

**FEATURES OF STUDENTS' RESPONSES TO A SOCIOSCIENTIFIC ISSUE
PRESENTED IN PRINT AND ON VIDEO**

by

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B.Sc./Ed., Makerere University Kampala, 1986

**A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF ARTS**

in

**THE FACULTY OF GRADUATE STUDIES
(Department of Mathematics and Science Education)**

**We accept this thesis as conforming
to the required standard**

THE UNIVERSITY OF BRITISH COLUMBIA

May 1992

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ABSTRACT

In recent years there has been increasing interest among science educators on the need to discuss science-related social issues in science classrooms. This study explores the features of students' responses to one science-related social issue (referred to as a *socioscientific* issue) presented in print and video formats.

In the study, Grade 10 students either read a newspaper-type article or watched a video on the issue of the use of animals in scientific and biomedical research. Through semi-structured interviews, students were asked to abstract and frame the central issues in the story and to specifically identify the different points of view discussed in the story. Students were also asked to give their own points of view on the issues. And afterwards, a second, related story that attempted to make the issues more personally relevant was read to students. The features of students' responses to this socioscientific issue across these areas were explored. Contemporary information processing theories on the comprehension and response to television and print material formed a theoretical perspective for analyzing the data.

The findings of this study reveal interesting features of students' responses by the presentation format of the story and by the gender of the respondents. Responses from students who watched the video story, when compared to those from students who read the print story tended to be rather superficial, more empathic to animals, and were sometimes framed more or less to describe a chronological sequence of events rather than an identification of the issues.

More important, it was found that the influence of the presentation format of the story is pronounced in students' ability to abstract the central issues in the story. The presentation format seemed to have little influence on the points of view students expressed and on the consistency of students' views in a personally-oriented situation.

As for the variation of these features by gender, females more than males tended to abstract the central issues in the story and to identify the different points of view presented on the issue. They also tended to give views that were geared toward caring and protecting animals, whereas males correspondingly seemed to give views that were utilitarian. When presented with a second, related story that attempted to make the issue more personally relevant, females, more than males, seemed to give views on this second story that were fairly consistent with the ways they expressed their points of view about this issue both at a personal and societal context, and continued to support views that were consistent with the caring and the protection of animals. Males mainly appear to support views that are utilitarian.

Implications for curriculum and practise are discussed.

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ACKNOWLEDGEMENTS

I am indebted to the team that conducted the Socioscientific Component of the 1991 British Columbia Science Assessment. I extend my gratitude to all the team members, HOTS, and particularly to Dr. P.J. Gaskell for his academic direction and tremendous support throughout all the phases of this thesis. I am equally grateful to Dr. R. Goldman-Segall and Dr. C. Ungerleider for their very helpful comments.

In addition, I am obliged to gratefully acknowledge the permission granted by the Ministry of Education, Assessment, Examinations and Reporting Branch to utilize its data in this study. Thanks are also due to The Canadian Broadcasting Corporation (CBC) and to Tony Glencoff, in particular, for allowing the use of the video about the use of animals in scientific and biomedical research for educational purposes. I would also like to thank all the participants in the video: Peter Hamilton, Dr. John McNeil and Dr. Bob Horsfall for granting permission to use this video.

Finally, I extend my thanks to Renée Fountain and to all other persons who have been of steadfast support in the course of this study.

CHAPTER I

The Problem

Introduction

The last decade has witnessed the broadening of science education goals to include educating students to formulate informed opinions about science-related social issues. The aim of science education for the informed citizen is being underscored as among the most important in this technological age (Science Council of Canada, 1984), and international momentum towards a science education that incorporates such a science, technology, and society emphasis is growing. In addition to traditional objectives, this emphasis requires students to gain an understanding of the method and limitations of doing science, and an appreciation of its practical and social implications.

In school and out of school, print and television media are among the important sources by which students receive information on science-related social issues. Although print has continued to be the dominant medium in school, television is the most frequent out of school information source. According to Postman (1983), between ages 6 and 18 children spend an average of 16,000 hours in front of television compared to the 13,000 hours spent in school. The overwhelming student use of television outside school threatens to undermine the place of the print medium in a traditionally print-oriented society (Olson, 1982). Because the viewing public consists of students, and since this social group is much broader than the reading public, it has an important influence upon many political, commercial, social and socioscientific issues.

The pressing problem is not whether the situation is good or bad, but rather how to utilize the increasingly diverse sources of information on socioscientific issues to enhance critical thought when responding to these issues. Given that there is an upsurge in the use of television for presenting information in formal and informal settings, there is increasingly a need for the young to think critically not only about what they read and what they hear, but also about what they see. Indeed, to be able to sort things out, to distinguish between rhetoric and evidence, to recognize when the facts are not enough, it is particularly important that students be efficacious with viewing television and reading print material.

Socioscientific issues periodically receive a lot of media attention. Wessel (1980) has observed that a socioscientific dispute essentially has three dimensions. First, the term *socio* connotes a high public interest in the outcome of conflicts involving the impact of science and technology on how we live. Such interest, he notes, is a relatively new phenomenon. More people now understand that they may be directly or personally affected. Because of the heightened public awareness of these kinds of disputes, there is a growing dissatisfaction with the ways in which such disputes are being handled. Subsequently, more and more persons are seriously concerned with the outcomes of disputes over socioscientific issues.

Second, the information and understanding required to formulate a rational judgement of the issues are complex. Information on the disputes is disseminated from a variety of sources and is often inconclusive. Attaching a meaningful interpretation to such information depends, in part, on our ability to extract the relevant information and frame for ourselves the issues under discussion. If one is to formulate a reasoned judgement which takes

into account the possible relevant constraints, this process demands that the audience be critical and reflective.

And finally, a sound final judgement on a socioscientific issue requires the fine tuning and balancing of a number of quality-of-life concerns about which different people have widely varying values and feelings. Wessel (1980) further notes that because these are disputes involving conflict between values and goals within persons and among persons, the resolution of these conflicts requires communication. Students have to engage in the dispute-resolution process which may involve seeking compromise and actively negotiating one's position. This process would also require us to reflect on the ways in which the images that bear upon us shape our views of the world and influence our values.

Need for the Study

Videos are now an essential component of school science instruction, of some teacher professional development courses, and of courses designed to trigger students' discussions of controversial issues appearing in the media. For example, Science and Technology 11, a recent high school course in British Columbia designed to discuss science-related social issues, is heavily dependent upon video scenarios to sensitize students about socioscientific issues. The emergence of such courses in the last decade was prompted by the increasing need to develop curricula that promote education for informed citizenry. These curricula are concerned with developing in students an awareness of the role science and technology play in creating and solving social problems, and with developing a sense of responsibility to influence the resolution of these problems. Given the nature of the issues, a science and social issues curriculum must involve teachers and students in areas of

political and ethical controversy, areas that science teachers have traditionally avoided (Gaskell, 1982). The video materials used in these courses, therefore, usually discuss material that presents subtly different views of the same situation, and which gives students an opportunity to formulate and defend their own judgements on matters that are indeterminate in character.

Interestingly, there is not much research available that examines the use of videos as presentation formats for socioscientific issues, although the influence of different media on children's interpretations of stories presented in print and on video continues to intrigue researchers (Neuman 1992, Meringoff 1980). Neuman (1992), for example, examined whether different media presentations elicit different inferencing strategies when children read or viewed episodes from two stories. And in her ongoing work on the discussion of social issues in school science, Solomon (1990) has used video excerpts to trigger discussions of social issues in science classrooms. From the videotapes they are shown, students use their interpretations of the situation portrayed in the video to engage in small-group discussions.

With the growing use of television as a technology of formal instruction, there is need to explicate some of the features of individual students' responses after exposure to similar print and video content and to explore how this exposure influences students' arguments in discussions of socioscientific issues commonly appearing in the media.

An opportunity for carrying out an investigation on these issues arose in the context of the British Columbia Provincial Science Assessment (Bateson, Erickson, Gaskell, & Wideen, in press) and particularly on the socioscientific issues component discussed in Chapter 3 (Gaskell, Fleming, Fountain, & Ojelel, in press).

Purpose of the Study

In order to further our understanding of the television and print media, this study aims to characterize the reading and viewing capabilities of Grade 10 students by exploring and documenting the features of these students' responses as they discuss a socioscientific issue. The study explores students' ability to frame the issues in the print and video scenario, to identify the points of view in the story, and to give their own points of view on the issues discussed in the story. Students are also given an opportunity to defend and possibly modify their points of view in a second, related story that is more personally relevant to them. The role of the researcher in this study is to establish the context and conditions which allow for individual student reflection on the information presented in the story and to elicit student understandings of this information as they discuss the issue.

