As a result, it is worthwhile to underline its implications for method here.

Methodologically, SCOT involves three stages. The theory examines technological artifacts or processes as they go through their evolutionary life cycle. This approach begins by noting that technologies manifest interpretive flexibility, i.e., they are open to more than one interpretation by different agents or social groups. The first stage is to establish the interpretive flexibility of the technological artifact and to characterize the different social groups and interpretations that are involved (Pinch and Bijker, 1987, 40). This involves examining different views of the problems and solutions posed by the technology (Pinch and Bijker, 1987, 34-35). The second stage is to characterize the mechanisms and results of processes of stabilization and closure of the technology. The third stage attempts "to relate the content of a technological artifact to the wider sociopolitical milieu" (Pinch and Bijker, 1987, 46). This stage recognizes that the social, cultural and political situations of different groups shape their interpretations of technology.

This case study examines cloning in its early phase, when the scope for interpretive flexibility is broad, before the stabilization phase. As such it does not offer an extended chronological analysis of the case in the same way that a SCOT analysis would. The decision to use SCOT as a theoretical perspective, then, necessarily involves an examination of the ways that the technology, in this case cloning, is seen by different actors or social groups. This does not limit the study to specific categories of analysis;

these were generated through grounded analysis as outlined above, which also enables us to look at the media as a social actor. The use of SCOT **allows us to determine how themes and issues were interpreted differently by different actors and social groups.**

Follow up

To fully utilize the SCOT approach, I looked for early indications of stabilization and closure in other sources outside of the sample. I drew on later media coverage of relevant developments in science and policy to follow the trajectories of key themes. This involved an informal sample of articles from the GM, CH, and CS and articles in popular science magazines.

Chapter 5

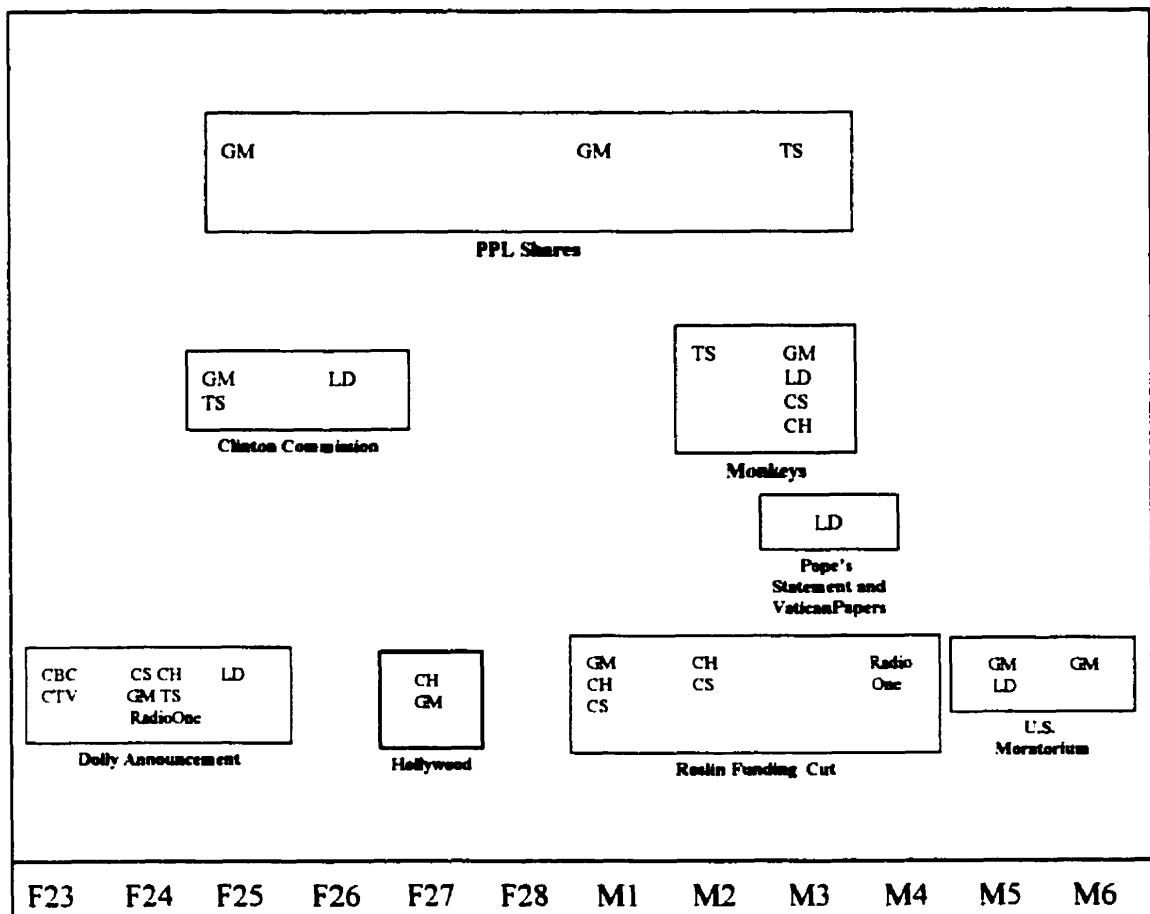
FINDINGS

Media coverage of Dolly was shaped by a series of key events that formed a storyline. In the wake of the initial reports about Dolly, related scientific developments as well as political and legal reactions served as focus points for the media coverage. A number of themes informed all these stories in different ways. After presenting the storyline, this chapter briefly characterizes several significant themes that shaped Canadian media coverage of Dolly, including identity, ethics, progress, and regulation. It then describes the main actors who contributed to the ongoing discussion of the significance of Dolly and the cloning technology that produced her: business sources, corporate scientists, academic and medical scientists, ethicists and religious experts, politicians, and other experts. The bulk of the chapter analyzes the claim making activities of the actors: how each characterized the development and potential implications of cloning. In general, this chapter shows how the main groups of actors in the Dolly story differ in the positions they take with respect to the main themes. This thematic analysis of the media coverage is a useful way to characterize actors in terms of their attempts to shape the technology.

Description and Timing of Events

Several key events formed the storyline of the Dolly coverage (Figure 4). These were also reflected in European media coverage (Einsiedel *et al.*, In Press). The storyline begins with the announcement of Dolly's existence and origin. Ethical, political, cultural, religious and legal reactions follow. Another important part of the storyline is an announcement of another scientific development, the cloning of monkeys, that is read as extending the technology toward the cloning of humans. The trajectory of the storyline

Figure 4. Time Line of Events In Dolly Coverage



Sources: *Globe and Mail* (GM); *The Toronto Star* (TS); *Calgary Herald* (CH); *The Calgary Sun* (CS); *Le Devoir* (LD); Canadian Television Network (CTV); Canadian Broadcasting Company television (CBC); Canadian Broadcasting Company Radio One (Radio One).

showed a divergence between animal and human cloning stories. This development had important implications for the way the technology was discussed and for the areas around which consensus began to emerge. The story of Dolly quickly became a story of the

possibilities and dangers of human cloning: the cloning of monkeys was explicitly framed as a step closer to cloning humans (Seifert, 1998; Einsiedel et al., In Press; see Figure 5).

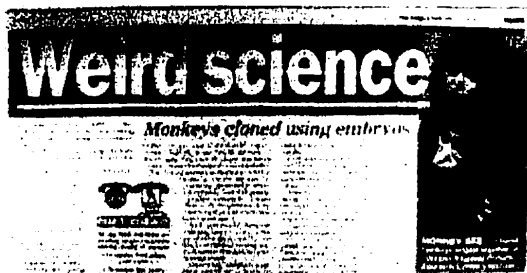


Figure 5. *Calgary Sun*, March 3, 1997. (AP)

The reactions to the initial announcement were largely addressed to the issue of human cloning: Clinton's call for the U.S. National Bioethics Advisory Commission to consider the ramifications of cloning and call for a voluntary moratorium on human cloning research, as well as the concerns expressed by Pope John Paul II.

Only two events were explicitly concerned with animal cloning: interest in the shares of PPL Therapeutics, the company that financed the work that produced Dolly, and the Roslin funding cut. These developments were framed as reactions, on the part of business and government, to the cloning technology.

The sequence of events portrayed in the media shows how the first cloning of an adult mammal was being worked out in different public fora. (1) Dolly is announced to the world: The first successful cloning of an adult mammal. (2) U.S. President Clinton asks the National Bioethics Advisory Commission to review the ramifications of cloning and to report back in 90 days. (3) Business expresses interest in the shares of PPL Therapeutics, the company that financed the creation of Dolly. (4) Hollywood reacts and rushes to make cloning movies. (5) The British Agriculture Ministry announces its decision to cut funding for the project that produced Dolly. (6) The embryonic cloning of two rhesus monkeys (born in August 1996) is announced at the Oregon Regional Primate Center in the U.S. (see Figure 4). (7) Pope John Paul II expresses concerns regarding "dangerous experiments", an event reported only in the French-language paper.⁵ (8) U.S. President

⁵

In European Catholic countries there was a report of the Vatican papers' call for

Clinton imposes a ban on federal funds for human cloning experiments and calls for a voluntary moratorium on human cloning research. In addition to detailing a sequence of news events, the media framed the story via visual and descriptive representations that drew on popular culture resources.

One interesting measure of the impact of cloning's link to popular culture is provided by the fourth of the listed events: the reaction from Hollywood. Previous and planned references to cloning in films and on television were framed as anticipations of and reactions to the cloning technology, especially in a detailed GM article (Feb. 27).

Screenwriter Lewis Kleinberg drew attention to the parallel between fact and fiction:

"Suddenly, it's splashed all over the newspaper. Even the scenes I had in my head. . . ."

Others saw Dolly simply as material for jokes: Eddie Feldman, writer for HBO's *Dennis Miller Live*, said, "It has all the comedy workings right there: science and sheep"; comedian Richard Jeni said, "Anybody who thinks Hollywood doesn't have tremendous cloning skills hasn't seen the *Die Hard* movies."

Another measure of cloning's link to popular culture is the characterization of cloning in visual ways. Characterizations of Dolly herself were an especially important contribution to the human cloning story. The visual presentations of Dolly were an important aspect of this. By day three, images of Dolly as a media star started to appear. These photos did not present her as an objectified result of a technological process. They showed her as the humanized subject at the center of wider social and ethical issues. The *Globe and Mail* used a photo depicting Dolly bleating into a microphone (Feb. 26) to accompany an article about the biotech industry. In this context, she is a star of the industry. A drawing of two sheep with "Holly" and "wood" on their backs and wearing

immediate laws prohibiting human cloning on Feb. 26 (Einsiedel *et al.*, In Press). Canada reported this on March 3 as part of an article on the Pope's reactions: this event appeared only in the Quebec paper in the sample.

sunglasses accompanies an article on movie scripts concerned with cloning (GM Feb. 27). A cartoon depicted Dolly on a book tour talking to Jay Leno, Charlie Rose, Don Imus, and the host of book notes (GM Feb. 28; see Figure 1, p. 4): the book that Dolly was promoting was humorously titled "My Mother My Self," pointing to underlying issues of identity. On March 3 *Le Devoir* uses the same photo of Dolly bleating into a microphone to accompany a story about the Pope's reaction to the cloning development. A cropped version of this same photograph accompanied an article on Clinton's moratorium on human cloning a couple of days later (LD March 5). Both of these articles reported reactions to the possibility of human cloning. On March 6 (CS), a humorous religious dimension was added by a photo, showing Dolly surrounded by photographers, which was captioned "Dolly Lamba," echoing the title of the charismatic Tibetan leader. Dolly's namesake, Dolly Parton, was mentioned in this same article, adding another level of humanization and celebrity.

The importance of how images are used is underlined by the various appearances of one specific photo of Dolly, standing alone facing and staring into the camera. This one photo was used more often than any other, four times in the first two days. On Feb. 24, the first day of newspaper coverage, *The Toronto Star* and the *Calgary Sun* both used this photo: *Toronto Star* depicting the freakish nature of the event, as reinforced by a caption, "This is Dolly the clone, the daughter of none"; and CS, with the caption "Hardly Sheepish," foreshadowing the humanization of Dolly that would take shape in the days ahead.

News magazine coverage shows these same characteristics. Both *Maclean's* and *People* characterized Dolly as a news personality and coupled this with ethical concerns. *Maclean's* used the same photo of Dolly being photographed by the media on its table of contents and on the first page of the main story. The latter image bore the caption, "Dolly in the limelight: religious leaders and many ethicists shuddered." *People* had both a photo

of a sheep that seemed to be lecturing to an absorbed audience of fellow sheep and a photo of Dolly shunning the paparazzi. The subtitle of this article read, "The debut of a lamb cloned from a sheep signals a time of ethical questions and mistaken identities." The link between the humanization of Dolly and her status as the object of a media frenzy was made explicit: "'Who's the freak here?' Dolly might well have wondered gazing back at the pack of one-eyed humans" (*Maclean's*).

Media characterization of Dolly in images went beyond simply portraying her as the animal at the heart of the story. They showed Dolly as the bewildered subject of worldwide attention, and as the unwitting personification of a host of scientific, ethical, political, and social issues. The storyline linked the technology of cloning to these various dimensions more directly.

This chapter explores these various dimensions, first by discussing themes that emerged through the grounded analysis. Two overlapping themes were especially significant in the development of the human cloning story: issues of identity, and issues of ethics, involving several specific concerns. Additional themes to be discussed are progress and regulation. This will be followed by a discussion of the parts that various actors played in the discussion of these themes in the media coverage.

Themes

Discussions of Dolly and of the significance of the cloning technology that produced her tended to center on a number of themes. These themes were arrived at through the process of open coding described above.

Identity

Many articles expressed concern about human cloning's potential to erode individual identity. The relation between identity and genetic structure was a significant theme. Some articles countered pessimistic and sensational views by distinguishing between genetic identity and the human personality. Parallels to twins were often drawn, naturalizing cloning by equating it with a "natural" process. Discussions of human cloning went beyond images of twins to speak of copies of particular individuals. This issue is one that raised particularly sharp ethical concerns.

Discussions of identity centered on the relation between identity and genetics, but this relation was ambivalent, as reflected in cartoons and images. On the one hand, genetics lies at the heart of important scientific developments, and the reduction of identity to DNA is linked to the positive aspects of new reproductive technologies. On the other hand, if we are our DNA, then cloning represents sciences having the potentially dangerous power to control and manipulate identity. This ambivalence manifested itself in the very intense ethical debate which was both reported and carried out in Canadian newspaper coverage of Dolly and the cloning story.