The main purpose of this study is to compare Grade 10 students' responses to one socioscientific issue presented in different media formats and to describe the features of students' framing of the essential issues in the controversy and of their identification of the different points of view expressed about it.

Because it is important in this study that students be able to talk about their understandings of the information presented in print and on video formats, it was felt that students would comfortably discuss their experiences and beliefs when the topic for discussion is familiar. The issue chosen for student discussion in this study, therefore, is the ongoing debate about the use of animals in scientific and biomedical research. Most students are familiar with the treatment of animals in everyday life; many have had experience with animals in the wild or zoos, and some of them even own pets. In addition, the growing concern about the way animals are treated has led to

considerable coverage in the media of the arguments about using animals in research. It is likely that students have encountered the dispute over the testing of certain scientific products, such as cosmetics, on animals.

Furthermore, the use of animals in scientific research is an introductory curriculum unit in the Science and Technology 11 course; the discussion of this issue in the research context may subsequently be of significance to the discussions of these kinds of issues in the classroom.

Research Questions

The following questions will guide the study:

1. What are some of the features in the ways students frame their responses to "What is the story about" when presented with a video or print version of the story?
2. How do students identify the different points of view discussed in a story presented in print compared to that presented in the video format?
3. What, if any, are the different ways students give their own points of view after watching the video, or reading the print story?
4. What modifications, if any, are there to these points of view on the issue when students are presented with a second, related story that is more personally relevant to them?

Theoretical Framework

In the last decade, research on the understanding of media has focused almost exclusively on the production of newscasts, television news content, and the cognitive aspects of television news audience (attention, comprehension, learning, and memory) (Collins, 1982). A number of studies

have critically examined media variables from such standpoints as news structure, the processing of news information, and media effectiveness in conveying news information (Weaver 1982, Stauffer, Frost & Rybolt 1981, Findahl & Höijer 1985). Very little research exists that concerns students' processing and response to news items, or to different kinds of expository discourse. A specific search of literature on students' understanding of and responses to science-related content commonly appearing in the media does not produce an overwhelming volume of information. Except for the few studies that have sought to explain differences in children's comprehension of other stories in the print, audio and video formats (Greenfield & Beagles-Roos 1988, Hoffner, Cantor & Thorson 1988, Beagles-Roos & Gat 1983), no literature has been found that directly describes the features of students' responses to socioscientific issues presented in two or more media formats, say, video, audio and print.

Research that has focused on comprehension of televised news has shown a remarkable lack of consistency in results. Some studies indicate little or no comprehension of televised news, others show considerable news comprehension affected by a number of factors (Woodall, Davis & Sahin, 1983). Arguments have been made to the effect that television viewing is a passive instead of an active process, and that the information gained from it lends itself to 'shallow' rather than 'deep' cognitive processing. These arguments lend support to the claim first, that television viewing encourages immediate gratification over deeper learning, and second, that the ever changing, flashy nature of images on a television screen foster shallow understandings and produce short attention spans.

Considering that in most television programs the pace is rapid and the movement is continuous, there is always new information that demands

assimilation; the viewer is confronted, if not bombarded, with rapidly changing scenes that must be processed instantaneously. The viewer is allowed little or no time to process the information and reflect on the information gained. Several authors have addressed this issue. Salomon (1981) and Singer (1980) have cited the lack of viewer control over the pace of presentation as a major contributor to "shallow" comprehension. It is argued that while readers maintain control over the pace and repetition of printed matter, television viewers have no similar opportunity to replay, pause or reflect on the content. The presentation simply proceeds whether or not the preceding content has been processed clearly.

Singer (1980) specifically points out that as the information presented on television needs to be processed through internal rehearsal and as its pace of presentation is often very fast, children in particular, are not able to process much of this information. Among other factors affecting children's cognitive processing of television content, therefore, there appear to be age-related changes in children's abilities to understand and retain television information. Younger children engage in somewhat less literate viewing than older ones, but as they grow older understanding improves dramatically (Collins, 1982). This would be expected from what is known about the development of information processing capabilities (Woodall, Davis & Sahin, 1983).

A variety of commentators suggest an interactive model to characterize the changes in children's television processing activities as they grow older—as children grow older their store of knowledge about the world increases, as does their knowledge of the media codes on television such as the use of such formal features as cuts, zooms, pans and the use of such generic codes as language and signs. What occurs is a communication interchange, what

Salomon (1981) calls reciprocal interaction. The more general knowledge the child has, the greater is their ability to understand the messages of television and, in turn, knowledge of specific media codes allows the child to understand more of the social world on television which may feedback and increase children's general knowledge about the world as well as their knowledge about the symbol system of television. Thus, processing from television is not a linear relationship, rather, it is interactive over the course of development with children using their knowledge to make sense of television and in turn, with television expanding children's processing abilities.

Viewers do differ in the "depth" of mental elaboration of the presented information as well. From our daily experience, one can read a text, read a map, or watch television, with an intention of constructing elaborate or 'shallow' meanings from it. The depth of information processed depends on the amount of mental effort (or mindfulness) one invests in the process, and the amount of mental effort, in turn, seems to depend on a number of factors such as the way information is structured, the difficulty of the task relative to one's skill mastery, and the perceptions one has of the task and of one's own abilities (Cohen & Salomon, 1979; Salomon, 1984). Salomon (1984) has argued that people process information with less mental effort when they perceive it, on the basis of a few structural elements, to be related to an area in which they feel comfortable and confident.

By their nature, socioscientific disputes are complex; they require understanding of the presented arguments, identifying the underlying values in conflict and a careful consideration of trade-offs in order to meaningfully respond to the issue. Making sense of information that is being presented on videotape, and organizing the material—both visually and in terms of a

verbal-labeling system—requires time. We have to replay what we have seen, think about it, and go through the sequential verbal process as well as the processing of the images themselves (Singer, 1980). With television's rapid exposition, however, it necessitates either a failure of storage of current material being presented, or a "tuning out" one of the sensory modes through which the television message must be processed.

Given that the likelihood of recalling items of a story varies with the perspective a reader brings to the material, it is reasonable to suppose that story elements that do not match the "slots" readied in the reader's mind are more shallowly processed and are, thus, less well retained. In the case of television, it could be that the amount of information elaboration is influenced by how a person wants to perceive (or is told to perceive) the information. At the image formation level, reading seems to call for more extensive imagery and reflective action whereas television merely stimulates specific image content, since it provides an external image that one can passively use rather than create one's own. This proposition is supported by work reported by Greenfield (1984) on the effects of television, video games, and computers on the mind.

It also appears that pacing of a medium affects the way in which information is processed. With the rapid stream of changing images that flow from television, the continuous reflective process, particularly of contingent material, becomes more difficult for television viewers. Thus, the extended reflection, retention of information, and critical evaluation of information, otherwise possible with the print medium, is reduced amongst television viewers.

Recent analyses of the modes of information presentation, or symbol systems, suggest that different modes require different amounts of mental

elaboration to derive meaning (Salomon, 1979a). In addition, the information processing theories (Luke, 1987; Woodall, Davis & Sahin, 1983) recognize that individual viewers, and readers alike, bring to the viewing/reading situation varied skills and biasing dispositions that may result in different interpretations of the same television or print content which are of consequence to the impact of the presented information.

Significance of the Study

This study would inform teachers of the influence that the various modes of presenting socioscientific issues in the classroom may have on the ideas and arguments which students are likely to construct about the issues.

In the curriculum development process where various modes of presenting information are proposed and encouraged, this study will help educators understand reasonable expectations of Grade 10 students' abilities in the discussion of science-related social issues presented in the print and video formats. It will also help educators better understand the implications for classroom practise in using print and video scenarios in the discussions of socioscientific issues. Although the features of students' discussions of these kinds of issues at a group level are yet to be explored, the findings of this study will form a useful starting point for understanding students' arguments, and for developing insights into the design of new materials and of the choice and subsequent use of the available materials in the classroom context.

Definitions

Socioscientific Issue

For purposes of this study, a socioscientific issue will refer to a topic of public interest involving science and technology and about which there are conflicting points of view requiring the balancing of competing quality-of-life concerns.

Point of View

As referred to in this study, a point of view on a socioscientific issue expresses a position on the issue discussed and offers a corresponding justification in the form of a reason or value principle to support the position.

Delimitation of the Study

The debate about the use of animals in scientific and biomedical research is one illustration of the great public interest in the impact of science and technology on society for which there is yet no consensual solution. A story on this issue was developed from snippets of television news, and an equivalent newspaper-type print story was written based on the information in the video story. The presentation formats of these stories, therefore, correspond to the ways television and the print media commonly present information. The unique presentation formats of this issue, together with the exploratory nature of the interviews, dictate the boundaries of this study. Knowledge claims will be made within these boundary conditions and will be based on the researcher's inferences and orientations arising, in part, from the researcher's background experiences and gendered interests. Those propositions may be generalizable only to similar socioscientific issues and

only under the conditions similar to the ones prevailing in this study. The study does not attempt to generate a 'grand' theory, rather it develops conjectures about Grade 10 students' abilities to reflect on and extract relevant information from the story on an issue presented in print and video formats.

It is also acknowledged in this study that the research context within which the interview was conducted may create a different type of viewing or reading on the part of students than when students watch or read on their own at home. And in conducting the study, as with the analysis of the interview transcripts, the researcher's prior commitments to and interest in the topic, particularly in the development of the coding schemes, may be reflected in the interpretations of the study.

CHAPTER II

Review of Literature

Overview

This chapter will provide an overview of the issues that have dominated media research. It will specifically draw from studies of print and television media to relate the aspects that characterize responses to these media formats in discussions of socioscientific issues. An attempt will also be made to build into this literature review a rationale for the methodology in this study.

'The Medium is the Message'

Since Marshall McLuhan's proclamation in "Understanding media" (1965) that "the medium is the message", there have been rigorous attempts to understand the implication of this conception for media research. In what could be a useful starting point, Dommermuth (1974) offered this interpretation of McLuhan's statement: "what we commonly think of as 'the message' is transmitted by some medium which, because of its mechanical nature, sends a simultaneous 'message'." Such an interpretation would imply that perception and interpretation of the original message is affected by the simultaneous message inherent in the mechanical nature of the medium.

McLuhan further asserted that different media have different effects despite equivalent content, and that a medium's effect will be in some ways consistent even when its content varies. The implicit assumption in this assertion that television, for instance, contained representational codes fundamentally different from those of, say, print precipitated a flurry of

research in the subsequent years. For example, Olson and Bruner (1974) addressed the cognitive aspect of McLuhan's thesis, asserting that each medium is associated with a unique pattern of skills for dealing with or thinking about the world.

It is only in the past few years that the attention of researchers studying the influence of the media on children, particularly television, has returned to the forms of the medium itself as distinct from the content presented with those forms. Before then McLuhan's ideas had remained a vague formulation until Salomon (1979b) and Huston-Stein and Wright (1977) began to elaborate the implications of these notions for developmental theory which was the core of research. Salomon focused primarily on the influence of visual media codes on children's mental processing and mental skills. Huston-Stein and Wright attempted to place television forms in the context of a broader theory of developmental change in patterns of attention and information processing.

Salomon (1979b) demonstrated the connection between symbolic forms associated with technology of a particular medium and the cultivation of particular mental skills. He determined that neither contents nor modes of usage constitute the essential difference between media. What does serve as an essential difference between media is their symbol systems—printed formal language in books, and the unique blend of pictures and sound in television. Goodman (cited in Salomon, 1979a) defines a symbol system as a set of elements, such as words, numbers, shapes or musical notes that are within each system by syntactic rules or conventions, and are used in specifiable ways in relation to fields of reference. According to Salomon (1981), the different modes of presentation serve as meaning contexts in at least two ways. First, different symbol systems, and the different symbolic

components within them, are processed by different kinds of mental skills. Second, the same context presented via different symbol systems appears to yield somewhat different kinds of interpretations.

The argument that each medium has a distinct interplay of symbol systems requiring specific skills has the implication that different content presented in the same medium will have some effects in common. It also implies that the effects of two media will differ from one another even when they are transmitting the same content (Greenfield and Beagles-Roos, 1988). The results of Meringoff's work (1980) seem to lend support to the second notion.

In that study, a story was read out of an illustrated book to some children, and was shown through animation on television to other children of ages 6 to 8 and 9 to 10. She found that exposure to the television story was associated more with use of visual information in recall and in making inferences than with exposure to the illustrated book. Children who had listened to the picture-book reading tended to be more bound to the text. More importantly, though, Meringoff found that the children in the book group based their inferences on their own past experience and general knowledge more often than did children in the television group. The latter group, on the other hand, were more bound to the picture and emphasized the visual events more. Could it be then that different amounts of processing are realized in different media, leading to different understandings from some than from others?

Processing of Media Information

In exploring the notion of information processing, Singer (1980) investigated the possible difference between television viewing and reading.

He attributed differences between media to media themselves, that is to their essential symbol systems (language versus pictures). Singer argues that television is a "crowded" medium which does not permit the transferring of presented content from short-term to long-term memory. Television apparently addresses itself to the right brain hemisphere, and allows only global, "holistic" recognition but no deeper analyses. Further, he claims the understanding of, say, a story requires the generation of imagery, but television offers a substitute for the active involvement of one's own imagery; thus, it stimulates images, but does not allow for their generation. In short, the rapid pace and flashy pictures in television do not permit its contents to be subjected to much mental elaboration.

According to Singer (1980), print material requires readers to draw upon their own memories and fantasies, to invest time in following the drift of a writer, and to conjure up images—a process that requires much reflection and effort. Thus, reading may demand more skill for most people, not only in manipulating vocabulary but in producing the necessary private imagery. But does such an explanation suggest that television, due to its very nature, does not allow, or even inhibits, deeper processing?

The notion that television is a passive medium and that the viewers will not engage in any deeper cognitive activities is quite widespread (Mander, 1978; Noble, 1983). For example, Noble (1983) maintains that television acts through feelings rather than via cognition and thoughts. Television producers and viewers alike agree that television can arouse emotions, but there is yet very little research available on television's effects on emotional development and functioning (Pearl, Bouthilet, and Lazar, 1982). Researchers have tended to focus on determining whether this notion of television processing implies that the viewer actively processes

information or is simply passive in the course of television viewing. Reeves and Thorson (1986) have proposed a synthesis between these standpoints that:

A more useful approach to the question of active versus passive audiences may be to try to determine when and how each process operates rather than assume that one exclusively explains how television viewing proceeds (p. 358).

Pursuing this 'when and how' notion of information processing, Höijer (1989) contends that it is not possible to fully grasp a viewer's cognitive processing, comprehension, and perception of a program exactly as they occurred during viewing. Nevertheless, by providing opportunities for viewers to communicate their recollections of expository television programs immediately after viewing, we can shed light on some relevant aspects of the processing of television programs. If a viewer is indeed an active information processor, he or she can be expected to compare the external information to his or her existing structure of beliefs and values. Similarly, if the viewer of a television program reflects on what he or she sees and hears, we can say that he or she is an active cognitive processor of the content. The absence of program-related thoughts indicates a more passive processing, in which the viewer does not compare the content of the program with his or her existing cognitive structures.

Media Comprehension Models

Much of the earlier research on the effects of television on children was based on a behaviorist model of televiewing, positing the viewer's response as a direct and measurable effect of the television stimulus. Underlying this approach was the assumption that the child is a passive viewer whose responses to and learning from television are determined by

how much and what is watched. Given the limited role for the viewer in this theoretical model, and the kind of data produced by effects studies, the generally negative reaction to television is not surprising.

By contrast, current research (for example, Salomon, 1979b; Huston, A. et al. 1981; Krendl & Watkins 1983; Rice & Wartella, 1981) relies less on explaining television's effects through the measurement of observables and sets out to incorporate the viewer's background knowledge and the actual viewing situation. A reconsideration of viewing as an essentially mediated experience may permit a clearer conception of how children's background knowledge and experience influence their learning from and comprehension of television—and how in turn, television mediates their experience and knowledge of the world. For many of these researchers, how knowledge is acquired, structured, and used is a critical factor in accounting for children's abilities (or inabilities) to deal with television's content and symbol system. This post-behaviorist orientation furthermore obliges researchers to focus on the viewers' social environment.

Both linguistic and nonlinguistic acts are forms of communication constrained, among others, by individual abilities and knowledge. As we gain competence in the world, our perception and knowledge of the world increasingly takes on a more linguistic character. We talk about nonlinguistic experiences in variable terms; we tend to express our understanding of human relationships, of pictures, and of observation through language.

Making sense of television's linguistic and visual information requires that the literate viewer draw upon prior knowledge. Visual processing of observation data (objects, static or dynamic, pictures or print), and the construction of meaning is a function of stored background knowledge; this includes general knowledge stored in long- and short-term

memory as well as more “immediate” context-specific knowledge. That is, we make sense of both print narrative and television narrative in terms of what we know about the content at hand; we also infer meaning on the basis of clues extracted earlier in the text or program. Background knowledge, situation and task content mediate our expectation toward incoming information. In televiewing, as with all communicative activities, the participant actively recalls, categorizes, and processes information.

In addition, because in television, linguistic and pictorial symbol systems are transient and because they are presented simultaneously, viewers may process this information in a very different way than the back-and-forth serial processing of linguistic and representational information in print. It is also possible that the symbol systems used and their transient nature affect the mental representation created with television.