Ethics

Ethical concerns, almost all centering on the potential of human cloning to erode basic values, were very prominent. These concerns were justified by a range of reasons. On the one hand, cloning was framed as a transgression of an absolute moral boundary. On the other hand, very often, it was just asserted that cloning humans is wrong and no reason was given. From the range of arguments, this section considers five themes in detail: issues of women and reproduction; appeals to religion; invocations of the mad scientist as a figure of distrust of science; and concerns about the cloning of specific sorts of 'others.'

Surrounding the theme of women and reproduction, three themes were mentioned

most often, changes in reproductive practices, erosion of family values, and commodification of the body. Each of these issues was raised in the context of the possibility of human cloning. These concerns in the area of women and reproduction portrayed human cloning as having potentially very serious ethical repercussions. These issues are related to issues of identity, but here the social and reproductive identity of humanity, not just individual identity, is seen as being threatened by cloning.

Arguments and metaphors that drew on religion and magic were often used to suggest that science, as illustrated by Dolly, violates fundamental values and threatens to take over God's work of creation.

The mad scientist theme was present through references to movies, books, and fictional characters are prominent in discussion of the issues raised by cloning and are often used to dramatize the negative potential of human cloning. This appeal to popular culture stands over against appeals to progress and the benefits of biotechnology: *The Boys From Brazil* and *Frankenstein* invoke the mad scientist and his threatening creatures. Frankenstein was also mentioned several times (see Figure 6). This image is an especially powerful way to evoke ambivalence regarding science and progress (Turney, 1998).

"Frankenstein" represents the side of science opposed to basic, even religious, values: It represents the dark side of the possibilities made real by the cloning.



Figure 6. *Boys from Brazil* (1978).

References to films of clones and doubles, especially *Multiplicity* and *Boys From Brazil*, were also common in media coverage in the weeks following the announcement of Dolly. Various types of 'others', in addition to mad scientists, were presented as possible misusers of human cloning techniques. Another type of

"other" is the nut or rich person that may be tempted to clone himself. However, there is more to this sort of image than the question of whether dictators or the rich will really clone themselves. Like the mad scientist, this sort of "other" represents concerns over the ambiguous potential of the cloning technology.

Progress

Five themes can be considered under the general heading of progress: progress and the transgression of boundaries, trust in progress, utilitarian discourses, scientific limitations, and business. The core set of issues here are those that appeal to the value of progress and to the veneration of scientific or technological invention.

Concerns with the possible implications of cloning were often expressed in terms of unease with scientific progress. However, occasional voices took issue with this general view, for example as embodied in the idea that cloning is unnatural. This unease with possible conflicts between values and scientific progress was expressed in general terms. Progress metaphors were also used to express the idea of crossing a boundary. Images and evocations of progress was framed in extremes. Some voices worried that, with cloning, science was out of control, that it had crossed natural boundaries that shouldn't be crossed. However, others saw cloning as a technique for use on animals that represented just another step in scientific and technological progress with potential benefits.

Beyond these sorts of examples of ambivalence regarding science and technology, progress was often discussed more explicitly in the media coverage of Dolly. There was some discussion of the history of cloning, most of it centering on whether Dolly is a big step forward or not. The nature and effects of scientific and technological progress were important themes. Attitudes ranged from admiration to ambivalence, from claims that Dolly marked a radical breakthrough to claims that she represented old science. However,

all these views seemed to agree that the development of the somatic nuclear transfer technology was an instance of progress, of a new ability to intervene in the world.

Many arguments focused on utilitarian discourses. Discussions of benefits were an important aspect of the coverage. Potential benefits of the cloning technology were discussed mainly as applied to animals. Potential benefits generally fell under four headings: improvements to agricultural products, better production of drugs, increased availability of organs for transplants, and research into human diseases. Discussions of risks were less prominent.

Some articles drew attention to the fact that the experiment that produced Dolly had not yet been duplicated. Discussions of scientific limitations were sometimes used to reassuringly limit the sphere of the technology to animal cloning: several sources pointed to the potential difficulties of extending the cloning technique to other species, especially humans. Some pointed out that animal cloning would hold little usefulness for some industries. In general, these discussions of scientific limitations served to insulate risk/benefit calculations regarding animal cloning from the more ethically loaded issue of human cloning.

In terms of its relation to business and industry, the Dolly story went two directions. On the one hand, some sources focused on the potential investment implications of the technology. On the other hand, some feared that business would use the technology with an eye to profit rather than ethical issues.

Regulation

Regulatory issues were most often raised in terms of which countries had or were planning laws against human cloning. Related stories focused on government reactions. Discussions of existing and potential legislation focused on human cloning. There was no

mention of legislating animal cloning.

Thematic Characterization of Actors

Work on the social construction of technology promotes the view that technology shapes and is shaped by society. This study explores the latter process, examining how interested actors engage in this shaping process via their rhetorical claims and strategies. This process is examined in this section. Table 1 shows which actors, excluding the media, were drawn upon each day of the newspaper coverage; during the first few days of coverage and the weekend the media tended to draw upon more sources. Table 2 outlines the main arguments given by each group. The following section looks at each group in depth.

Table 1. Newspaper Sources by Day

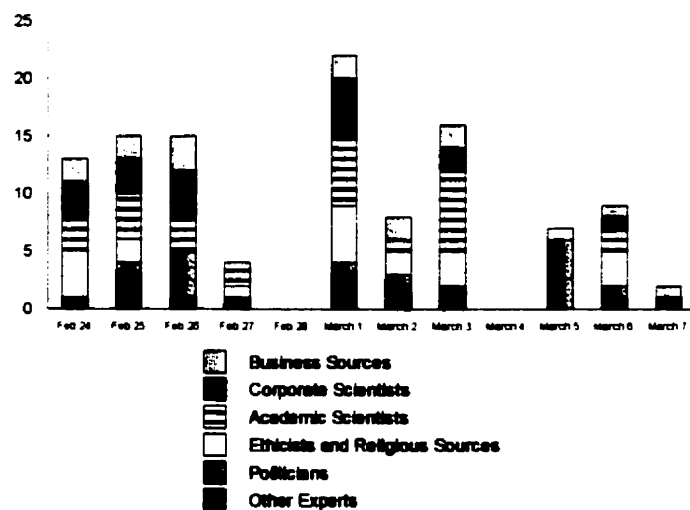


Table 2. Main Arguments by Actors.

Actors	Main Arguments
Media	Fears concerning the potential negative implications of cloning were framed both in terms of a perceived threat to identity and as an unease with science that was presented in terms of the image of the mad scientist, as well as in discussions of legislation. Framed the story as a breakthrough within the story of scientific progress.
Business	Animal cloning has potential investment implications based on agricultural uses. Human cloning should be prohibited.
Corporate Scientists	The technique can be extended to provide agricultural and medical benefits. Wilmut says human cloning is ethically indefensible and should be legislated.
Academic/Medical Scientists	Dolly represents a significant scientific breakthrough with immediate scientific benefits, potential medical benefits, and some risks. Cloning crosses a scientific boundary.
Ethicists/Religious Experts	Cloning is a radical breakthrough with disturbing implications, but with potential medical and agricultural benefits. Human identity is not reducible to DNA. Human cloning would cross an ethical/religious boundary and should be legislated.
Politicians	The potential ethical, religious and legal implications of human cloning warrant consideration.
Other Experts	Threats to identity, crossing boundaries, ambivalence to scientific progress and legislation of human cloning were discussed.

There were several different types of actors with different positions on many issues. The list of actors to be considered includes Business, Corporate Scientists, Academic and Medical Scientists, Ethicists and Religious Experts, Politicians, and Other Experts. An initial list was arrived at by noting all sources cited. Paying attention to similarities and differences in their positions on key themes resulted in the final list. For example, the initial category "Scientists" was split due to their expressing different perspectives and the initial categories of Ethicists and Religious Experts were collapsed due to similarities. With the exception of those from business, most categories of sources made some reference to human cloning. However, many of those that commented on ethical issues regarding human cloning also pointed to the medical and agricultural benefits of the animal technology.

The following six sections examine the stances that these five groups of actors, and an additional category of "Other Experts," took with respect to themes of identity, ethics, progress, and regulation. Other experts included entertainment figures and professionals not included in the six main categories.

The Media

The media was a key actor in the coverage of Dolly because journalists, photographers and editors literally shaped the story. However, the story of Dolly, even as expressed in media coverage, was much more than the creation of any single actor, including the media. Two figures closely tied to the development of Dolly were very surprised with how the story took off. Dr. Harry Griffin, assistant director for The Roslin Institute, said that his office was overwhelmed by the worldwide news media attention in the days after the announcement regarding Dolly (GM Feb. 27). Alan Colman, research director of PPL Therapeutics said, "We have been surprised by the extent of the political

and international reaction . . ." (LD March 6).

Popular culture references and themes were prominent in Canadian coverage of Dolly (*Boys from Brazil*, *Frankenstein*, copying celebrities, clone movies). The prominence of these references was due more to journalistic references than to citations of the social groups considered later in this chapter

Identity. The media commonly framed the technology that produced Dolly as a development that could lead to human cloning and, hence, that calls human identity into question: human cloning "raises countless questions about fate, immortality and the nature of self" (CS Feb. 25); "It's an event that changes not just our understanding of nature, but also our own nature." (TS Feb. 26); there should . . . only be one of any of us" (TS Feb. 25).

Issues of identity were often emphasized by metaphors that compared cloning to mechanical reproduction: "mirror image" (GM Feb. 28). "carbon-copy" (TS Feb. 24); "she was manufactured" (CH Feb. 27); "drug factories" (GM Feb. 24); "xerox" (*Time* March 10).

The assumption implicit in these metaphors of mechanical reproduction, that a clone is identical to the original, stood behind other fearful statements: *New York Times* columnist William Safire warned that "Cloning's identity would restrict evolution" (GM March 6); Libby Purves, *Times of London* columnist, said that "Diversity in all living things is our best hope" (CH March 2).

In order to counter the perceived threat to identity, many journalists emphasized the parallel between clones and twins (e.g., GM March 4). Others argued that environmental factors would result in important differences between clones or expressed concern over the reduction of identity to DNA (e.g., CS March 5).

Images were an important way in which the media presented certain view of Dolly

and cloning. The most commonly used photo of Dolly, standing alone facing and staring into the camera, was used in a way that emphasized the theme of clone as copy. This one photo was used more often than any other, four times in the first two days. Most

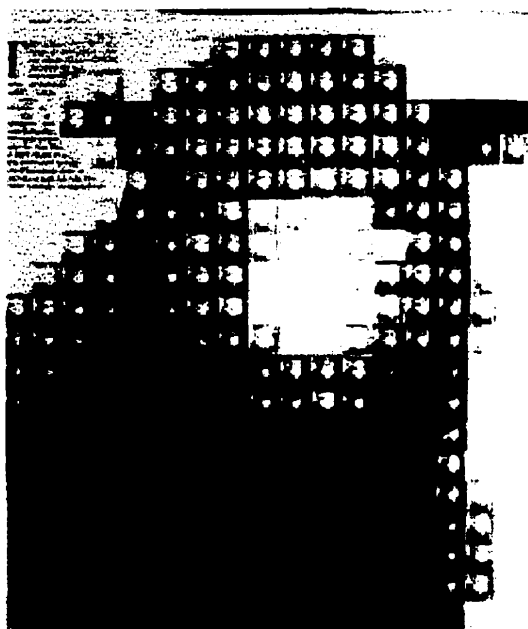


Figure 6 *Toronto Star*, March 1, 1997.

importantly, this common image then became an original which itself was subjected to processes of duplication and mass reproduction. It was duplicated on day four (CH), where two identical Dollys stare out from a single image. By day six (TS), a cropped version of this photo was reproduced over two hundred times to make up a large compound version of the same image: this most often replicated image of Dolly has become a mechanical reproduced element reflecting itself for the viewer (see Figure 7).

Issues of identity were often expressed in terms that drew on popular culture images.

Replication of celebrities was portrayed repeatedly, perhaps because famous people serve as popular paradigms of identity. Jean Charest was depicted in multiple-copies in a cartoon (GM Feb. 25) and several pictures of Michael Jordan are presented on the sports page (TS Feb. 25). On March 4, *Le Devoir* reproduced a *Der Spiegel* cover that showed one Dolly but many clones of Hitler, Einstein and Claudia Schiffer (see Figure 14, p.111).

Popular culture was present in references to books and films in news magazines as well. For example, five of the ten articles in the magazines included in the sample referred to films or Hollywood, *Boys From Brazil* being cited the most often. There was a still shot from *Multiplicity* in both *People* and *Maclean's*. *Maclean's* had an entire article taking a

retrospective look at the theme of cloning in film; it suggested that "cloning is what Hollywood is all about. . . the dubbing down of mass culture."

In news magazines, many visual images emphasized identity issues. Both *Time* and *Maclean's* presented visual images of duplications: Dolly on the front cover of both magazines; a woman pointing in astonishment at 8 overlapping images of herself (*Maclean's*); a photo of a 1936 Nazi rally in Berlin with seemingly identical soldiers (*Maclean's*); these images evoke ethical concerns over the cloning of humans.

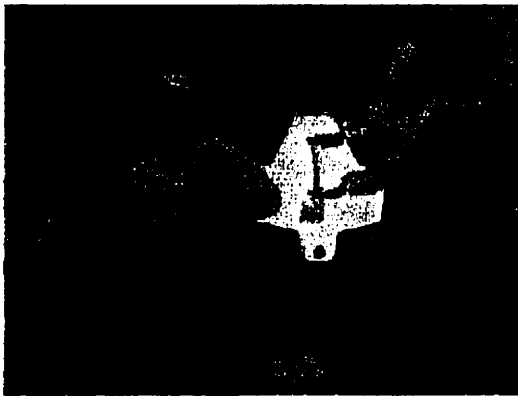


Figure 8. *Sleeper* (1973).

Television also made popular culture references. CBC's *The National* played clips from *Boys from Brazil* and *Sleeper*, both concerned with issues of identity (see Figure 8). In the clip from *Sleeper*, Woody Allen and Diane Keaton are disguised as doctors, and Allen humorously explains the cloning process: "What the doctor's doing here, is placing the garments, because we're going to make an

attempt to clone the patient directly into his suit."