Indeed, television stands apart from print by virtue of its unique structural features: production techniques and the visual symbol system. However, a fundamental aspect of the “meaning” accessible to the viewer is the reliance of this symbol system upon spoken language and the cultural convention in which language is embedded. As with text, the viewer calls into play a variety of linguistic skills and linguistically coded knowledge to make sense of, and actively interpret a given program. An understanding of what is meant, that is of what is said and shown, depends on some familiarity with the codes of social life: prior linguistic and nonlinguistic knowledge of the world and on our imaginations of it.

Top-down and Bottom-up Theories

Traditionally, experimental and developmental psychologists in television comprehension research have measured the amount and content

of television watched, the attention span of the subjects and, in addition, observed students' subsequent behaviors upon exposure to violent programs, for example. Such research has partly been based on the tacit assumption that since children are cognitively and experientially less sophisticated than adults, they could be regarded as inherently passive, uncritical, and unreflective viewers (Luke, 1987).

According to Luke (1987), the schema theory, which culminated from these early comprehension studies, is associated with what have come to be known as "top-down" theories of language comprehension as distinct from "bottom-up" theories. The reciprocity of top-down and bottom-up processing has been used to explain television and print comprehension. Top-down theories hold that the reader's subjective prior knowledge determines comprehension and the construction of meaning to a greater extent than does the text's intrinsic linguistic features. From this perspective all individual ascriptions of meaning to a particular sign or set of signs would be considered equally conceivable, and actual comprehension would be dependent upon individual knowledge and experience.

Bottom-up theories, on the other hand, hold that meaning is determined by the actual textual data rather than in conjunction with subjective knowledge. This "data-driven" theory of comprehension is premised on the presupposition that the acquisition of knowledge is a more or less linear accumulation of information, building from the simple to the complex. Individual, conceptual, and cultural frameworks are deemphasized and the subject's knowledge and the cognitive abilities are seen as wholly determined and manipulated by a given set of external stimuli. From this perspective, given an appropriate set of input data, desired

behavioral, or cognitive responses can be elicited from a subject or group of subjects.

Within a schema theoretical perspective, therefore, the efficient processing of information—whether textual, observation, pictorial, or aural—depends on striking a balance between bottom-up and top-down processes in relation to a given task or context. Meaning, then, is neither an intrinsic property of a particular sign nor is it of the processor's interpretive framework. Rather, constructing a meaningful interpretation is a reciprocal process between the cues of external data and the conceptual structure of the individual.

Salomon (1981) has applied the concepts of top-down and bottom-up processes to explain the interaction between television-specific skills (bottom-up) and general ability (top-down) in comprehending television's form and content. The young, socially inexperienced viewer, he notes, relies heavily on bottom-up processes of decoding and "recoding" messages into meaningful, internal representations, then integrating or "chunking" these into whole units of meaning. With increased experience and age, the child makes use of broader background knowledge and more general abilities, and incorporates top-down processes in more complex "elaborations" on incoming data. For the older experienced viewer, bottom-up processes become automatic, that is basic decoding, recoding, and chunking are no longer closely and self-consciously attended to. Instead, one may intentionally seek particular information from a program, predict outcomes, attend to specific production features and reflect on accuracy (or inaccuracy) of the presented information. As Salomon comments:

The furthering of one's television literacy, beyond the basics, is apparently a matter of interplay between "bottom-up," hypothesis-testing and inference-making processes. Epistemically guided by a conception, expectation, hypothesis or tentative inference, one addresses new and more complex elements in a program, and recodes them to extract the additional information that is epistemically sought. Thus, "top-down" processes guide one to encounter novel elements and the practise of recoding them leads to improved mastery of new TV-related skills. Improvements of this kind, such as the ability to selectively chunk larger amounts of visual information, lead, in turn, to additional inference and other high-order cognitive products . . . general abilities and television-specific ones mutually guide the development of each other (1981, p.11).

Factors Influencing Comprehension

Much of the research on comprehensibility has focussed on how children of different ages mainly understand television programs in a more general sense; that is, researchers have sought to trace developmental trends in understanding that can be related to and explained by what is known about cognitive development. In looking for age trends, it is easy to forget that comprehension is highly dependent on the form and content of the stimuli, the programs tested.

Comparability between studies may be complicated by other factors as well. In the first place, understanding is defined variously (Woodall, Davis & Sahin, 1983). Secondly, the definition used will determine one's choice of measures, which is of decisive importance. It makes a big difference whether understanding is measured by asking the children to reconstruct the story in their own words, to respond to questions, or whether they are asked to abstract the gist of the story. Such methodological differences between studies make it difficult to make totally congruent generalizations about children's comprehension of television programs or print stories.

Despite the fact that studies on media comprehension sometimes lack comparability because of difference in program content and format, we can still trace some general factors that affect the cognitive processing of information presented in any media format. Individual differences and variations due to situational and contextual factors do contribute to differences in information processing. The important thing is that mental representations of scenes in the program are created during the act of comprehension, and thus, consist of our impressions and interpretations of the program as they are represented in our cognitive structures. They also include other cognitive and emotional responses, such as thoughts evoked during viewing, which together, feature in the responses about the story or program except in differing amounts.

In order to communicate the content of our thoughts, at least partly, to another person, the mental representation must pass through memory processes. We must recall what we earlier experienced. For this reason, when the act of recall takes place becomes an important factor. Bower, Black, and Turner (cited in Höijer, 1989) posit that the memory process immediately after exposure mainly consists of reproduction of mental representations formed during the act of comprehension. They note that the longer the interval that elapses, the more reconstructed the memory process becomes. In an interview situation, for example, they suggest that the viewers should be interviewed immediately after exposure in order to minimize recall effects and the risk that the viewers' memories will be too reconstructed.

Predispositions about media use also seem to influence the processing of information received from the media. Television is often perceived to entertain and to serve escapist functions whereas print is perceived to inform and educate (Salomon, 1984). Salomon found that significantly more

children attributed success in learning from print to internal causes ("they are smart") and success in learning from television to external ones ("its easy stuff"). These findings suggest that television is perceived to be an easy medium and print a tough one. Hence, when people treat television as a shallow medium they learn to disregard its potentially more demanding contents which would have made them exert more or less mental effort in processing the content, and in this way further reinforce their predispositions. Therefore, aside from what is medium-determined, one's expectations of the medium's demands and one's beliefs about his or her own efficacy has an effect on the processing of media information. It could as well be that perceptions and attributions simply reflect the true nature of the media, that television inhibits deeper processing—and this fact is reflected in children's attributions—while print requires more focus, and is perceived accordingly.

In order to shift student perception of the task demands, students in this study were informed that after exposure to the story, they would be interviewed about their understandings. As Salomon (1984) points out, students will then purposefully engage in an activity and will feel more competent to succeed in the task. In other words, informing students that they will be interviewed after viewing a television or reading a print story, will more likely lead to an in-depth processing of information. Thus, in-depth or deep processing does not seem to be a direct function of what the media actually require but rather of what one thinks they require.

CHAPTER III

Methodology and Analysis

Overview

This chapter presents the methodology adopted in the collection of the data for this study. In it is described the research instruments used in the study and the procedure followed in the selection of the subjects who participated in the study. This will be followed by a discussion of the methods used in the analysis and interpretation of the data.

Methodology of the Study

This study stems from one of the components in the larger study on the provincial science assessment exercise under way in British Columbia conducted with the help of a grant to Dr. P.J. Gaskell from the Ministry of Education, Assessment, Examinations and Reporting Branch. The preliminary development of the instruments used in the study, as to a large extent, was the collection of data for the main study, was a result of a joint team effort (Gaskell, Fleming, Fountain, & Ojelel, in press). The particular component from which this study derives its data was conceived to elicit student understandings of science-related issues commonly appearing in the media. In the study, students are presented with a similar story on a socioscientific issue in print and video formats and then interviewed about their understandings. This story is about the ongoing debate about the use of animals in scientific and biomedical research.

In developing the video scenario, snippets were obtained from the CBC television news and carefully edited resulting in a five-minute story that

explores the controversy between the need to further human knowledge of scientific and biomedical processes through research on animals, and the ethics of the treatment of animals. The story explores fairly extensively the fundamental arguments for and against the use of animals in laboratory research and gives contextual information on the evidence used in each of the positions.

One perspective on this issue advocates restraint in the use of animals in experiments, arguing that scientific experiments requiring animal testing is indefensible. The position is reinforced by the argument that recent technological advancements, particularly in the use of computers, together with the growing capability to carry out experiments on tissue samples, should replace animal testing altogether. Furthermore, the argument goes, data accumulated over the years on animal testing shows that animals used in scientific experiments are poorly cared for in the laboratories and experience unnecessary pain and suffering during and after experimentation, and yet their systems are far different from those of humans.