Ethics. In general, the media coverage of Dolly gave a sense that the cloning of Dolly had potentially serious ethical implications: "Dolly represents the most icy of slippery moral slopes" (GM March 1). Letters to the editor also emphasized the ethical implications of cloning: "the very idea of genetically replicating anything is laden with moral questions. . . Surely it is time for a very loud debate on the science of the lambs" (TS March 4). Cloning was often framed as a transgression of an absolute moral boundary: it is "playing God" (TS Feb. 27; CH Feb. 28; GM March 3). Comparisons were made to eugenics and to the development of new means of mass destruction (TS Feb. 26; CH March 2).

Most articles at least touched upon human cloning, and discussions of human cloning inevitably commented on ethical implications. This began on the very first day of coverage, on which TS and CH had a more extensive discussion of human cloning. The *Toronto Star*'s news breaking title, "Genetic Marvel Spawns Potential Ethical Nightmare,"

highlighted the tension between scientific progress and ethical concerns from the initial moment of the story's presentation to the public (TS Feb. 24).



Figure 8. *Calgary Sun*, Feb. 28, 1997.

The prominent concerns that cloning, especially human cloning, would transgress boundaries were often expressed in religious terms: "possess the same power as God" (TS Feb. 26); "meddling with creation . . . God's sacrosanct make-work project" (GM Feb. 28); "Contrary to what people think, cloning does not make us God!" (CS Feb. 28; see Figure 9); "Morally, it ruffles all sorts of religious feathers. . . will doing such an end run around

God's divine order result in a final and

ignominious end to the game?" (CS March 5). Science is portrayed as dangerous because it crosses a God-given boundary and seems to claim God-like powers by doing this.

The religious symbol of the "lamb" was used several times. An example was the citation of part of Blake's *Songs of Innocence*: "Little Lamb, who made thee?" (Feb. 28 GM). On March 1 in *The Globe and Mail* Dolly was referred to as an "immaculately conceived lamb." Finally a letter to the editor from a nonreligious reader finds it significant that Dolly was "born at the turn of the millennium, at the predicted Second Coming; The

lamb is a virgin birth. . . Christ was himself hailed as the Lamb" (GM March 3). A column evoked this image with the title "Humble sheep heralds rebirth of soul"(CH March 5).

The media framed cloning as posing religious as well as ethical concerns: cloning "poses profound questions encompassing biology, philosophy and theology about the nature of human life, the soul and the reproductive process" (CH March 2). LD, the Quebec paper, had the most prominent mentions of religious issues.

Magic was a related source of metaphors that framed the cloning of Dolly as a radical breakthrough that signaled the strange powers of science. On Feb. 25 both CS and CH carried an same Associated Press story that began, "It's as if the birds and bees are now totally irrelevant. Around the world, biologists huddled around laboratory water-coolers yesterday to assess the latest installment in a gripping biotechnology soap opera--the creation, as if by magic, of a lamb named Dolly." Magic metaphors also emphasized a boundary being crossed into the unknown: "This is not a genie that will go gently back into the bottle" (CS March 5).

Three issues related to women and reproduction were presented by the media. First, cloning was presented as "the end of sex" as we know it (GM Feb. 25). Gina Kolata, in the original New York Times report suggested that a woman could theoretically bear a clone of herself (reprinted GM Feb. 24). The effects of this possibility were mentioned several times: "Sperm . . . is passe. Men, too Only eggs are needed."(CH Feb. 27); "[p]opular culture has long been preparing us for this glum moment in history when we no longer need sexual intercourse to replicate ourselves" (GM Feb. 28); "Men are about to become obsolete." (TS March 5). Even where these possibilities of changing practices of reproduction were argued against, the language used evoked the image of technology out of control: "it's a bit too early to mourn the End of Sex and declare a Brave New World in which people have first names and model numbers" (CS Feb. 25). Second, human cloning was seen as a potential threat to values of the family and of romantic love. A cartoon

showed a world where courtship and romantic love were dead (CH March 2). The third theme was the commodification of the body. A columnist asked, imagining the consequences of human cloning, "How much is your mother worth? Your girlfriend? Or your kid?" (LD March 3). This issue was related to one where women would be needed to act as surrogate mothers: to "clone humans would call for women willing to be 'pseudo' pregnant to carry the clone" (CS March 2).

Mad scientists were mentioned by the media several times in ways that emphasized mistrust of science. Cloning was called "Star Trek run amok, Isaac Asimov gone mad" (CS March 5). A list of "past creations of the mad scientists of the movies" underlined this ambivalent way of framing Dolly (GM March 1). Comparisons to other developments seen as dangerous scientific advances were made: nuclear weapons (TS Feb. 26; CH Feb. 26 and 7; CS March 2); "Science, having brought us mad-cow disease. . ." CS March 2). Frequent references to Huxley's *Brave New World* (CS Feb. 25; TS Feb. 26 and March 1; GM Feb. 27, 28 and March 1; CH day 7 and day 13) point to a more general dystopian worry: "Brave New World of eugenics" (TS Feb. 26); "we stand now at the entrance to Aldous Huxley's *Brave New World*" (CH Feb. 27). Vicki Mayberry, of the *CTV National News*, reported that "A brave new world has arrived with the debut of Dolly" (CTV Feb. 24).

Even where cloning was presented in a more positive light, the image of the mad scientist served as a touchstone: "Dolly . . . doesn't look like Frankenstein's monster" (CH March 2); "Frankenstein's laboratory [is] not needed for this technique" (CS Feb. 25). Several other mentions of Frankenstein resonated with these concerns (CH days 4 and 7; GM Feb. 28; CS March 3).

They also present ethical concerns with crossing boundaries. Two cartoons illustrate these two dimensions of critique: A scientist holds up a hand mirror filled with multiple images of his horrified face as he drops a test-tube labeled "CLONING" which

spills over as it falls; a scientist says, "Contrary to what people think, cloning does not make us God!" and God responds with a thunderbolt, saying "Don't you forget it!" (CS days 5 and 9; see Figure 9).

Editorial cartoons in the blue-collar tabloid showed stereotypical mad scientists (CS days 5 and 9). These images are also evoked less directly by, for example, showing Wilmut in silhouette holding and gazing into a test-tube above the headline "Nightmare scenarios foreseen" (TS March 1) or showing Wilmut gazing self-absorbedly outside the frame, apparently at the word "fears" in the article's headline, with the caption "untroubled" and anchoring a column of text where Joseph Rotblat worries that genetic engineering might "lead to other means of mass destruction more readily available than nuclear weapons" (CH Feb. 26; see Figure 10).

In general, characterizations of scientists tended to be negative: "well-aware of the

fears

where she was created.
ever, Joseph Rotblat, the nuclear
dist who won the 1995 Nobel
Prize for his campaign against
atom bomb that he helped create,
is convinced.
worry is that other advances in
the science may lead to other
and mass destruction more readi-
dible than nuclear weapons. Ge-
engineering is quite a possible
means of the frightful potential
often told BBC radio.



IAN WILMUT: CRYSTAL CLONING

Figure 9. *Calgary Herald*, Feb. 26, 1997.
(Reuters)

spectre they have raised" (CH March 3); "the idea of cloning humans has fascinated scientists since the dawn of the genetic engineering era" (TS Feb. 24); "unleashed a scientific genie" (TS March 1). Portrayals of Ian Wilmut draw this together with images of Frankenstein. In newspaper coverage, "Wilmut . . . said he was untroubled by nightmares." In news magazines,

both *Maclean's* and *Time* characterized Wilmut as Dr. Frankenstein in a prominent space on the page: "One doesn't expect Dr. Frankenstein to show up in a wool sweater. . ."; "Critics call the leader Dr. Frankenstein." (The former passage reappeared in the 75th anniversary edition of *Time* in March 1998.) Although *People* presented Wilmut in a more personal way, by chatting about his hobbies, he was asked whether he has any moral problems with his discovery. All of the pictures of Wilmut characterize him as the scientist

creator: with Dolly (*Time*), in a lab coat with a microscope behind him (*People*), or with a test tube in his hand (*Maclean's*).

"Dictators" were often mentioned as possible misusers of human cloning (GM Feb. 28, TS March 1, CS March 2). These references were often fantastic: "nightmare visions of duplicate dictators dancing like sugar-plum fairies" and "the reproduction of little Hitlers" (TS March 1). The spectre of cloning dictators was evoked by references to Saddam Hussein (TS Feb. 25, CH March 1), to Hitler (TS Feb. 24 and March 1; CH March 2; CS March 5; GM day 13), and to the film *Boys From Brazil* (TS Feb. 24, 27, and March 1; GM day 4 and day 6; CH day 4 and day 5). One article suggested "the possibility of a great new thriller, *The Sheep from Brazil*" (TS Feb. 25).

Again, reassuring statements often accepted the same image as a touchstone: syndicated Southam columnist Andrew Coyne wrote that "[s]omewhere between refusing blood transfusions and 'The Boys From Brazil' there is a middle ground" (TS Feb. 27, CH Feb. 28).

Progress. Issue of progress were generally linked to views of science. Some media comments reflected an opposition between science and society: "scientists and the general public [have gone] in very different directions" (GM March 1); "Science is moving very fast and human wisdom, ethical and social responses, are moving less rapidly. . . . Modern science and technology need a considerable amount of social oversight." (CH March 2). The incompatibility of science and ethics was also noted: "while science is able to give us very specific answers to technical and reductionist questions, the larger human and environmental questions must still be addressed from the perspectives of art, philosophy, ethics and politics" (TS March 4). Science and ethics were also seen as separate by Art Vandenberg, a reader writing to the *Globe and Mail* web-site, whose email was cited in the paper: "morality is always one step behind technology" (GM March 1).

On March 2, *Le Devoir* ran a story that said, "A small team of scientists entered into a kingdom that novelists have for a long time written as diabolic. The literature had already envisaged, in this domain, all the nightmares, for example the cloning of a few dozen Hitlers" (LD March 2). On the same day a Calgary Herald stated that "The prospect of human cloning . . . opens doors to many nightmares. Those doors should be immediately closed and bolted shut" (CH March 2).

Science was sometimes portrayed in terms of instrumentality: "what can be done . . . will always be done" (TS Feb. 26; cf. TS March 1; LD March 2).

Cloning was sometimes presented not as a radical breakthrough but as an extension of scientific and technological progress. In a story on *The National*, Bob MacDonald introduced a piece on "Dolly, the first cloned mammal," which included clips from both *Sleeper* and *Boys From Brazil*. It used them in this same way but normalized cloning animals by a comparison to the cloning of plants: "it's been the stuff of science fiction and fantasy movies up until now, scientists making copies of people, with all the scary ramifications. . . but actually we've been doing it for centuries and it's a lot closer to everyday life than you may think. Do you like Macintosh apples? These are clones." Comparisons between cloning with other developments had this same effect: "like the first publication of Charles Darwin's *Origin of the Species*" (TS Feb. 26).

The technological development responsible for Dolly was often linked metaphorically to the development of nuclear technology: it is "like the first splitting of the atom" (TS Feb. 26); "We have just experienced a change in the human condition as crucial as the Copernican revolution or the splitting of the atom" (LD March 2). This linked progress to the transgression of boundaries. Progress metaphors and nuclear metaphors were often linked in the coverage of Dolly.

The theme of trust in progress was presented mainly in discussions of the science

involved. Scientific progress is presented through the use of diagrams that explain the science involved with the cloning of Dolly (GM, CH March 1). These images express a confidence in the matter-of-fact nature of scientific expertise that reflects the continuing

POTENTIAL for MALICE

Breakthrough in cloning

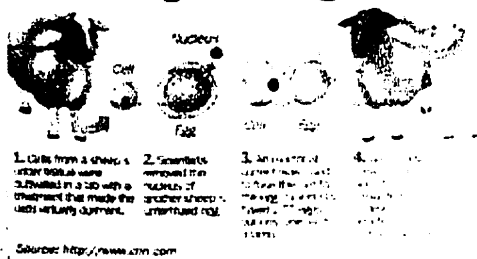


Figure 10. *Calgary Herald*, March 1, 1997. (CNN)

legacy of the Enlightenment. *Time* was the only magazine to provide insets clarifying the science and techniques involved: diagrams of the cloning process and a photo of a pipette removing the nucleus and DNA from an egg cell. This scientific content, however, was part of a story emphasizing identity fears: the subtitle stated that a "line has been crossed" and an illustration on the title page showed a

human bubble gum machine of identical clones. Figure 11 demonstrates another case of this in the *Calgary Herald*; the words "Potential for Malice" are used to frame the diagram.

Sometimes, the sense of inevitable scientific progress was tinged with ambivalence. For example, as reported in *Le Devoir*, the *Japan Times* said, "Whether we're ready or not, the future is already among us" (LD March 2).

The news coverage was quick to look past Dolly to signs of continuing scientific progress along the path that she had taken the first steps on. Several stories extended the issue of animal cloning to other species. On March 2 and 3 all five papers reported the recent embryonic cloning of monkeys in Oregon, a development which "added fuel to the fiery cloning debate" (CS March 3). This development was framed as a step toward human cloning. On March 6, LD had a large article discussing extensions of the cloning technique to other species; of all items coded, this article included the most extensive discussion of transgenic animals. On Feb. 26, TS reported that Toronto doctors had previously produced embryonic clones of mice; several articles mentioned the previous cloning of cattle (e.g.,

CH Feb. 25, GM March 1).

Utilitarian discourses were not very prominent in media statements. On the first day of coverage all of the English-language newspapers had some discussion of benefits, although the tabloid had significantly less. On day three the *Globe and Mail* had the most extensive coverage of benefits. The larger articles in all the newspapers had significant coverage on days 6 and 7. However, there was some mention of benefits in some smaller articles on other days (e.g., GM Feb. 25). Certain metaphors highlighted these uses of cloning: "designer critters" (GM Feb. 26); "designer sheep" (GM Feb. 28). One letter writer raised the possibility of cloning endangered species (CH Feb. 28).