In the story, the position that advocates for continued use of animals in research argues that the use of animals in testing is especially inevitable in the final stages of the research. They specifically argue that other testing methods could be employed in the early stages, but an animal has still to serve as the final test before the medicine or surgical technique can be used on humans. Supporters further argue that laboratory animals are not subject to unnecessary suffering before, during, or even after experimentation as claimed by the opponents. They also point out that if an animal is bound to experience pain and suffering after an acute surgery, an overdose is administered to put it to sleep. These researchers point out that they observe their own ethical guidelines on the responsible treatment of animals used in

research and those guidelines stipulated by the Canadian Council on Animal Care. This has resulted in a reduction of the number of animals used in experiments and a decrease in the kind of experiments that may subject animals to unnecessary suffering.

As another mode of presenting the issue in this study, a newspaper-type article was written to convey the different points of views explored in the video story. While it was essential that the video and print stories be as similar in content as possible, it was also important that each version retain its symbol system uniqueness. Thus the print version of the story was not simply a transcript of the video scenario. Rather, information that provides contextual background to the important items discussed in the video story was included in the print version in order to enhance the readability of the story. In doing so, information that presents the arguments on the different points of view explored in the video and which could be expressed in an understandable vocabulary was written into a one page, two-column story.

The drafts of the print and video stories were both extensively reviewed by a specially appointed committee in accordance with some of the "equivalencing" procedures proposed by Baggett and Ehrenfeucht (1982) when matching information in content-equivalent movie and text stories.

After developing the print and video formats for presenting these issues, an interview protocol that utilized semi-structured questions was developed to elicit student responses to the use of animals in research. These questions have no choices from which the respondent selects an answer. Rather, they are open-ended, but are fairly specific in their intent. And since in the study the respondent was required to communicate freely, the questions asked were phrased to allow for individual responses. In the interviews, probe questions were frequently and consistently used in order to

seek clarifications of students' statements. This enabled the interviewer to distinguish between those ideas which play a significant part in the students' understanding of the issues and those which are generated in response to the social pressure to produce an answer in an interview or test situation.

On the basis of the interview protocol and on what the student volunteers, the following probe phrases were employed: "Could you tell me more about that . . .", "Did you think of anything in particular when you saw (or read) that?" "Let's explore that bit a little further." The amount of probing in the initial part of the interview, however, was minimized, thus decreasing the likelihood that subjects will engage in inferential processes or guessing what the interviewer wants by way of response.

The interviewing procedures elaborately discussed in McMillan and Schumacher (1989) were adapted in this study. Before asking the questions in the interview schedule, the interviewer spent a few minutes with small talk in order to establish a comfortable relationship with the respondent. At this preliminary stage, the central aim of the interview was made explicit and the respondent was asked whether he or she had any questions or concerns. In this case, students were informed that the process was not a test, rather the study was interested in gathering students' ideas about the use of animals in research. During the interview, the student was encouraged to express freely his or her point of view and was allowed to feel that by asking follow-up questions, the interviewer was only seeking to clarify what the student had said. The method involved active listening and maintenance of attention through nods, eye contact, and affirmative noises (*um - hmm*). This approach encouraged the interview to take on a conversational form.

Pilot Study

To establish consistency in the wording of interview questions, an interview protocol was developed and extensively piloted with an arbitrarily selected sample of students from four different schools in two Lower Mainland school districts. An interview protocol was developed to cover a range of areas about students' understanding of and response to the issues explored in the scenarios and about their ideas on the interaction between science, technology and society. The beginning questions asked, (1). What the student thought the story was about, (2). What the different points of view expressed in the story were, and (3). What the student's own point of view was. Questions were also asked that explored the students' experiences that could have informed their points of view and of the additional information they would require in order to develop their ideas about the topic further.

During the piloting of the instruments, adjustments were made to the sections in the interview protocol that the students found difficult to interpret. The videotape and print version of the story were likewise piloted in the same schools as the interview protocol. Sections of the videotape that the interviewer perceived to distract students from the central issues discussed in the story were also noted and edited. In addition, some of the expressions that were apparently difficult to understand in the print story were accordingly rewritten.

Selection of Subjects

This study drew its participants from a randomly sampled population of Grade 10 students across the province of British Columbia who accepted to take part in the provincial science assessment exercise. These students were randomly sampled from schools in six (6) geographical zones drawn from the

seventy five (75) school districts in the province. The schools in this study were arbitrarily chosen to take part in the assessment exercise due to their accessibility and readiness to participate. Students were then selected after establishing the schools that were to participate from these zones. For this study, three Grade 10 students on the average were randomly selected from their classrooms in each of the six zones and then randomly assigned to the print or video formats of the issue. Overall, twelve (12) Grade 10 students (6 Females and 6 Males) watched the videotape and fourteen (14) students (7 Females and 7 Males) read a newspaper-type version on the use of animals in research.

Interview Procedure

Students who participated in this study were randomly assigned to watch the video or read the print story. One student at a time was shown the five-minute video on the use of animals in scientific and biomedical research, or asked to read the print version. Prior to the exposure, students were reassured that the exercise was not a test, that is, their responses would neither be rated right or wrong, good or bad, nor would they affect their science grades. Nevertheless, they were informed that they would later be interviewed on their ideas about the issue. They were also advised to carefully watch the video or read the story that was to follow. Students were then encouraged to try their best to understand the story and told that only they can report upon their own thoughts about the use of animals in research. However, students were given no cues about the nature of the questions that would be asked, nor were they given any specific information about the topic that they were going to read or watch.

The subjects were also told that if ever they felt uncomfortable with any parts of a question in the course of the interview, they were free to decline answering such a question. Although these reassurances were made as calmly as possible in an attempt to elude 'test' conditions, it is likely that supervised viewing of a videotape, or reading of the story, would be taken more seriously compared to the televiewing or reading conditions done at the student's own time.

The instructions to students were clearly and consistently spelled out at the beginning of every interview, since:

When given essentially comparable material through two media and in the absence of clear instructions, perceptions of the media and of one's own efficacy with them are related to the investment of processing effort, which in turn is related to inferential learning (Salomon, 1984, p. 656).

Students were not given an opportunity to pause the videotape during play, or to play-back. The students who read the story were asked to do so at their normal reading speed. On completing the reading, they either handed the script back to the interviewer or put it away. Immediately after watching/reading the story, in-depth interviews lasting about 30-min were carried out.

Data Analysis

All the interviews conducted with students in the pilot study and the main study were transcribed soon after the interviews were completed and the transcripts were analyzed for recurring patterns or themes. A theme of the students' response refers to either the direct or indirect statement of the students' central idea of the story. An analysis of the pilot study transcripts

provided a preliminary phase for analyzing and interpreting the data in the main study in order to answer the four research questions. The themes first identified in the pilot study are elaborated here in the analysis of the data from the main study. Sub-themes have been developed in order to adequately describe the features of students' responses and to sufficiently answer the four research questions posed in this study. The following are the areas around which the results of the interviews conducted in the main study shall be discussed.

(a) Framing of Students' Initial Responses

The first question that the students were asked was, "What do you think the story is about?" This question sought to elicit the different ways that students framed their initial interpretations of the story. The framing of one's interpretation of the story is important because it helps an individual define the central issues, and specifically sort out from the given information what it is that makes sense. As it turns out, students framed their responses in a variety of ways. Student responses vary according to the kinds of details from the story that students selected to use, the images in the video that they drew upon to describe the story, and even in the match between the given information and the students' interpretation of the story.

The following are the descriptions of the different ways of students' responses to this first question:

Reiteration of Topic

In these brief responses students described only a sense of the topic or gave a sense of the difference in the points of view expressed about the issue. These sorts of responses give little information that would suggest a

considerable attempt on the part of the respondent to capture the trend of argument in the story. Rather, they reiterate the topic without identifying the difference between the different sides that are discussing the topic, for example, "This story was about using animals in research basically" (VM1)¹. Or the responses give a general sense of difference with only a mention of the topic, as in, "The story is about the use of animals for scientific experiments and if they should or shouldn't be used" (VF1).

One Position with a Justification

Students also gave responses that identified with only one side of the arguments presented in the story. These kinds of responses convey little sense of the conflicting sides of the issue explored in the story. Students who gave these responses used value-laden expressions that are rather explicit in their support for only one side of the story. They do not attempt to acknowledge the alternative position expressed on the issue and its corresponding justification. Rather implicit in these responses is a sense that the student is overwhelmed by the arguments of one side. For example, "The story is about animals being used in laboratories for *curing* diseases and finding out about diseases" (PF1).

Sometimes these kinds of responses are framed in a form that identifies with the point of view that is against the use of animals in

¹This code format is used throughout the document to distinguish students' responses. The first letter refers to the presentation format, which in this case is either Print (P) or Video (V). The second letter indicates the gender of the respondent and the figure shows the response's arbitrarily assigned number. This first response (1), therefore, was given by a respondent who is male (M) and who had also watched the Video (V) story.

experiments: "The story is about the *abuse* of animals in the laboratories, and freezing them and testing on them" (PM1).

As mentioned earlier, these responses make use of strong value statements that are particularly unaccommodating to the opposing points of view. And especially when expressing an unfavorable point of view, these responses are usually emotionally-charged.

"The story is about animals dying through experimental surgery because some scientists are putting, testing things, um, chemicals in animals instead of humans" (VF2).

Two Positions with Justifications

Some of the students were able to identify the conflict in the story together with the essential arguments behind the different sides of the issue. Students framed the issues in a variety of ways, perhaps because a number of issues on the use of animals are raised in the story. In this analysis, however, a clearly stated issue is recognized when it consists of explicit positions that are supportive of and opposed to the use of animals in scientific research, followed by the justifying arguments for the different positions taken on the issue. Because an underlying value judgement is inherent in each justification for a position on the issue, and since our personal values rate variously across issues, the issues discussed in the print and video story are subject to multiple interpretations.

Given below is an example of how students framed the issues discussed in the print and video stories in terms of the ethics of using animals in experiments and the human need to seek cures for diseases:

"A lot of people are debating about whether or not we should use animals for testing out. People are saying whether or not we should do research on animals 'cause some people feel that it hurts or harms the animals, it's not fair to the animals, others

feel that if we don't use the animals well, we'd be behind in some of our medicines and we'd have to use people to test it on and they don't want that" (PF2).

Other students perceived and framed the issue quite differently, they framed it in terms of the disagreement over just how much the alternatives can replace the animal models:

"It's about a debate between two groups, the group that believes that experimentation on animals has a place in society, and the other group that thinks it is unnecessary and can be replaced by computer methods and other methods" (VM2).

(b) Identification of the Different Points of View in the Story

If students had not identified the different points of view in their response to the first question, they were specifically asked to identify the different sides of the issues discussed in the story. In most cases students did not voluntarily give this information in their initial response. A response to this question helps the researcher to explore students' ability to extract relevant information about the arguments of the different sides. An awareness of the various points of view is important for two reasons. First, such an awareness is valuable when we are trying to make a responsible judgement about the overall desirability of a course of action. The more relevant facts we take into account in making such a judgement the more responsible the judgement is likely to be. Knowing the points of view from which value judgements may be made gives us a good picture of the range of facts that are relevant to our judgement of the credibility and relevance of the information. The second reason for being aware of various points of view is that such an awareness helps us avoid the mistake of supporting a judgement from one point of view with reasons that are appropriate to a different point of view.

Some of the ways in which students identified the different points of view from the story are described below:

Students' own Reaction

Other than identify the points of view expressed in the story as specifically requested, some students felt strongly about the issues right-away and instead gave their own reaction to the issues explored in the story. In some instances, students first identified the points of views expressed in the story and then summed-up the different positions with their own points of view. For example,

"There are people on one side that think that they should be researching, and they say that if they don't do it then the humans won't live as long, and people that don't want it say that it's cruelty to animals and it's unfair to 'em. I think that they shouldn't be able to do it unless it's really, really important, 'cause um, animals have lives too" (VM3).

The Different Points of View

Students also identified and described the different points of view expressed in the story in terms of the positions taken on the different sides of the issue and often with an accompanying justification for the different positions. A justification consisted of the reasons or the kind of arguments used by the different sides to support their positions on the use of animals in research. Some students saw the essential conflict presented in the video as that between those supportive of the use of animals in experiments because animals have been and continue to be used for seeking cures for mainly human diseases, and those who do not support the use of animals in scientific or biomedical research because they see the use of animals in

research as a violation of animal rights especially when alternatives to the use of animals in research are present.

Students described the different points of view in various ways:

(i) Positions with No Justifications

In some of the responses, even when specifically asked, it is common for some students to give responses that give only a general sense of the perspectives used by the different sides to justify their positions on the use of animals in research. Often these kinds of responses portray the sense that two sides are presented in the story, but these responses only offer general information to support the different sides. Essentially these kinds of responses could be categorized as superficial since little attention appears to have been paid to the information in the story that explains the reasons for the different positions on the issue. One revealing example of these kinds of responses is given below:

"Well there's one guy that's against it in the video and he thinks that we should do it because it's alright and they don't need to do it and they just do it needlessly. And the other people, the guy from SFU animal experimentation place says that it's, you have to do it to see what it's gonna do to the person that you put it into, the drug or whatever it is, so they experiment on the animals" (VM4).

This response conveys only a general identification of the information discussed in the story.

(ii) Positions with One Justification

These are the in-between responses; they have identified the central conflict but have offered a justification for only one of the sides leaving out

the reasons for the other side. They represent the respondent's awareness of the alternate viewpoints on the issue but who, at the same time, consciously chooses to disregard them, perhaps because they are not consistent with the students' own point of view on the issue. For example:

"Well one is that they shouldn't at all use animals and the other one is that they don't hurt them and if it is proven, if the tests do, um, result in permanent damage or injury, then the animals is put to sleep. I don't know, I don't feel that animals should be used, but on the other hand if they weren't, some cures wouldn't have been found. I think if it's just, um, like just, can't think of the word, um just watching them, you know, in a laboratory its okay, I guess, but if they're using it, using the animal and its going to cause permanent injury so they kill it, I don't think that's right" (PF3).

(iii) Positions with Two Justifications

Some students were very articulate about the issues discussed in the story. By accurately identifying the different sides represented in the dispute in terms of groups of people, the different views or perspectives expressed, they were able to express clearly the different points of view on the issues discussed in the story. For example:

"There was the one point of view that we must test on animals because it betters the human life-span and they're closely related to humans and so that we have to, in order for humans to live longer, and there is also the view that there are alternatives to doing this such as computer testing or using tissues like, meat tissue, and some people argue that it's not fair that we're sacrificing these animals for our needs" (VF3).

(c) Students' Points of View on the Issue

Students were also asked to give their own points of view on the use of animals in scientific research in the light of their understanding and interpretation of the information discussed in the story. Asking students to

give their points of view enables them to clarify their own ideas on the use of animals in research particularly in response to the perspectives expressed in the story. It also offers students a chance to critically examine the credibility of the information or to question the assumptions behind the arguments used by the different sides to support their positions.

The Array of Student Views

Students expressed their views on this issues in a variety of ways. Given below are some of the main ideas behind students' points of view on the use of animals in research:

- a. I support the use of animals in research as long as researchers use only a few animals.
- b. I am against the use of animals because it is not fair to hurt animals.
- c. I support the use of animals as long as the experiments are important and help to find cures for human diseases.
- d. I do not support the use of animals because the kind of animals that researchers use could become extinct.
- e. I support the use of animals as long as the experiments do not cause pain and suffering.
- f. I do not support the use of animals because we should use alternatives like computer models and human tissue samples.
- g. I support the use of animals as long as the animals are already sick.
- h. I do not support the use of animals because animals are not the same as humans. You cannot be sure that what works on animals will work on humans.
- i. I support the use of animals because human needs are more important than the needs of animals.

- j. I am against the use of animals because animals have as much right to live as humans.

One of the most commonly expressed views on the use of animals in research is that which supports the continued use of animals as long as the experiments are important and as long as the experiments do not cause pain and suffering. The other equally dominant point of view on this issue is that which is opposed to the use of animals in experiments because animals have as much right to live as humans. There are interesting differences between these views by gender and the presentation format of the issues which will, as with other findings, be discussed in the following chapters.

There are also a number of qualifier statements (justifications) that students expressed for their different positions on the use of animals. For instance,

"I also think that they should use computers or stuff a bit more if they can. It's better than using animals but I'm pretty sure in some cases they probably have to use animals, so I think that it is okay, but if they can do the work on computers, if it's gonna cost a bit extra money. I think they should use that bit of extra money to save the animals" (VM5).

The student in this example only links the reasons for not using computer models in research to the high costs involved, and to the reasons expressed by other students, such as the fact that computer models are only simulations, in which case, they are bound to make mistakes.

(d) Consistency of Students' Points of View

The fourth research question explored the relationship between students' earlier points of view and students' views on a second, related story

that is more personally relevant to them. The exact wording of this second story is given below:

A team of scientists at Metropolitan hospital had an idea about a new technique for removing tumors deep in the human brain. However, member of the team disagreed about whether to use animals to test the idea. Some scientists tested the technique using a computer-simulated model of the human. Other scientists tested the technique on monkeys that had been given injections so that they grew tumors in their brains. Which group of people would you want to operate on you if you needed a brain tumor removed?