Scientific limitations were addressed at several points. Several articles in each English-language paper addressed limitations of the cloning technology. Half of the 18 articles that mentioned scientific limitations emphasized the inefficiency of the technique, often mentioning that 277 fused eggs were implanted in order to achieve Dolly. GM (March 1) gave perhaps the most accurate description of the process: "[f]usion with mammary DNA was only successful in 277 out of 434 cases; of these only 29 divided sufficiently for implantation; they were planted in 13 ewes; only Dolly was born." There was some mention of scientific limitations on almost every day (GM: days 1, 3, 6, 8 and 11; TS: days 1, 3, 4, and 9; CS: two on Feb. 24 and one on March 2; CH: days 3, 5, 6, 7 and 12).

The media did not mention business issues much. Quebec journalists emphasized the dangers of the profit motive and worried about "biocolonization" at the hands of "neoliberalism" (LD Feb. 25; LD March 3). A *Toronto Star* column said "gene havens will develop . . . like the biological equivalent of tax havens" (TS Feb. 26).

Regulation. The media reported often on existing and proposed legislation addressing cloning. Thirteen articles mentioned Canada's proposed legislation (later

abandoned when an election was called): GM Feb. 28; CS March 2 and twice on March 5; TS Feb. 24, 25, 26, and 27; CH Feb. 24, 25, 26, 28 and March 1. One article mistakenly claimed that Canada already had made cloning humans illegal (TS March 1). Britain's legislation against human cloning was mentioned seven times: Feb. 25 (GM); Feb. 26 (TS); Feb. 27 (TS); Feb. 28 (GM, CH); and March 1 (GM, TS). However, a columnist in LD suggested that the U.K.'s reluctance to legislate in this area was an important reason that the breakthrough occurred there: "the regulation of the weakest, in this case Great Britain, is the one that in the end will be applied" (Feb. 25). The U.S. government's ban on human cloning was reported on March 5 (GM, TS, CS, LD) and March 6 (GM). The creation of a bioethics advisory commission in the U.S. was reported on Feb. 25 (TS), Feb. 26 (CH, LD), and March 1 (TS, CH). The cut in funding for the Roslin Institute was reported on March 1 (GM, CH, and CS) and March 2 (CH, CS).

In the French coverage, religious voices are given some play in the call for legislation: *El Pais* (Madrid) is cited as calling for an "Interdisciplinary reflection on an international scale that helps clarify these new situations" (LD March 2). The Vatican newspaper, *Osservatore Romano*, was cited as calling for laws prohibiting the cloning of humans (LD March 3).

To summarize, the media coverage of Dolly contained some discussions of the science involved, pointing out limitations of the technology but framing it as a breakthrough within the story of scientific progress. Fears concerning the potential negative implications of cloning were framed both in terms of a perceived threat to identity and as an unease with science that was presented in terms of the image of the mad scientist. The media also discussed legislation, framing this as an issue of protecting human interests from any threat posed by human cloning.

More generally, both journalistic text and visual images in Canadian newspaper coverage of Dolly show a fundamental ambivalence. On the one hand, we see images of

fear, images that reflect an anti-rationalist critique of science as well as ethical and religious concerns with crossing boundaries. On the other hand, we see an ambivalent fascination with cloning as both a freakshow and an enchanting play of doubles. Multiple copies of politicians and other celebrities parade across the page (LD day 9; CS March 5). Two rhesus monkeys produced by embryonic cloning huddle together pathetically—"Monkey See. . ." (CH and CS March 3). Identical twins smile playfully above a reassuring caption. Drawings show absurd copies of people: a man with a younger self perched on his knee like a ventriloquist's dummy (GM March 6); a woman like a character from Alice in Wonderland lecturing herself (CH March 2). These images, like the many puns and jokes, express both anxiety and playfulness in the face of what was perceived as a major development in reproductive technology.

Business Sources

Relatively few citations of business people were present in the sample of coverage. This group mentioned both medical and agricultural benefits of animal cloning as well as asserting that humans should not be cloned. Evaluations by business people of the economic prospects of animal cloning were reported mainly in the first three days of coverage.

Progress. One business source provided a utilitarian justification for cloning animals: Paul Schmitt, Chief executive of Chrysalis International Corporation, said, "This will shorten the time it takes to breed transgenic animals by 2 to 3 years" (GM Feb. 26).

Two business sources commented on the investment implications of animal cloning. Hemant Shah, of HKS & Co. Inc., an independent drug industry research firm in Warren, New Jersey, was quoted in both the *Globe and Mail* and the *Toronto Star* as saying that

"It's more of a scientific event than anything with investment implications" (GM Feb. 25; TS March 3). Dr. Jane Fiskin, a biotechnology analyst with London-based Dresdner Kleimwort Benson pointed out that initial business interest had been intense: "The markup [on PPL Therapeutic's stock] is just incredible. . . . I'm not surprised to see it coming off a bit. It's jumped a lot"; and she suggested that once the technique becomes optimized, it will be significant (GM March 1).

No business sources were cited regarding Progress and the Transgression of Boundaries, Trust in Progress, or Scientific Limitations.

Regulation. One business source was cited in support of prohibiting human cloning: Carl Feldbaum, president of the Biotechnology Industry Organization, the U.S. industry association, suggested that steps should be taken to ensure humans aren't cloned (TS Feb. 24).

To summarize, although the total number of business sources cited was small, two main points emerge in terms of their characterization of the cloning technology and its implications. Using the technology to clone animals was seen as having potential agricultural benefits and investment implications. It was suggested that human cloning should be prohibited.

Corporate Scientists

This group, along with business people, were the main actors to emphasize the positive potential of animal cloning: most sources held that once the technique is optimized, it will be significant. Along with ethicists/religious experts, this group was very vocal in arguing that human cloning is unethical. Ian Wilmut was especially vocal on this issue, and, given his role in creating Dolly, he was frequently cited. Wilmut accounted for all but one

citation of corporate scientists's arguments against human cloning. The variety of ethical arguments was narrower than that of ethicists/religious experts. Wilmut was also a lone voice in this group calling for legislation against human cloning. This group gave the greatest emphasis to both medical and agricultural benefits of animal cloning. Again, Wilmut was the most prominent voice here, but corporate scientists were distinguished from all other groups by the degree of attention to the medical and agricultural benefits of animal cloning even without Wilmut. Benefits that were cited included production of proteins, organs for transplantation into humans, studies of genetic diseases, and increased meat and dairy production. This concern with arguments both against human cloning and for animal cloning might reflect a greater need among corporate scientists (and for Wilmut specifically, given the intense media attention) to distinguish their activities from those of the profit-motivated aspects of the corporate sector that they are connected to. It is also likely that they were putting their work squarely within the bounds of 'acceptable science' and distinguishing it from the science that they knew was publicly abhorrent.

Identity. Identity was not presented as an issue of great concern to corporate scientists. Identity issues in the coverage were almost always framed in terms of human cloning. The one corporate scientist raising an issue of identity did so in terms of animal cloning: Russell Nugent, Senior geneticist at Tyson Foods Inc. suggested that this technology is a "cookie-cutter approach to breeding animals" (GM Feb. 26).

Ethics. Dr. Ian Wilmut, Embryologist at the Roslin Institute and creator of Dolly, was the most prominent voice taking an ethical stance regarding cloning. He said that cloning humans "would be ethically unacceptable" and that he personally found the concept "distressing and offensive" (TS Feb. 24; CH March 7). However, Wilmut was not fearful about the possibility of human cloning because scientists see no clinical or practical reason

to clone people: "Why would you want to make a copy of a human being?"; "We cannot see a clinical reason why you'd wish to make a person" (TS Feb. 24, March 1).

Regarding the cloning of others, Alan Colman, research director of PPL Therapeutics raised "the possibility that some tin-pot dictator might make use of the technology to clone himself" (TS March 1).

No corporate scientists addressed issues of women and reproduction, religion, or mad scientists.

Progress. Trust in progress was a significant theme among corporate scientists. Sometimes progress was seen in a positive light: Ian Wilmut said, "This should be a happy day for mankind," and "science must march on" (GM Feb. 25; TS March 1). John Logan, Vice-president of research at Nextram Inc.(Princeton N.J.), called Dolly a "significant achievement" (GM Feb. 26). Wilmut clarified the unique nature of the experiment that produced Dolly by comparing it to the embryonic cloning of monkeys which was reported on March 2 and 3: the monkey development is "an important step, but the material they used is fundamentally different and easier to work with" (CH March 1). Dolly's status as a step on the path of technical progress is underlined by the importance placed on developing further applications of the technology: Alan Colman, research director of PPL Therapeutics, said "We are presently in the process of extending the cloning technique to cattle and pigs. We hope to obtain the first transgenic sheep made from nuclear transfer. . ." (LD March 6). Both these developments have since occurred.

Utilitarian discourses were also significant among corporate scientists. Ian Wilmut mentioned several potential benefits of animal cloning: "mostly. . .to produce more health-care products"; "a tool in animal husbandry"; "to study genetic diseases"; cloning animals good at producing meat, milk or wool cloning animals that produce useful proteins, e.g., the clotting factor needed by hemophiliacs; making pig organs available for human

transplants; clones of cows that are especially good at producing milk, resisting disease and reproducing" (GM Feb. 24). Alan Colman said that cloning "concerns itself primarily with biomedical applications" (LD March 6). Brian Shea, embryologist with Alta Genetics, said, "With this technology you can take truly superior animals and clone them" (GM March 1). David White, Research chief of Imutran Ltd. (a British unit of Switzerland's Novartis AG that is engineering pigs to produce organs for human transplant): "This could definitely improve our ability to create genetically engineered animals" (GM Feb. 26).

Scientific limitations were discussed by a number of corporate scientists. Some pointed out that animal cloning would hold little usefulness for some industries. Kim Stanford, sheep specialist with the Western Canadian Sheep Research Alliance, said, "I don't see cloning as helping the average sheep producer" (CS March 6). Brian Shea, embryologist with Alta Genetics, pointed out that a similar technology had already been rejected: "Between 1986 and 1992, we cloned quite a few embryos but the person doing it left and we dropped it because it's not terribly efficient in producing pregnancies" (CS Feb. 25). However, Shea suggested that the Scottish experiment could be more useful to farmers because they would know what their product, the adult animals, would look like. He believes it will be 5-10 years before the technology will be put to use in Canadian livestock herds, because of the current limitations: "If it works just one out of every 100 times it is simply too expensive" (CH Feb. 25).

Only one corporate scientist was cited regarding the business implications of animal cloning. Grahame Bulfield, director of the Roslin Institute said in the *Calgary Herald* that Dolly's creators had received an encouraging response from industry.

Regulation. Ian Wilmut was almost alone among corporate scientists in commenting on regulation. He suggested that one reason for his team's having gone public with Dolly was to give the government time to frame legislation (GM Feb. 28). Wilmut

noted that human cloning "is illegal in this country [Britain]" and said that he was "delighted" that Clinton had called for the creation of a committee to investigate ethical issues (TS March 1). In an interview aired on *The National*, early in the coverage, he spoke out against cloning humans and the necessity for regulation:

The reason why we are happy and keen to discuss this with people like yourself and with fellow scientists and with ethicists all around the world, is because we hope that by describing this advance, we can stimulate and inform discussion about this technique, and consider what each particular society decides is inappropriate, and to ensure that there is effective legislation to prevent misuse, whilst at the same time, permitting the uses which are acceptable. (CBC Feb. 24)

Grahame Bulfield, director of the Roslin Institute, addressed a tangentially related issue, the reasons behind cuts to the Institute's public funding, which were announced very shortly after the unveiling of Dolly. The Roslin funding cut, according to Bulfield, was not in any way a reaction to the work that led to Dolly; he also said that one of the reasons that public funding was cut was because the research was more likely to be used by the biotechnology industry (CBC Radio One March 4). He noted that he had been warned of the cuts in Nov. 1996, long before the announcement of Dolly's existence, and he resolved to fight for funding: "I will move heaven and earth to keep resources in that cloning program" (CS March 2; CBC Radio One March 4).

To summarize, corporate scientists emphasized the view that Dolly represented a significant step along the path of technological progress. They stressed potential agricultural and medical benefits. Ian Wilmut, the most prominent corporate scientist, held that human cloning is ethically indefensible and should be legislated.

Academic/Medical Scientists

Academic scientists, along with politicians, were most likely to emphasize that the cloning of Dolly was a significant event and a sign of scientific progress: "unbelievable"; "no limits"; "a mind-blower"(GM, CH Feb. 24; CH Feb. 27; CH, CS Feb. 25). Academic scientists, along with politicians, had relatively little to say against human cloning. Academic scientists emphasized to a greater extent the possible disadvantages of animal cloning: exact copies are more susceptible to genetic abnormalities; DNA in adult cells might have become damaged during aging, passing on genetic deficiencies through cloning. Apart from one ethicist making a similar point, this group was unique in raising these concerns. However, the total number of such comments was relatively small.

Identity. In terms of issues of identity, academic scientists were cited mainly to present the reassuring view that nurture plays an important role in the formation of identity. On this view, cloning's manipulation of genetic nature is not a threat to identity. For example, Alan Bernstein, head of Mount Sinai Hospital's Samuel Lunenfeld Research Institute, said clones "are genetically identical, so their physical attributes will be the same. . . We don't know how much our genetic make-up contributes to personality, but to the extent that it does, they would, have the same, I would say, genetic disposition to a personality type. . ." (TS Feb. 27).

Ethics. Regarding the cloning of others, one academic scientist (Martin Johnson, Professor of reproductive sciences at Cambridge University) said that the wealthy may start "cloning themselves" (TS March 1). Another suggested that this scenario is unlikely: Russ Meintz, director of the Centre for Gene Research and Biotechnology at Oregon State University and director of the human in vitro fertilization laboratory at Oregon Health

Services University, tried to place these sorts of statements in context by saying that "The idea that there is a rich person who is a maverick or an eccentric or worse out on some island is what we call the Jurassic Park syndrome. . . . It's more science fiction than reality." (CH March 3). Richard Dawkins was also reassuring, saying there is "no need to worry about "phalanxes of identical little Hitlers, goose-stepping to the same genetic drum" (CH March 2)

No academic scientists commented on issues of women and reproduction, religion, or mad scientists.

Progress. Regarding issues of progress, academic scientists for the most part saw Dolly as a significant breakthrough. Dr. Neal First, Professor of reproductive biotechnology at the University of Wisconsin said, "The ability to clone dairy cattle could have a bigger impact on the industry than the introduction of artificial insemination in the 1950s" (GM Feb. 24). Dan Rieger, reproductive biologist at the University of Guelph, said, "We have learned something fundamental about cell biology. . . . We have reversed the direction of development" (GM March 1). One academic scientist downplayed the significance of the development: Alan Bernstein, head of Mount Sinai Hospital's Samuel Lunenfeld Research Institute, said, "we've been cloning them [mammals] for at least five years" (TS Feb. 26).

Often, the breakthrough was framed in terms of crossing an important boundary. However, it is important to note the specific nature of this boundary: developing the somatic nuclear transfer technology for cloning animals is seen as crossing a scientific boundary, opening the door to new scientific procedures on many sorts of organisms. Lee Silver, Professor of molecular biology at Princeton University, said "It basically means that there are no limits. . . . It means all of science fiction is true" (GM and CH Feb. 24). Ursula Goodenough, geneticist at Washington University, St. Louis was quoted twice as

saying that "The whole thing is just a mind-blower" (CH, CS Feb. 25). The theme of crossing boundaries was made forcefully by comparison between cloning and the development of nuclear technologies: John Dick, Professor of molecular biology at the University of Toronto, suggested that "in biology now, we are at the same stage where they were when they split the atom" (CBC Radio One, Feb. 26). Joseph Rotblat, nuclear physicist and Nobel peace Prize recipient, brought out the dark side of this comparison to nuclear weapons: "My worry is that other advances in human science may lead to other means of mass destruction more readily available than nuclear weapons. Genetic engineering is quite a possible area because of its frightful potentiality" (CH Feb. 26).

In terms of utilitarian discourses, academic scientists emphasized scientific and medical but not agricultural benefits. M. Susan Smith, director of the Oregon Regional Primate Research Center, said that the work on monkeys would make for "better science, and much better experiments" (CH and CS March 3). Lee Silver, Professor of molecular biology at Princeton University, suggested that cloning might make it easier to find bone marrow donors (GM March 6). George Seidel, Researcher and cloning expert at the Colorado State University, said that in future, using cloned body parts, "you wouldn't have a transplant rejection problem anymore" (GM Feb. 26).

Academic scientists were the most prominent voice addressing the issue of scientific limitations. Some pointed to the potential difficulties of extending the cloning technique to other species, especially humans. Steen Willadsen, the Danish discoverer of the somatic nuclear transfer technique, suggested that there might be species specific problems with human cloning (GM March 1). Robert Church, Emeritus Professor of Medicine at the University of Calgary, Co-founder of Alta Genetics, said, "Domestic animals have been selected for reproductive performance and humans haven't been" (GM March 1). Others raised more general potential problems with the technology. Shiela Shmutz, cattle molecular geneticist at the University of Saskatchewan, suggested that exact copies more

susceptible to genetic abnormalities (GM March 1). Colin Stewart, developmental biologist at the U.S.A.'s National Cancer Institute, said that DNA in adult cells used for cloning might have become damaged, passing on genetic deficiencies (GM March 1). Michael Roberts, Chairman of the department of veterinary research at the University of Missouri at Columbia said that other scientists still needed to discover exactly how the Scottish method works (GM Feb. 26).

No academic scientists commented on business issues or regulation.

To summarize, academic scientists framed cloning as a significant step with immediate scientific and potential medical benefits. Cloning was presented as crossing a scientific boundary, opening up new possibilities for scientists to manipulate living organisms. Academic scientists mentioned the possibility of some risks in their discussions of scientific limitations, mentioning, among other things, that the viability of the technique in humans problematic. They countered the view that human cloning would threaten identity on the grounds that identity is not reducible to DNA. As a group, academic scientists had nothing to say about the ethical or regulatory aspects of cloning, apart from contradictory views of the potential for misuse by 'others.'

Ethicists/Religious Experts

This group raised the majority of arguments against human cloning, though corporate scientists (Ian Wilmut almost exclusively) were also vocal on this issue. This group was also unique (again except for Wilmut) in arguing that the line between animal and human cloning should be sharply drawn. Along with politicians, ethicists/religious experts were substantially more inclined to call for legislation or for ethical discussion regarding human cloning than other groups. Ethicists/religious experts were the only group to explicitly suggest that motives of profit conflict with ethical reasons for not

pursuing cloning research: "there are obviously marketing forces that could use and misuse the technology if we allow those boundaries to be passed." However, the number of such comments was small. Ethicists/religious experts were most prominent in voicing identity concerns in the context of human cloning, primarily by using the image of a "copy."

Identity. Ethicists frequently emphasized that identity is not reducible to genetic characteristics: Patricia Baird, pediatrician and chair of Canada's Royal Commission on New Reproductive Technologies, said, "It is simplistic and naive to think making a genetic copy of someone would mean that the resulting adult person would be identical" (CH March 2). Margaret Somerville, founding director of McGill University's Centre for Medicine, in a breaking news story, was quoted as characterizing clones as "identical, if time-delayed, twins" (CH Feb. 24). Stanley Grenz, Christian ethics instructor at Carey-Regent College, Vancouver, said that he does not believe that the ability to clone humans would automatically threaten the sanctity of the human being--since identical twins are already created naturally (CH March 1). Henry Greely, a bioethicist at Stanford University, addressed this issue directly: "The problem is, we sanctify DNA. People seem to want to be eager to view their genome as their essence. . . . In our secular culture, it's almost taken the place of soul" (GM March 6).

However, cloning's threat to identity sometimes appeared between the lines even when it was denied. This happened at times with appeals to the image of the "copy": Patricia Baird wrote that "making multiple copies of a particular adult human . . . is viewed almost unanimously as being unethical" (CH March 2). At other times, ethicists appealed to popular culture images of cloning individuals: Arthur Schafer, head of the Centre for Professional and Applied Ethics at the University of Manitoba, said,

We could decide the world would be better off with more Dolly Partons. Why not

one Dolly Parton for each city? Why not have several thousand? Every hockey team might want several Wayne Gretzkys. Every basketball team might want several Michael Jordans and every rock group might want several Michael Jacksons. Saddam Hussein might decide: Why should Iraq have only one of him. (CH March 1)

Ethics. Not surprisingly, ethicists emphasized the ethical implications of cloning. Margaret Somerville, founding director of McGill University's Centre for Medicine suggested that it is "urgent to discuss the disturbing ethical questions of such practices" (CH Feb. 24). Bartha Knoppers, law professor and chair of ethics committee for the Human Genome Organization, said that the ethics committees that she has served on "never developed any discussion of why human cloning was wrong. We just accepted that it was" (GM March 1). Knoppers said that there is no "humanity in human cloning . . . just hubris" (GM March 1). Most critics offered objections to human cloning by citing problematic examples of what it could lead to: George Annas, Professor of health law and bioethics at Boston University, said, "Is it reasonable to clone a dying child if this is what the grieving parents want? . . . The answer is no . . ." (GM March 6). This technological advance "could lead to cancer patients being treated with cells from their identical, if time-delayed, twins" (CH Feb. 24). For some ethicists, cloning was framed as a transgression of an absolute moral boundary: Patricia Baird wrote, "Cloning humans is a boundary that should not be crossed" (CH March 2).

Regarding issues of women and reproduction, one ethicist was quoted as saying that human cloning could undermine two-parent family (CH March 1).

Religious experts were most prominently cited in LD. One article, for example, compared Vatican to secular reactions. Pope John Paul II characterized cloning as "dangerous experiments regarding the respect for life," and the *Osservatore Romano*, the official organ of the Vatican, said, "Human beings have the right to be born in a humane

manner and not in a laboratory" (LD March 3).

References to the theme of mad scientists by ethicists were infrequent but revealing. Jeff Nisker, chairman of the ethics committee of the Society of Obstetricians and Gynecologists, linked the theme of the mad scientist to that of transgression of boundaries: "we do not know if we wish to play at being God or Dr. Frankenstein. I'm not even sure many of us know the difference" (CH Feb. 27). Law professor and ethicist, Bartha Knoppers underlined the importance of popular culture images, like that of the mad scientist: "novels and movies are probably the most important source of scientific information in the general public" (CBC Radio One Feb. 26).

The cloning of others was a theme raised by some ethicists. On the first day of coverage, three of the newspapers (CH, CS and TS) have the same quote from ethicist Dr. Richard Nicholson, editor of the *Bulletin of Medical Ethics*: "what is its value if it comes with the enormous risk of some nut trying to clone himself" (TS, CH, CS Feb. 24). Suzanne Scorsone, member of the Royal Commission of New Reproductive Technologies was quoted as saying that "Some very rich individual who had a major ego problem could decide that he wanted all his children to be just like him" (CH March 1).

Progress. The theme of progress and the transgression of boundaries was prominent. Donald Bruce, of the Church of Scotland, underlined the radical implications of cloning: "The imagination runs riot" (CH March 2). Cloning was presented as crossing a boundary: on the first day of coverage, Dr. Art Caplan, bioethics specialist at the University of Pennsylvania, said, "this cloning experiment is both amazing and a bit frightening. What it shows is that it is possible to cross a barrier that some scientists doubted" (*CTV National News*, February 23). Margaret Somerville provided yet another example of linking images of cloning and nuclear technology to emphasize the way that cloning crosses boundaries: "this was the ethical equivalent of the first atomic bomb, only more profound" (CBC

Radio, Feb. 24).

Arthur Schafer, head of the Centre for Professional and Applied Ethics at the University of Manitoba, drew attention to the ambivalence of the new technology:

it has potentially enormous benefits and potentially disastrous repercussions. . . . Science is moving very fast and human wisdom, ethical and social responses, are moving less rapidly. . . . I think the public realizes that not everything that can be done should be done. Modern science and technology need a considerable amount of social oversight. (CH March 1)

Trust in progress was exemplified by Margaret Somerville's pointing out "how far science has come since the first test-tube baby" (CH Feb. 24).

Utilitarian discourses were prominent in comments by ethicists. Patricia Baird, chair of the Royal Commission on New Reproductive Technologies, admitted that "there may be justification for some uses in animals" (CH Feb. 25). In a commentary, Baird expanded on this view: certain "potential uses of cloning in animals . . . are ethically defensible . . . to make multiple copies of an animal that produced proteins that are therapeutic agents for diseases . . . to make many copies of particularly good beef or milk cattle . . . to make copies of animals useful in studying . . . diseases" (CH March 2). On the other hand,

These sorts of arguments were limited to the case of animal cloning. George Annas, Professor of health law and bioethics at Boston University, for example, rejected utilitarian arguments for human cloning (GM March 6).

There was some discussion of risks. Patricia Baird raised the possibility of "large herds of domestic animals being wiped out because the animals are identical and susceptible to a particular infectious agent" (CH March 2).

Scientific limitations were sometimes mentioned in order to reassuringly limit the

sphere of the technology to animal cloning. Arthur Caplan, bioethics specialist at the University of Pennsylvania, said "We have to seriously look into this case. The technique is still too costly and too imperfect to be applied to man" (LD March 3).

Business issues were raised in negative terms. Industry was presented as motivated by interests that could conflict with ethical and religious considerations. Patricia Baird said that the spectre of scientists using the new method to clone adult humans - and possibly to make money doing so - is nearer than many of us think (TS, CH Feb. 25). She added that, "there are obviously marketing forces that could use and misuse the technology if we allow those boundaries to be passed" (CH Feb. 25). John Habgood, Archbishop of York, "Cloning is a means of standardizing products, and that is what industry always wants" (GM March 6).

Regulation. Ethicists were unanimous in calling for legislation in order to prevent human cloning, limiting cloning to work with animals. Margaret Somerville, founding director of McGill University's Centre for Medicine, said "If you can do it with a sheep, then you can do it with us" (CH Feb. 24). Patricia Baird, chair of the Royal Commission on New Reproductive Technologies, "we need some legislation and regulatory regime in place" (CH Feb. 25); Dolly constituted a "clear signal that Ottawa should hurry up Bill C-47 containing recommendations from [Baird's] commission"; "we need to have some guidelines in place so we use these technologies in a humane and wise way" (CH March 1) Baird wrote that the 1993 Royal Commission "strongly recommended that the cloning of humans be prohibited," but that the legislation currently before Commons, which she rightly suspected might "die on the order paper," "contains a clause that would prohibit cloning humans"; there are currently "no legal safeguards"; Baird concludes that, although cloning is "not something Canadians wish to see permitted, . . . it could be quite some time before legislation is in place" (CH Feb. 25). Regarding regulation, Bartha Knoppers made

a clear ethical division between animal and human cloning, and called for clear legislation regarding the latter: "just like the total prohibition against torture and slavery, I think there are scientific possibilities not yet achieved, i.e., human cloning, that we don't even want to consider, and we should not even wait for them to happen . . ." (CBC Radio One, Feb.26). George Annas, Professor of health law and bioethics at Boston University echoed this point, saying that "cloning should be stopped at racehorses, cats and dogs" (TS Feb. 25).

To summarize, ethicists were the most commonly cited sources in discussions of the relation between identity and cloning. They emphasized that identity is not reducible to DNA. This underlines the fact that ethical issues were prominent from the moment Dolly was introduced to readers. Ethicists and religious experts saw cloning as a radical breakthrough with disturbing implications. Potential medical and agricultural benefits were mentioned, along with the possibility of some risks. Human cloning was seen as ethically indefensible, usually on the ground that it would cross an ethical or religious boundary, leading to hubristic or unnatural actions. This is a very different sort of boundary crossing than that mentioned by academic scientists. Legislation against human cloning was called for.

Politicians

Politicians, along with academic scientists, were most likely to emphasize that the cloning of Dolly was a significant event and a sign of scientific progress: "surprising news from Scotland"; "a remarkable scientific discovery" (LD Feb. 26; TS Feb. 25). Politicians, along with academic scientists, had relatively little to say against human cloning, except, of course, for Bill Clinton, who suggested that we would be crossing a line and "playing god." Politicians, along with ethicists/religious experts, were most prominent in calling for legislation or ethical discussion regarding human cloning.

Identity. U.S. President Bill Clinton implied that cloning threatened identity: "Each human life is unique, born of a miracle that reaches beyond laboratory science. I believe we must respect this profound gift and resist the temptation to replicate ourselves" (TS March 5; LD March 5).

Ethics. Clinton again underlined the need to consider the "serious ethical questions" raised by cloning, and he did so in a way that linked ethical and religious issues: "My personal feeling is that human cloning provokes some serious concerns, if we consider our most sacred concepts of faith and humanity. . . . All discoveries that touch on human creation are not simply a scientific question but also of morality and beliefs. . . . We have the responsibility to advance with caution and care" (TS Feb. 25; LD March 5). Religious issues were also raised by Clinton's prominent use of the phrase "playing God," cited in three of five articles reporting the U.S. moratorium on cloning research (TS March 5; GM March 5 and 6).