This story was read to each of the students and it gives students an opportunity to defend and to personally evaluate the consequences of their earlier points of view on the use of animals in research.

Procedure for the Analysis of the Features

The records of the study are entirely audiotapes of each of the interviews conducted. These audiotapes were transcribed and using a computer, responses to each of the questions in the interviews were generated. They were later grouped to correspond with the research questions of the study and the print and video presentation formats.

After repeatedly going through the responses to various questions, familiarizing with the data, the emergent themes or patterns of the responses were noted alongside each response in the print or video group. Some student responses showed multiple categories. A pattern of the responses was considered an interesting feature if about one-half of the print and video responses showed the emergent pattern.

Responses from the print and video groups which had common patterns were identified, and the sizes of these groups were noted. The

responses that were identified as exhibiting an interesting feature of responses were then analyzed for variation of the feature by the gender of the respondents.

To quantify these results would give a false sense of precision in the exploration of the phenomena under investigation and might also give a false sense of the generalizability of the study's exploratory results. The small sample, the fact that the sample was a sub-sample of a larger sample which was itself a sample of B.C. Grade 10 students, the exploratory nature of the study, and the method of analysis—analyzing verbal utterances—suggest that quantification at this stage would not be justifiable and might, in fact be misleading.

Limitation of the Methodology

Short and engaging video materials, and those that present rich and balanced points of view on the different sides of a socioscientific issue are scant. After an extensive search, one source of video materials which could approximate these desired attributes was television newsclips. But in editing these clips so as to focus information and arguments on the issues, a marked influence of the researchers' understanding of the underlying issues is inevitable. And since socioscientific issues are subject to multiple interpretations, and given that we have unique personal experiences which we bring to bear on our interpretations of new situations, it is likely that some viewers may relate rather differently to this short video story. Nevertheless, the researcher believes that through the extensive reviews that the videotape and the print story used in this study were particularly subjected, the final stories are thought-provoking and equally stimulate discussions of the different perspectives on the use of animals in scientific research.

CHAPTER IV

Discussion of Results (I)

Introduction

For convenience of presentation, the discussion of results of this study has been split into two chapters. This chapter describes data that correspond to the first and second research questions that focused on the information about the presented story. It specifically discusses the features of students' abstractions of the issues from story information and of students' identification of the different points of view presented in the story.

Chapter V will discuss data that correspond to the third and fourth research questions. In both chapters, an analysis of the influence of the presentation formats and gender on students' responses to the focus questions of this study is incorporated.

1. The Framing of Students' Responses

Before an interview begins, students were either shown a five-minute video story or given a newspaper-type article of the same story to read. This section describes the features of students' responses to the first question they were asked, "What do you think the story is about?" Students' interpretations of the story varied widely and exhibit features that will be described in terms of how students abstracted and framed the central issues discussed in the story.

The information students chose to use in their abstractions and framing of the issues discussed in the story is an interesting pointer to the

students' interpretation of the story. The student, guided by his or her own perception of the purpose of reading or viewing the story, actively selects that information which he or she considers pertinent to the framing of the central arguments. Students commonly offered interpretations of the story that are related to one of the following responses:

"Well, it's a debate between two groups, the group that believes that experimentation on animals has a place in society, and the other group that thinks that it's unnecessary and can be replaced by computer and other methods" (VM2).

Or that the story is about,

". . . One side arguing with another, like one side feeling that it's cruel to have animals put through tests and experiments and stuff, and another side saying that it's fair cause they use anesthetics and it helps save human lives" (PM2).

Students' Perceived Self-Efficacy

In giving their interpretations of the story, some students reported that they were poor at extracting information from certain media and were hesitant about the thought of not responding satisfactorily. In what Salomon (1984) has called a 'perceived self-efficacy', one's perception of his or her efficacy with the medium seems to significantly affect the kind of information extracted and retained from a particular media presentation. For instance, one revealing response is from a student who had watched the video story and was asked to respond to the question, "What is the story about?"

"It was about how the animals were, *I'm not so good at this type of thing*, um like the animals were being, like you didn't really need to do all those experiments on them, I don't know. *I'm not very good at this type of thing*. . . . They could take tissue sample instead of like putting the animals to sleep and then operating on them" (emphasis added) (VF4).

Differences in perceptions of our efficacy with extracting information from a particular medium appears to lead to a possible difference in the kind of information extracted. Low perceptions of our abilities with extracting information from a particular medium tends to lead to a superficial extraction of information. Perhaps, for this reason, most of the responses from students who watched the video tend to be brief and often to be expressed with little confidence in the interpretation of the story. For instance,

"Um, I think it was about showing both sides, like uh, the animal, y'know, they have to do animal research but somehow, I think sometimes it's not necessary, it's just trying to show both sides so that you can make a decision" (VM5).

Although these kinds of responses were usually given to the visual medium, it is useful to note that a low perceived self-efficacy with extracting information was also shown in some print responses, for instance in the response below:

"Well, it's about, like there's two sides to the story I guess, like about, about using animals for scientific experiments and stuff" (PM3).

Perhaps our perceived abilities to extract information from a particular medium is related to our attributions of the difficulty or ease of extracting information from such a medium. We expect certain media to present information in certain ways and this makes us attend to the presentation modes in those anticipated ways.

Level of Empathy

Responses suggesting a high level of student emotional involvement are framed in a way that provides information that supports only one side of the issue. These kinds of responses were found in both presentation formats. However, empathetic statements, particularly about not using animals in research, were more frequently given to the video story than to the print version of the same story. Responses such as,

"It's about animals and how people treat them, how some people use them instead of humans and other others are looking at it like animals have their own feelings and all that, so we shouldn't treat them like different from humans. We should treat them as equal, as humans treat us" (PM4).

connote an interpretation of the story that does not favour the use of animals in testing but which is sympathetic to the rights of animals.

One other difference between these kinds of responses is in the gender of the respondents. Proportionately, male respondents mostly offered one-sided responses. And in terms of the side that is most likely to be portrayed, however, responses from males tend to be explicit about the need to use animals in research in order to better the human quality of life

Females, on the other hand, are more likely to be opposed to the use of animals in experiments because they perceive that testing on animals causes pain and suffering to the animals and, therefore, is an abuse of animal rights. In either case, the value positions tend to shift to imaginatively enter another person's feelings.

Details in Students' Responses

Students' responses also tended to carry a significant amount of detail. These range from descriptions of the scenes and images shown in the video story and use of statements in the print story to the extraction of concrete information in the story in the form of names of persons or places. For example in the print response below:

"I think it is about the use of animals in laboratory experiments and the two different sides arguing against it. On the one side is Peter Hamilton who formed the Life Force, that organization, Animal Rights and the other one is about professors at UBC arguing their point saying that they have to use it because, it says in there 'either you use animals or they humans,' and they want to use animals instead of humans" (PM5).

The details that seem to recur in students' responses, however, are those that emphasize specific statements in the story and those that use the exact names of the persons and organizations mentioned in the story. Use of these kinds of details in student responses is marked among students who read the print the story.

In both the print and video formats, students were able to identify the conflicting sides about the use of animals in research, for instance, "The story is about whether or not they should use animals in the laboratory and in research" (PF3) Students who read the print story were, however, more likely to refer to the arguments or justifications for the different sides of the dispute using many details in their responses compared to those students who watched the video.

What is significant is that most of the responses to the first question that were categorized in Chapter 3 as reiterating the topic or a general sense of

difference were offered by students who saw the video story. Below is an example of a response given to the video story:

"(The story is about) whether or not the animals should be used for experimentation and I don't know, to like, I think it is just a debate over if animals should be used, and like to what degree, and on the other hand, not at all, like just using skin types and the like" (VF5).

This observation is consistent with the proposition that the video or television medium is transient in character because it continuously displays a stream of changing images on the screen which has an effect on the extraction of story information, whereas the print medium is regarded as a stable medium (Kozma, 1991). This feature of television makes it difficult to extract specific and concrete information from the visual media other than to acquire a 'gut-feeling' about what is being discussed. It also makes responses given to particularly the visual medium take on a less detailed and less complex character.

Length of Responses

An analysis of the length of student responses shows a difference between print and video. Video responses tend to be short and superficial. Responses to the print story tend to be longer and offer detailed interpretations of the central issues explored in the story. Responses from students who read the print story identified the issues and usually referred to the premises of the arguments. For example,

"Um, there are a lot of people debating about whether or not we should use animals for testing out. People are saying whether or not we should do research on animals because some people feel that it hurts or harms the animals, it's not fair to the animals, others feel that if we don't use the animals we'll be behind in

some of our medicines and we'd have to use people to test it on and they don't want that" (PF2).