No politicians commented on issues of women and reproduction, mad scientists, or the cloning of others.

Progress. Clinton provided yet another example of linking images of cloning and nuclear technology to emphasize the way that cloning crosses boundaries: "like nuclear fission, it's a discovery that imposes obligations on us" (LD March 5). Worries about science crossing boundaries was also expressed by another politician: France's Farm Minister warned of "six-legged chickens," suggesting that cloning is unnatural (CH Code No. 66).

Regarding utilitarian discourses, Clinton said cloning "could offer potential benefits in such areas as medical research and agriculture" (TS Feb. 25). Business issues were raised by a British "Ministry Spokesman," who made it clear that further development of

the technology was dependent on industrial interest in it: "if the project is to progress then it is up to industry" (CH March 2).

No politicians commented on issues of trust in progress, or scientific limitations.

Regulation. U.S. President Bill Clinton asked a committee on ethics to recommend "possible federal actions" (TS Feb. 25). Whitehouse spokesperson Michael McCurry characterized this as a request "to study the legal and ethical consequences of this technology" (LD Feb. 26). On, March 5, Clinton announced that the National Bioethics Advisory Commission had been asked to report in 90 days, and he requested a "voluntary moratorium . . . to prohibit the use of all Federal subsidy for experiments on human cloning" (TS March 5; LD March 5).

Canadian responses were also reported. David Dingwall, Federal Minister of Health, said that bill C-47 "addresses a lot of the concerns that Canadians have, and that I certainly have as the minister of health," and he said that a funding ban was "under active consideration" for Canada (TS and CS March 5).

To summarize, politicians framed cloning as a surprising scientific event with ethical, religious and legal implications. They recommended careful consideration of these implications in order to take potential legislative action.

Other Experts

The category of Other Experts includes many different types of sources. Examples of other experts included Don Nichol, Professor of English at Memorial University of Newfoundland, Richard Dawkins, Professor of the Public Understanding of Science, Oxford University, and Vincent Packard, author of *The Remodelled Man*. Citations from

each were used to emphasize aspects of the human cloning story. As is to be expected with a catch-all category, the views of these sources varied widely.

Identity. On the one hand cloning was presented as a threat to identity: English professor Don Nichol warned in a commentary that "individuality would cease to exist" (GM Feb. 28); Some other experts made light of cloning in a way that suggested that cloning would reproduce identity. Richard Dawkins, Professor of the Public Understanding of Science, Oxford University said, "Wouldn't it be wonderful to advise your junior copy on where you went wrong and how to do it better?" (GM March 6). Commentator Don Nichol said, "I want to be the first in line to get another me to take out the garbage. . . ." "no hope for rugged individuality in a futuristic world of biologically engineered conformity" (GM Feb. 28). Don Nichol asked, "Could JFK, John Lennon or even Elvis live again?" (GM Feb. 28).

On the other hand, many other experts argued that cloning does not threaten identity. Vincent Packard, author of *The Remodelled Man*, holds that cloning denies the unique character of human individuality (LD March 3). Apparently contradicting himself, Don Nichol said, "A human clone just wouldn't have the same character . . . if scientists could clone character, then it wouldn't be character" (GM Feb. 28). James Azzopardi, an identical twin, is quoted as saying that "[p]eople think twins are like Etch-A-Sketch, you just make a reproduction and that's dumb" (GM March 1). Thomas Bouchard, psychologist at the University of Minnesota, (GM March 1) also emphasized the parallel between clones and twins in order to suggest that cloning would not reproduce identity.

Ethics. Cloning was sometimes presented in very dark terms: Don Nichol called it "the ultimate in pragmatism and horror . . . [with] humans farming clones of themselves for body parts," according to a commentator (GM Feb. 28).

Nichol also raised the theme of women and reproduction: "If parents can afford 'designer kids' they may well want 'back- up babes'"; "What if our clones should escape, get medical degrees and come after our body parts?" (GM Feb. 28).

Unease with cloning was sometimes expressed in religious terms. Don Nichol wrote, "The question of who made the Little Lamb has become confused, multiple-choice, for the first time since Creation."; cloning is "meddling with creation . . . God's sacrosanct make-work project"; "Thanks to a little lamb named Dolly—taking the sins of the world or creating a whole bunch more?" (GM Feb. 28).

Regarding the cloning of others, Don Nichol suggested the potential use of "secret agents . . . to provide mad dictators with multiple copies of themselves" (GM Feb. 28). On the other hand, Richard Dawkins, Professor of the Public Understanding of Science at Oxford University, reassured readers that there is no need to worry about "phalanxes of identical little Hitlers, goose-stepping to the same genetic drum. . . .

None of the other experts were cited regarding mad scientists.

Progress. Regarding the theme of progress and the transgression of boundaries, cloning was presented in both negative and in reassuring terms. Don Nichol was "frightened . . . that science can make up for God's perfections or nature's mistakes. . . . Science is proving scarier than any sci-fi novel" (GM Feb. 28). Some of the other experts were more reassuring. Richard Dawkins said, "Certainly cloning is unnatural. But unnatural isn't necessarily a synonym for bad. It's unnatural to read books, or travel faster than we can run, or scuba-dive, or fly. It's unnatural to wear clothes, but we do" (CH March 2). Mary Midgely, former senior lecturer in philosophy at Newcastle University, thought we should "forget fears" of Huxley's *Brave New World* (CH March 2).

Several of the other experts commented on the theme of trust in progress. Sometimes progress was presented as inevitable: Patrick Dixon, author of *The Genetic*

Revolution, said, "The lesson of history is that whatever can be done scientifically will be done. . ." (TS March 1). Spider Robinson, science fiction writer, said that it was "all done 20 years ago' in science fiction," implying that cloning is a step along the path of scientific progress (GM March 1).

Some of the other experts expressed unease with scientific progress: An article in *Le Devoir* cited Arthur Koestler to make a similar point: "What is tricky with inventions, is that they do not disinvent themselves" (LD Feb. 25). On CBC's *The National*, author and biotech critic Jeremy Rifkin said "let me be very clear: this is not an elaborate sophisticated technique. It means that any decent college or graduate school student could potentially clone a human being" (CBC Feb. 24).

One other expert addressed the business implications of cloning, taking a pessimistic view of the effect of business interests on scientific research: Martin Hebert, a Quebec lawyer, said, "Pure science is disappearing little by little to profit, while there are no other words but that of commercial science" (LD Feb. 25).

Scientific limitations were sometimes referred to in order to reassuringly limit the sphere of the technology to animal cloning. John Horgan, senior writer at Scientific American said, "Before we start conferring divine powers on ourselves," the limitations of the technique should be considered (GM March 6).

No other experts were cited regarding issues of utilitarian discourses or scientific limitations.

Regulation. Two other experts called for the legislation of human cloning. Joseph Rotblat, nuclear physicist and Nobel peace Prize recipient, called for "the creation of an international ethical committee to control cloning. . . . I do worry, seeing what is being done in the field of genetic engineering" (CH Feb. 26, TS March 1). Patrick Dixon, author of *The Genetic Revolution*, held that human cloning "needs to be regulated and outlawed"

(TS Feb. 24).

To summarize, although the other experts held widely varying views, these views did center on the same sorts of issues as those presented by the other categories of experts: cloning's threat to identity, crossing boundaries, ambivalence regarding scientific progress, legislation of human cloning.

Steps towards Stabilization

The technological frames which developed over the course of the coverage demonstrate two things: the move toward stabilization and the fact that this takes different directions. While the ethical commentary and move towards legislation seem to predict that human cloning will not be accepted as a norm in society, however, there remain some contrasting undertones: some felt that human cloning was inevitable: "human cloning will take place and fairly fast" (LD March 3). One commentator suggested that legislation would only postpone an inevitable ethical debate: "the first trial would . . . [raise] questions like why is it a crime to produce human beings?" (GM Feb. 28). Other voices emphasize the continued development of somatic nuclear transfer as a cloning technique for use on animals.

Several points from the above characterizations of the technological frames of different social groups are worth highlighting here. Ethicists/religious experts (discounting the prominence of Wilmut among corporate scientists) were, not surprisingly, the most vocal opponents of human cloning on ethical grounds in both number and variety of arguments. Very few statements by any actors explained the science of cloning, emphasizing the point that the technology is not simply a scientific phenomenon but one whose social construction draws on a variety of themes and discourses. All social groups

mentioned both medical and agricultural benefits of animal cloning, though corporate scientists did so to a greater extent, a much greater extent taking Wilmut's comments into account. The moral debate emerged early, creating a consensus on the unacceptability of human cloning. The media often emphasized this position: "Dolly seems to look at us and tell us: You made me for the benefit of science, but, before imposing this same treatment on yourselves, you should ask yourselves why God has made you slightly different" (LD March 2). Policy issues focused on national and international discussion of and steps toward the banning of human cloning.

More Recent Cloning Stories: Human and Animal Developments

Since the initial furor surrounding Dolly, the cloning story has continued to develop. This is briefly addressed here to suggest another direction in which the discussion of cloning moved toward stabilization. The animal and human cloning stories have continued with the momentum established in that initial period. A number of experiments with cloning animals have applied the technology used to produce Dolly in other areas, with other species. On the other hand, the prospect of cloning humans continues to provoke moral outrage.

Since the birth of Dolly there have been several further advances in cloning. Wilmut and other Roslin researchers cloned a transgenic sheep, Polly (born in the summer of 1997), by adding a human gene for a specific protein to the donor cell: Polly, that is, was born with a small functional portion of human genetic material (Wilmut, 1998, 61). Dolly's DNA was analyzed, eliminating speculation that she was not in fact cloned from an adult cell and demonstrating that she had made history (Lemonick, 1998, 38; Coghlan, 1998, 4). Ryuzo Yanagimachi and colleagues at the University of Hawaii at Honolulu recently cloned mice using cells from adult donors (Wilmut, 1998, 62; Caldwell, 1999). A research team at

Kinki University in Nara, Japan cloned eight calves from one cow in December of 1998 (Zehr, 1999). A Quebec company, Nexia Biotechnologies Inc., has used the same technique to clone goats; this is the first step to producing spider-silk from genetically altered cloned goats (Zehr, 1999).

Human cloning has also seen an important development: it is believed that researchers at Kyunghe University Hospital in Seoul, successfully used somatic nuclear transfer to obtain a four celled embryo from the cell of an adult woman; they destroyed the



Figure 11. *Globe*, October 27, 1998.

embryo at that stage for ethical reasons (Zehr, 1999). In April of 1999, Researchers at Tufts University in Massachusetts cloned three goats in order to extract a protein from their milk that might be useful in treating heart attacks and strokes (Abraham, 1999). A group of Texas researchers are currently reported to be attempting to clone a dog, and a Wisconsin company is trying to clone a pig (Abraham,

1999). In June of 1999, biologists Ryuzo Yanagimachi and Teruhiko Wakayama at the University of Hawaii reported the first male clone, a mouse, produced from an adult non-reproductive cell ("Scientists Clone First Male Mammal," 1999). Other more radical uses for the technology are being considered: Japanese scientists are searching for reproductive tissues from a woolly mammoth in order to attempt to clone one (Stone, 1999).

The mad scientist theme continues with introduction of Dr. Richard Seed who advertised wanted to clone humans, beginning with himself. He seems to be the perfect mad scientist for the media to center on: he is older than most scientists and not connected to an institution; he also made connections with Clone Aid, a cult (*Clone Rangers*, 1998).

The copy theme also continued: two tabloids had cover stories on cloning deceased famous people: "Scientist wants to clone Jon Benet" (*Weekly World News*, March 3, 1998); "Bizarre plan to clone Princess Diana!" (*Globe*, Oct. 27, 1998; see Figure 12). *Wired* had a cover story with a fictional piece which was supplemented by a small section on Richard Seed: The caption on the cover reads "My name is Katy. I was born in 1999. I am a clone" (Kadrey, 1998, 146-151).

Dolly has also served as a catalyst for an extension of ethical debate about technology in late modernity, setting a pattern for how scientific issues, particularly in the biosciences, are handled in the press. Several books considering the ethical and religious dimensions of cloning have been published since the news of Dolly emerged in February of 1997 (Cole-Turner, 1997; Harris 1998; Kass, 1998; Nussbaum and Sunstein, 1998; Pence, 1998).

The most recent news of Dolly is sobering. Researchers from the Roslin Institute and PPL Therapeutics, the creators of Dolly, reported in a *Nature* article on May 27, 1999 that Dolly seems to be aging prematurely (Abraham, 1999). Dolly was cloned using a cell from a six-year old sheep, and an important age-dependent characteristic of this original adult cell was passed on to Dolly. The telomeres on all her chromosomes were shorter than they should be for a sheep her age. (A telomere is like a tail or cap on the end of a chromosome that keeps the genetic material intact.) In effect, all of Dolly's chromosomes already had six years' wear and tear on them at the moment she was first constituted as a zygote. The same result was found in two other animal clones, suggesting serious limitations for the usefulness of cloning as a reproductive technique.

Chapter Summary

This chapter began by laying out the storyline of the cloning story in the Canadian news media, from the announcement of Dolly's existence and origin, through various ethical, political, cultural and religious reactions, including a further scientific development that threatened to extend the cloning technology to allow the cloning of humans. A number of important themes were then presented, including identity, ethics, progress, and regulation.

A discussion of the way that the news media characterized these themes introduced a number of points: cloning's potential threat to identity is inseparable from the reduction of identity to DNA; the view that cloning preserves identity is closely connected to fears that cloning would be misused by "dictators" or "nuts"; ethical and religious objections to human cloning often frame the technology as one that crosses boundaries that should not be crossed, a view often expressed in the parallel between cloning and nuclear technology; the image of the mad scientist is often used to embody ambiguous views of science and progress; scientific and technological progress, especially when motivated by business interests, may well take place at the expense of ethical and religious concerns.

The main actors who contributed to the ongoing discussion were then described: business sources, corporate scientists, academic and medical scientists, ethicists and religious experts, politicians, and other experts. The chapter then analyzed how each group of actors characterized the development and implications of the technology, emphasizing how different actors differed in the positions they took with respect to the main themes. The points raised in the analysis of the way the media framed the cloning story reappeared frequently in the views of various actors.

The chapter concluded by noting that some signs of stabilization are visible in discussions of cloning in the media: animal cloning offers potential benefits, and human cloning should be prohibited.

Chapter 6

CONCLUSIONS

The social construction of technology involves two hermeneutic dimensions that work at different levels of analysis (Feenberg, 1991). The first dimension is the social meaning of the technology. The preceding chapter has examined how cloning was constructed by different social groups or actors. From this perspective, it has been important to examine the different voices present in discussions of the technology. The second dimension is the cultural horizon of the technology, the "culturally general assumptions that form the unquestioned background to every aspect of life" (Feenberg, 1995, 10). This set of cultural assumptions shapes interpretations of new technologies. Where Feenberg focuses on certain cultural norms, those that contribute to the hegemony of the dominant social groups, this thesis looks at the cultural horizon more broadly. Specifically, popular culture references, images, metaphors and jokes reflect the cultural horizon against which the meaning of cloning is being constructed, and these can be read in a critical manner, drawing out underlying concerns about science and technology.

This concluding chapter will situate this polyphonic discussion of cloning in its social context. The actors who attempted to define the shape and direction of this new technology each emphasized particular themes and lines of argument. This struggle had a political dimension, discussed in the following section. The chapter will then clarify the extent to which this struggle over the significance of the technology was conducted, in part, by drawing on the resources of popular culture. It will then argue that this process of socially constructing a technology takes on specific characteristics that reflect the social context of late modernity. The thesis concludes with a consideration of limitations of the research, directions for further research, and some summary comments.

Actors and Technological Frames

The social meanings of technologies are contested: "technology is a scene of social struggle" (Feenberg, 1995, 8). Technologies have "interpretive flexibility"; they are open to a wide variety of views of their applications, limitations, promises and dangers (Pinch and Bijker, 1987). Interpretive flexibility has a decidedly political dimension: technology is a tool of domination, but its meaning and uses are open to different standpoints (Feenberg, 1991). This tension and struggle are embodied in the technological frames of the different actors or social groups, in their views of the uses and shape, promises and risks of the technology. The cultural horizon of a technology, including popular culture, also offers resources that are drawn on in different ways by different groups. The media coverage of the cloning story exemplifies this process, as different actors presented varying views of this new technology. The struggle to construct the significance of cloning involved the interests of each of these actors.

Most generally, and most obviously, each actor or social group attempted to frame cloning in terms of their own sphere of activity: business sources saw it as a potential investment opportunity, corporate scientists as a practical technique to be extended, academic and medical scientists as a scientific and medical breakthrough, ethicists and religious experts as a problem with ethical and religious implications, politicians as an issue to be deliberated on through the political process.

The interests of different actors were also implicated in the way the debate was framed at a very general level. The clearest example of this is provided by the converging interests of business sources and corporate scientists. These interests were served, in effect, by the way that the story split immediately into the animal and the human cloning stories. Several actors emphasized Dolly's status as a scientific breakthrough leading to

agricultural and medical benefits. Business interests and industry scientists were dominant in developing this aspect of the cloning debate. It is possible, though, that an important aspect of the cloning story passed virtually unnoticed: Ethicist Arthur Schafer has said that he doesn't know if it is "deliberate or intentional, but . . . we're so fascinated by the prospect of human cloning that we've missed what may truly be horrifying and dangerous and threatening, which is animal cloning" (Moysa, 1997). In other words, Schafer suggests that the intensity of debate over the possibility of human cloning distracted attention from potentially more important ethical issues in the sphere of animal cloning. The intense ethical debate over human cloning, the outcry over threats to identity, and worries about the transgression of natural boundaries were all confined to discussion surrounding the possibility of human cloning. The discussion surrounding animal cloning was much less prominent, with little charged rhetoric, and it was framed almost entirely in utilitarian terms. From an industry point of view, Dolly represents a step toward more efficient and profitable agricultural and pharmaceutical production. As the human cloning story became the focus of ethical and policy debate, the aspect of the cloning story of interest to industry was left to be discussed in terms favourable to industry: the weighing of risks and benefits. Even within this limited utilitarian context of discussion, coverage of Dolly and cloning framed the animal story in terms that seem favourable to industry. Discussions of animal cloning focused more on benefits than on risks.

To summarize, discussions of cloning were presented in two streams, animal and human, and because ethical concerns were linked to the latter stream, the biotechnology industry's interests in the former stream were protected from ethical critique. Although this thesis has considered the social construction of technology in a broader sense than Feenberg, who focuses on issues of hegemony and domination, some of the same themes emerge (Feenberg 1991, 1995). Specifically, we find that the shape of the debate over

technology and the path that it takes toward stabilization can serve the interests of specific social groups or actors such as industry.

Cloning and Popular Culture

Perspectives on issues surrounding Dolly and cloning in Canadian media coverage tended to be polarized. Trust in the benefits brought by scientific progress is balanced by a range of ethical and other concerns. These are two competing discourses prominent in a number of analyses of technologies. A study of public attitudes to the new genetics in Britain found a similar tension and characterized it as a tension between 'discourses of promise' and 'discourses of concern' (Durant *et al.*, 1996). A study of media coverage of Dolly in Britain found that these two discourses were prominent and distinct (Wilkie and Graham, 1998). European media coverage of Dolly was similarly characterized by a similar polarization in terms of contrasting frames of progress and of doom (Einsiedel *et al.*, In Press; cf. Mulkay 1993).

The discourse of promise in Canadian media coverage was represented by discussions of the potential benefits of animal cloning and reassurances that human cloning, even if carried out, would pose no threats. The discourse of concern was represented by ethical and religious issues, including concerns about identity and the control of reproduction. It was also represented by a number of popular cultural images, including mad scientists and the Frankenstein monster. Images in Canadian papers echo works of fiction and film where portrayals of the mad scientist provide an "antirationalist critique of science"(Toumey, 1992, 432).

In Canadian media coverage, the cultural horizon of cloning is visible in the strong

tendency for both journalists and the sources that they cited to use popular culture images. These images reveal issues of deep cultural concern. Much of what the public knows of science and technology comes from the sources of these images: “The power of books and films in science popularization is often underrated. . . . movies in particular have proved themselves a force to be reckoned with in shaping public opinion” (Dixon, 1986). There is a constant interaction between the media construction of the story and the popular cultural resources that are drawn upon. As a result, works and images of popular culture are important elements in the social construction of technology.

One of the themes of images from popular culture is the questioning of traditional sources of expertise. As Nicholas Garnham notes, “the figure of the expert is now a deeply ambivalent one in our culture. . . . And the media play into and amplify that ambiguity. . . .” (1995, 381). Popular culture images often reveal critical concerns about science and technology and distrust of the often reassuring voice of science.

Other films on cloning have appeared since the news of Dolly, including *The Third Twin* and *Cloned* (see Figure 13). However, in two cloning movies produced after Dolly, cloning is presented as resulting in the loss of

original identity. In *The Third Twin*, there are only clones with no original. The clones are discovered by a geneticist who is looking for a gene for aggression by doing studies with twins. The lack of an original is exactly what provides terror for the audience. In *Cloned*, another post-Dolly cloning movie, twelve boys are cloned from the dead son of the protagonists. The clones are identical physically. They are first seen collectively on a

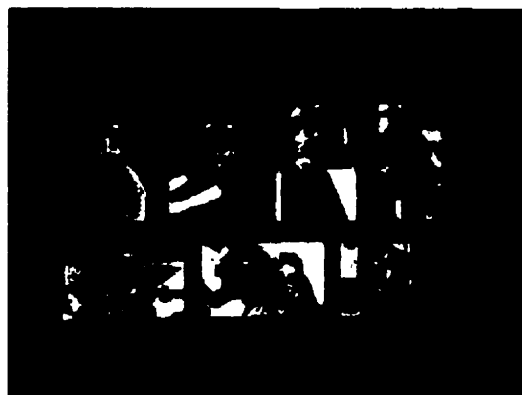


Figure 13. *Cloned* (1997).

computer screen, and they are more images than characters in the film. The parents do not want a clone of their son when it is offered to them. They realize that they could not name a clone of their son Chris, his original name, because he wouldn't be Chris. *Cloned* concludes that identity has been lost with the cloning of an original.

In addition to dealing with themes of the mad scientist, the double, industrialization, etc., science fiction films dealing with the issue of clones or replicants can also be read as reflexive critiques of views of identity. After Dolly these films seem to express a greater fear of loss of identity. This raises the possibility that Dolly represented a watershed in perceptions of these and other issues of ethical significance.

Dorothy Nelkin and Susan Lindee have analyzed how the popular discourse around biotechnology emphasizes genetic essentialism (Nelkin and Lindee, 1995). They show that popular culture is filled with representations of how DNA defines our identity. As Stephen Jay Gould notes, this current tendency to emphasize genetic essentialism is one extreme of a spectrum of views that have swung back and forth over the course of this century, and discussions of recent developments like cloning reflect current tendencies to favour this extreme: "Dolly the cloned sheep . . . [has] been reported almost entirely in genetic terms. . . I am convinced that exactly the same information, if presented twenty years ago in a climate favoring explanation based on nurture, would have been read primarily in this opposite light" (Gould, 1998, 43-44). Old myths and narrative are set within this frame of genetic essentialism in discussions of cloning since Dolly.

Dolly was presented as a sign of science's power to manipulate and reproduce this genetic identity. Popular images expressing this genetic essentialist view of identity were linked to broader concerns in the resources that were drawn on the discussions of cloning: "as a symbolic site for the exploration of identity, heredity, destiny, and the social meaning of science [Dolly] is a spectacular beast. She is one more step in a series of dreams about

science. . .” (Nelkin and Lindee, 1998, 148). Because she embodies the convergence of all these themes, Dolly represents the social construction of cloning in progress.

Different sorts of narratives, metaphors and images embody this convergence. Mechanical reproduction metaphors presuppose the link between identity and DNA and express concerns over the social effects of the possible commodification of individuals.

These metaphors, which have been common in popular discourses on cloning, are tied to the ongoing public discussion of biotechnology.

Dolly symbolizes science and technology’s power to reproduce identity in this way. Edge (1990) argues that the technological metaphors that become popular are those that best reflect prevailing moral views. He adds that, once they become popular, these metaphors reinforce these moral views. Technological metaphors play a role in establishing and reinforcing a moral consensus. Images of factories and assembly lines in the media coverage of Dolly help focus ethical discussion on issues of identity and social relations.

Joking references to cloning famous people also presuppose a genetic essentialist view of identity and express concerns over its manipulation and reproduction (see Figure 14).

As Nelkin and Lindee put it, “Their humor

depended largely on the pervasive assumption that human identity is contained entirely in



Figure 13 *Le Devoir* March 4. (Der Spiegel, Reuters)

the sequences of DNA in the human genome. . ." (1998, 145). The more ominous portrayal of "others" as potential misusers of cloning also largely presupposed the reduction of identity to DNA. References to novels like *Brave New World* and films like *Boys From Brazil* reflected concerns over science's control of genetic identity.

The tension between genetic essentialism and views of science and technology that is documented by Nelkin and Lindee is explored in greater depth in Valerie Hartouni's analysis of the controversy surrounding cloning. Hartouni looks at dominant and popular discourses in order to see what forces are working to maintain them and to consider possible alternative views. Cloning threatens a specific type of identity, one framed in terms of genetic essentialism. Hartouni notes that this sense of identity, the self reduced to genetic patterns, has become increasingly prominent in public discourse around new reproductive technologies. It serves to underline the uniqueness and individuality of each human organism as one way of resolving complex disagreements about the status of embryos and fetuses. However, preserving the status of the unique individual by this reduction to genetics reveals a different sort of threat, the threat to identity posed by cloning:

Rescuing humanism's unique, radically contained, and separate individual by an appeal to nature in the form of genetics works, at least rhetorically, to preserve the idea of originality, authenticity, indivisibility, and natural diversity. It also reinstalls a creature that bears a convincing likeness to the one potentially displaced by cloning. . . (Hartouni, 1997, 127).

This view of the individual is rescued by an appeal to genetics. The self is defined in terms of a unique genetic code.

The Frankenstein image also served as an important resource in the debate over

cloning. It has been applied in discussions of many scientific and technological developments where it functions as a sort of moral critique (Turney, 1998). The image of the Frankenstein monster still shapes popular perceptions of cloning, and this discourse of concern stands over against the discourse of promise that is more prevalent in scientific views.

Society can probably blame Mary Wollstonecraft Shelley and her fervent imagination for much of the brouhaha over cloning. The Frankenstein story colors popular reception of the recent news, fomenting a potent brew of associations: many people assume that human lives can be made to order, . . . and, of course, that it is all going to turn out disastrously. Reality is much more complicated . . . so one should preface debates about the morality of cloning with a clear understanding of the scientific facts. (Kitcher, 1997, 58)

This quote clearly brings out the idea that Frankenstein is used both as a trigger to point out moral concerns and as a representation of criticisms of science in the popular



Figure 15. *Boys From Brazil* (1978).

imagination. Even attempts to portray cloning in a reassuring manner accept the image of Frankenstein as an issue of debate: "Dolly . . . doesn't look like Frankenstein's monster" (CH March 2).

Similar images in films, for example, *Boys from Brazil*, work in a similar way to cast science, technology and progress in a unsettling light (Skal, 1998; see Figure 15). Duplicate

humans in recent films are "spectacular images of monstrosity that are paraded across the cultural landscape, capturing our attention for the moment, but, in the end, inciting relief

more than fear" (Hartouni, 1997, 130). One writer echoed this point in a discussion of films about cloning: "Our cinematic terrors not only multiply but darken, symptoms of even deeper fears" (Ribalow, 1997, 41).

Feminist scholars also pay special attention to new concerns that are raised by cloning: commodification of the body, family relations, identity, and eugenics. The image of the monster is prominent in feminist literature on reproductive technologies.. Looking at recent concerns over the issue of cloning, Valerie Hartouni (1997) argues that the fears surrounding cloning are fears that the boundary between human and nonhuman are disappearing. A certain view of human identity is at stake here, a view that emphasizes autonomy and that defines uniqueness in terms of genetic identity. For Hartouni, the fact that this view of identity is seen as threatened and as needing to be defended serves to reaffirm it. It gains a certain status and solidity from being the site of contestation:

the [cloning] controversy functioned to reset what are highly permeable, continuously shifting boundaries that circumscribe the distinctly human. Through the specter of what "human" might become if these boundaries are transgressed or effaced, humanism's unique, self-contained, self-determining individual is recuperated at least rhetorically. . . . (Hartouni, 1997, 130)

Hartouni argues that the real issue is not that the boundary is under attack, but that it is being reaffirmed and redrawn. The discourse of concern in the cloning coverage frames this contestation and construction of identity.

Media coverage of Dolly contained many jokes that referred to issues of reproduction and about the status of reproductive roles. They warned of the end of sex and romantic love and of sperm being passé. This sort of humour also functioned as an implicit critique of science and technology, forming part of the discourse of concern.



Figure 16. *The Globe and Mail*, Feb. 27, 1997.

The humor which was prominent in the Dolly coverage has been attributed to a general underlying anxiety associated with cloning. The jokes reveal “just how much cloning appalls us, unnerves us, disgusts, horrifies and revolts us, precisely because it engages our deepest concerns about personhood, identity, life and

sex” (Miller, 1998, 81; see Figure 16). They reflected a deep anxiety about control of reproduction and about the status of reproductive roles.

Technology in Late Modernity: The Case of Cloning

The above patterns of tension and struggle between different actors illustrate the social construction of cloning. They do this not in an abstract sense, but in the context of a specific social and historical context: late modernity. This section of the chapter will draw out four characteristics of the social construction of cloning in the Canadian news media that reflect this context.

Aesthetic Reflexivity

The first characteristic of the social construction of cloning in late modernity is the centrality of popular cultural resources to the perspectives of the various actors. Late modernity is reflexive in an aesthetic way in addition to the conceptual reflexivity explored

by Beck and Giddens (Lash, 1994). This links the critical function of popular culture to a broader social context. The media and other cultural industries reflect on and critique science and technology, among other aspects of late modernity, at the same time that science and technology also prove further resources for the media to extend the popular imagination. More specifically, references to and images from popular culture can perform this critical role.

Aesthetic reflexivity takes place as cultural symbols flow through the information and communication structures of late modernity (Lash, 1994, 135). Popular culture narratives, metaphors, and images perform this sort of reflexive function in the mass media coverage of cloning. Science fiction films, for example, form "a counter-body of subversive texts" that are partly critiques of science and society (Denzin, 1991, 145). Films like *Sleeper*, *Boys From Brazil*, or *The Third Twin* offer critiques of science as a transgressor of ethical, religious, and natural boundaries. In this same vein, the mad scientist provides an "antirationalist critique of science" (Toumey, 1992, 432). The Frankenstein story, for example, evokes ambivalence regarding science and progress; (Turney, 1998). These references to popular culture are a core part of the media coverage. They reveal an important dimension of the social construction of cloning in late modernity.

Distrust of Science and Progress

Another characteristic of late modernity is an increasing distrust of science. Belief in the objectivity of science formerly gave scientists the status of experts simply by virtue of their being scientists. Trust in scientific expertise has been eroded as scientific progress has led to dimensions of risk that result in a critique of science itself and of the roles of scientific experts (Beck 1992; Lash and Wynne, 1992, 4). As a result, the appeal to science

as a source of unalloyed benefits is undermined; awareness and discussion of risks become more prominent. In addition, related to the above point, the status of scientific experts is called into question.

This is reflected in the debate over cloning in two ways. First, the relation between science and society is called into question, especially by the media and by ethicists and religious experts. It is not taken for granted that cloning, as a product of science and technology, is necessarily good or free of danger. Second, the prominence of calls for regulation of human cloning underlines the distrust of science: science and its activities must be watched closely.

Erosion of Expertise

Late modernity is characterized by a proliferation of multiple authorities and a correlated "disenchantment with all experts" (Giddens, 1994a, 87). Scientific experts are increasingly distrusted, but the point is a more general one. Traditional markers of expertise, such as class, gender, or institutional location, no longer count to the same extent as guarantees of trustworthiness in experts.

This development is reflected in the social construction of cloning in Canadian media coverage. Many types of experts, with widely varying views, all contribute to the debate over the significance of cloning. Scientists are not given a privileged position in determining the outcome of the debate. Moreover, corporate and academic scientists speak with very different voices, manifesting the proliferation of experts in late modernity.

The End of Nature

Late modernity has been characterized in terms of “a society which lives after nature,” “where we switch the focus of our anxieties from what nature can do to us to what we have done to nature” (Giddens 1998, 26; Beck 1998, 10). The debate over cloning reflects this. Cloning is framed, especially by the media and by ethicists/religious experts, as a transgression of natural boundaries, one that undermines fundamental categories and processes of natural reproduction.

The End of Tradition

Late modernity has also been characterized in terms of “a society which lives after tradition” (Giddens 1998, 26). In former times and in other societies, people live their lives in traditional ways as if they were decreed by fate: gender and class roles, for example, determine much of life. In late modernity, processes of individualization have increasingly freed people from these roles (Beck 1992, 127ff.).

The debate over cloning reflects this as well. Individualization involved the radical disembedding of people from tradition social structures. But this is exactly what lay at the heart of much of the anxiety over cloning’s potential threat to identity, to family, and to reproductive roles. In a sense, cloning seemed to threaten a development that is already taking place. Perhaps certain elements of the debate over cloning can be seen as displaced discussions of these broader social processes.

Moral and Ethical Risks

A final characteristic of late modernity is an increasing prominence of moral and ethical risks. These emerge as the broader social and cultural context of risk issues is taken into account. Risks are socially defined (Powell *et al.*, 1997, 181; cf. Wynne, 1992, 291; van den Daele, 1993, 173). And different views of risk result as boundaries between the public and traditional institutions, including those defined in terms of expertise, are eroded. Newer technologies especially involve more complex definitions of risk.

Cloning underlines the increasing importance of moral and ethical risks in discussions of technology in late modernity. In the case of cloning, a wide variety of moral and ethical concerns are expressed as risks, as dangers threatening nature, identity, family, and social structures. Both the media characterizations of Dolly, which drew upon religious imagery, and the religious sources that are vocal on this issue contribute to an awareness of this ethical dimension of risk. Cloning is an example of the many possibilities of biotechnological innovation that open up “an entirely new dimension of risk,” implying “fundamental changes in the ‘order of being’ as it has been experienced by humans until now” (Leiss 1999, 9).

To sum up, several characteristics of late modernity can be seen in the way that the debate over cloning unfolded in the Canadian news media. The social construction of technology reflects its social context. The debate over cloning reflects the character of this social context. Perhaps the urgency and magnitude of the debate was due in part to the fact that cloning is an issue that manages to touch on all these issues at once.

Limitations of the Research

One limitation of the research in this thesis stems from its use of Bijker's analysis of the social construction of technology. Bijker has developed and applied this method of analysis to historical cases, where the processes of stabilization and closure have worked themselves out. The case of cloning is one where these processes are ongoing. Some degree of stabilization has taken place, but no closure is evident. This is a limitation only in that the present study, by considering recent developments that are still in progress, cannot make the definite claims that might be possible at a later date.

A second limitation of the research is rooted in the relation between theory and data. Theories of late modernity are descriptive and explanatory rather than predictive theories. The research can, at best, speak to the plausibility of the theory. It can't prove it or disprove it. Conversely, the theory yields important insights into the case of cloning, but cannot easily make testable predictions about the reception of new technologies in the future. The value of the research lies in the greater degree of understanding provided by looking at this data with this theoretical perspective, not in providing a test case.

Questions for Further Research

Given that the processes of stabilization and closure are ongoing, one area for further research would be to follow this particular case to see how it turns out. The tendencies to stabilization that have been identified could be studied in greater depth and other tendencies could be characterized. A second area for further research would be to examine differences between media, e.g., newspapers, radio and television, whereas this

study examined the corpus of items as a whole. A third area for further research would be to consider the case of cloning in a comparative perspective, contrasting Canada with other countries or English and French coverage within Canada. The present study, for example, suggests that religious issues were more prominent in the Quebec coverage. Another angle on a comparative study would be to take a historical perspective, comparing the social construction of cloning in late modernity to the case of another technology at an earlier period, perhaps in vitro fertilization. A fourth possible area for further research would be to see if references to and images from popular culture play a role in other areas besides the media. Technology is constructed by discussions in other fora besides the media, including scientific publications, industry documents, ethical and religious papers. Although it would seem likely that popular culture plays much less important a role than it does in the media, the role that it does play, if any, might be worth investigating.

Conclusion

The cloning of Dolly became an important media story and the focus of intense debate between many voices in part because it raised a number of important issues. Dolly encapsulated many important themes related to interpretations and uses of new biotechnologies, and her creation provoked responses from a wide variety of actors. Reactions may well spill over into ethical debates concerning other biotechnologies. This complex set of meanings attached to Dolly as an iconic symbol reveals the social construction of cloning in progress. Dolly embodies the socially negotiated meaning of this technology: "Dolly has become far more than a biological entity; she is a cultural icon, a symbol, a way to define the meaning of personhood, to describe social issues, and to express concern about the forces shaping our lives" (Nelkin and Lindee, 1998, 149).

From a social scientific point of view, Dolly can also serve as a focal point for discussions of several aspects of late modernity. In the late-twentieth century, science and technology are important objects of public discussion and concern. They are seen as having an element of uncertainty built into them, and this is reflected in the intensity of ethical debate. In this context, risk has become a political tool, as experts and policy makers carry out risk/benefit calculations with far-reaching consequences. The development of Dolly illustrates and, perhaps marks a new level of, the importance of ethical discussion surrounding new biotechnologies.

In terms of Bijker's approach to understanding the social construction of technology, the key issue is the process of stabilization, as the often conflicting voices of different actors begin to converge on points of agreement. There is evidence here that some degree of stabilization is already occurring. The emphasis on agricultural, medical and business benefits became dominant regarding animal cloning. A consensus developed in ethical and policy spheres that human cloning should not be allowed. Stabilization, however, is not necessarily a neutral affair. It can serve the interests of one or more actors. As noted above, for example, the distinction between animal and human cloning stories furthers the interests of industry by framing animal cloning, the realm of agribusiness, solely in utilitarian terms.

The development of these two different strands of the cloning story, animal and human, is reflected in more recent media developments. The human cloning story continued to reflect the discourse of concern more prominently, though not exclusively. Richard Seed continues the narrative of the mad scientist. He has several characteristics that set him apart from the usual industry and academic scientists: he has a single-minded focus on the most problematic aspect of cloning, i.e., its commercial use in humans; his name underlines the seedy side of new reproductive technologies; he is not employed by an

academic, government or private institution; and he is associated with a cult, Clone-Aid, that sees cloning as a key part of their utopian vision of the future. The theme of cloning dead famous people also echoed the early discussions in the wake of Dolly. Tabloids reported plans to clone Princess Diana and Jon Benet Ramsey, reasserting the reduction of identity to DNA in a morbid way.

The ongoing animal cloning story received a different sort of spotlight than discussions of human cloning. Developments in animal cloning were presented almost exclusively in the discourse of promise. The embryonic cloning of monkeys, the cloning of mice and cows from adults cell, the cloning of a sheep with a human gene, and the birth of Dolly's offspring were all framed in terms of progress, with agricultural, medical, and business interests as the main themes. Each development in animal cloning was presented as a refinement or advance in the technology.

Ethical arguments for and against cloning took a wide variety of forms. Two points stand out. First, Dolly transformed and intensified the ethical debate around the biosciences. Second, many of the issues raised in these ethical discussions echo themes found in cultural texts, including boundary transgression and threats to social and individual identity. Myths, metaphors, narratives and images provided terms of reference within which the news of Dolly was interpreted and the meaning of cloning constructed.

The themes of progress and ethics, the discourses of promise and concern, were not totally distinct. They overlapped, as metaphors, for example, linked the potential dangers of cloning to the dark side of progress itself. Beck's view of late modernity suggests that the enlightenment trust in science and progress has not disappeared; it has become shaky, questioning, and in need of constant reassurance. A distrustful awareness of the ambivalence of progress lies between optimistic trust and the radical denial.

The discussion surrounding cloning has been carried out in many voices: scientists

speak of "somatic nuclear transfer" in ethically neutral terms; popular fiction and films explore images of Dr. Frankenstein and doppelgängers; ethicists and religious experts suggest that science has begun to meddle with things best left alone. The common references to various forms of popular culture reflect and reinforce this moral dimension. Stories about mad scientists and doubles were early markers of boundaries circumscribing the correct use of knowledge and the nature of identity. Cloning can be seen as a site where these various discourses converge in distinct ways in the context of late-modernity.

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Mary Shelley's Frankenstein. 1994. Directed by Kenneth Branagh.

Metropolis. 1926. Directed by Fritz Lang.

Multiplicity. 1996. Directed by Harold Ramis.

Sleeper. 1973. Directed by Woody Allen.

The Third Twin. 1997. CTV. Directed by Tom McLoughlin

APPENDICES

Appendix A

Categories Emerging from Open Coding

1. **Basic Information**
 - a) **Headline and Page**
 - b) **Date and Day**
 - c) **Publication**
 - d) **Code No.**
 - e) **News Type**
 - f) **News Agency and Dateline**
2. **The Law**
3. **Auto Control by Scientists**
4. **Ethics/morals**
5. **Double/copy**
 - a) **Animal**
 - b) **Human**
6. **Identity, Filiation, Vertigo**
7. **Incompatibility of Science and Ethics**
8. **Science/society Opposition**
9. **Natural/unnatural**
10. **Risk**
11. **Utility**
12. **Metaphors, Literary References, Films, Etc.**
 - a) **Literary References, Films, Etc.**
 - b) **Metaphors**
13. **History of Cloning**

- 14. Colour
- 15. Journalistic Constructions
- 16. Constructions of Personalities/events
- 18. Limitations of Science

Appendix B
Final Categories For Selective Coding

1. Evolution of the Problem
2. Conserve Identity and Timeline of Articles
3. a) the Animal Story
b) Explanation of Cloning and Science in the Animal Story
c) Science in the Animal Story
4. Humanization:
 - a) What Is Lost
 - b) the "Others" and Misuse
 - c) Women and Reproduction
 - d) Religion
 - e) Law and Control
 - f) National and International Authority
5. Irony and Exaggeration
6. Images
 - a) Themes as above
 - b) Actors as above