In addition, student responses also spread widely from superficial to more complex articulation of the debate on the use of animals in research. Both the students presented with the print and video story identified the conflict between the perspectives expressed on the use of animals in testing the products of scientific research. However, it is noticeable that students who read the print story were able to offer lengthy justifications of each of the sides in the dispute that were paralleling those discussed in the story than those who watched the video story.

This suggests that whereas responses from students who read the print version articulated the central issues in the story, televiewers monitor a presentation at a relatively low level of engagement, their moment to moment visual attention periodically augmented by salient audio cues. And this is perhaps what makes their processing of information in the story sometimes effortless, resulting in the construction of shallow, unelaborate representation of the information.

Issues versus Chronologies

In giving narrations of the story, students framed their responses to the question by describing a sequence of events rather than abstracting the issues, and thereby seemingly responding to the question, "What happened?" A narration tended to focus primarily on the chronology of events in the story, rather than on the arguments presented. An example from the response given after watching the video story illustrates this feature of student responses:

"It (the story) is about *how* like animals will be used like guinea pigs, literally, so we can live longer and *they're talking about* how one day animals won't be needed like as much so there won't be any suffering for them or us and we can still get technology" (VF6).

Most students can identify that the story is about the use of animals in research, and even can recognize that differing perspectives are being expressed on the topic, but they are not certain about whether to represent it as a clash of perspectives, in which case as an issue, or simply recount it as a story. The response to first question given below after the student had watched the video story is one revealing example.

"I think it was something about the people against using animals for experiments, medical experiments and then, I think it was mostly his, the view of one person and then well they interviewed the view of several other people who are for animals, the use of animals for medical experiments" (VF7).

Responses describing what happened, rather than an abstraction of what the story is about, can again be seen in the response given to the video story below.

"The story's about doctors or, well, whatever they are, are trying to help animals but other people don't want them to be, like, they wanna save their lives. The doctors want to figure out the best way to help these animals because we're creating more problems for them but other people want to help them but they don't want to kill in order to figure out more problems" (VM6).

These kinds of responses are typically a video phenomenon. There appears to be no differences by gender in this feature of responses.

2. Identifying Points of View in the Story

After responding to what they thought the story was about, students were asked to specifically identify the different points of view expressed about issues discussed in the story. Students' descriptions of the different points of view discussed on the issues exhibit interesting features. These features will be discussed below in terms of the issue presentation format and the gender of the respondents.

Focus on General Differences

The points of view that students were asked to identify required giving arguments that were discussed in the story that were supportive of, and opposed to, the use of animals in scientific and biomedical research. As earlier defined, a point of view consists of a position taken on the use of animals and a corresponding justifying reason for adopting such a position. A central issue in the story is then identified if a recap is made of the information in the story on the points of view.

For the issues identified, students were specifically asked to give the points of view of the different sides. Differences also abound in the students' ability to extract relevant information from the story that corresponds to a particular position on the issue. Of the students presented with this story, a high proportion of those who read the print story identified the different points of view compared with those who watched the video story.

The focus on general differences without justifying reasons on the issue was most prevalent among the video responses. A greater proportion of the students who watched the video gave superficial responses that

conveyed only a sense of difference in the points of view. One revealing response is the following given to the video story:

"Well there's one guy that's against it in the video and he thinks that we should do it because it's alright and they don't need to do it and they just do it needlessly. And the other people, the guy from SFU animal experimentation place says that it's, you have to do it to see what it's gonna do to the person that you put it into, the drug or whatever it is, so they experiment on the animals" (VM4).

That is, students' responses, such as in the example above, identified the different positions about the use of animals in research but did not correspondingly give the sorts of justifications in the story that are offered by the different sides. These kinds of responses were earlier described as only identifying a general sense of conflict in the story. Typically, more males than females gave responses that focused on general differences.

Disposition to Support One Side

Another feature of students' identifications of the different points of view discussed in the story showed in students' noticeable attention accorded to the kind of information that highlights and pronounces only the arguments of one side. Students who watched the video story gave responses that acknowledged general differences in the points of view on the issue, but furnished detailed information that supports only one side of the story. In these kinds of responses, most students felt strongly that animals not be used in research, and more often at this stage of the interview, even revealed their own points of view. Reacting to the story line in this way would suggest that the visual medium seems to set the agenda for public discussions and,

perhaps by its nature, provokes a personal response to the information presented.

"There are people on one side that think that they should be researching, and they say that if they don't do it then the humans won't live as long, and people that don't want it say that it's cruelty to animals and it's unfair to 'em. I think that they shouldn't be able to do it unless it's really, really important, 'cause um, animals have lives too" (VM2).

This could partly be because of the strong emotional appeal that the visual medium tends to exert on the feelings of the viewer for the issues described. Such a disposition to supporting one side of the issue shows in the expressions in the story that students use in their responses. Quite often, extraneous information is appended to that presented in the story, with the result that the information presented is greatly exaggerated and sharpened as to provoke a personal response. An example of the students' description of the different points of view expressed in the story is given below.

The people for it were saying that it is the only way, that if they didn't use animals for experimentation then they would have to use humans but *that is not very possible because not very many people would donate themselves for the experiment*, while the person against it was saying that it isn't fair to the animals because they have no say in the matter and just because they can't talk, it don't give us any reason to use them and that the animals also have feelings, *they're not just blocks of stone*" (VF7).

Responses in which there is significant influence on the presented information from the student's interpretation of the story do not seem to have much variation by the gender of the respondent, but are greatly dependent on the presentation format of the issue. Students who watched the video story gave more of these kinds of responses. By taking sides on the

issues at the beginning of the story, it appears that the student does not become receptive to the specifics of the arguments used by the other side of the issue.

Identifying Concrete Information

Students' responses were also weighted with specific information found in the story such as names of persons, their places of work, or any such other specific information that students selected to use in their responses. Students who watched the video tended to identify the different sides of the issue in terms of the number of persons on one side of the issue, rather than by the perspectives expressed about it. The most revealing of this kind of response is given below:

"There was one chairman or something like that, well the guy that kept coming up there I forget his name, but he doesn't think that any of the actual operations on the animals and this way they don't wake up is necessary at all, like you can just use the *skin types* and everything and he agrees with that. And then there are the other ones that think it is absolutely necessary to discover diseases and to see how some of their medicines work and everything, and um, they figure that's the only way" (VF5).

These kinds of responses say something about the kind of information that is extracted from the visual medium. It is apparent that it is difficult to extract concrete information such as names of persons, or names of groups of persons or even use the vocabulary that reflects that in the story with a similar kind of accuracy as in the print medium.

Incidentally, where students identified the different points of view by the number of persons supporting that point of view in the story, an argument of any one side was relegated to that of the talking heads in the story. Because the video in this study, rolls at a predetermined speed which is

not under the control of the viewer, the viewer is not free to go back and review parts of the video. By contrast, a reader of a print story can read at his or her own rate and can even reread any part of the text at will.

The ease of identifying concrete information from the medium seems to correspond to the characteristics inherent to the medium. Kozma (1991), in his extensive review of learning with media, has noted that because the visual medium displays dynamic images which move as the story is told, it is limiting when it comes to extracting specific information from the presented story. The print medium, on the other hand, because of its explicitness, makes the extraction of concrete information from the story and use of it in subsequent arguments easier.

Whereas the students in the print story successfully identified the different names of the individuals expressing certain views on the issues and sometimes used these to represent the different points of view on the issue, students who watched the video did not as much focus on the concrete information presented in the story. These students did not lay emphasis on the names of persons, places or other such specific information.

This feature has an interesting correspondence with the gender of the respondents. Females more frequently gave names of persons and places and used various other details in the story to represent the sides of the issue and to furnish as evidence for the arguments used. Males were not as specific about this kind of information as females were, nor did they focus on the details of the arguments in the story as much.

Emphasis on Images and Propositions

Student descriptions of the different points of view in the story also reflect an emphasis on the propositions in the print story and on the images

shown in the video. A substantial number of statements that students who read the print story used in their arguments were active reconstructions of the propositions in the print story.

One point of view was saying that it's cruel to have animals used in experiments . . . and *they can be mentally and physically damaged, but they can't talk so we have to stand up for them . . .* One point of view which is led by some guy from UBC, says it's fair, they use anaesthetics and *if there's gonna be a major injury then they just give them an overdose of drugs so that they never wake up . . .*" (PM2).

Students who read the print story commonly use the italicized phrases in the above excerpt in their descriptions of the different points of view of the story.

In contrast, much of the descriptions from students who saw the video story were specific to some of the scenes and the images highlighted in the video. These were mostly the images of the animals shown in the video to illustrate the arguments pursued by the different sides to support the positions they upheld on the use of animals in research.

Students' responses to the video story were also reactions to the audio statements in the soundtrack or the voice-over narrative of the story that corresponded to the images shown of animals used in experiments.

It appears that for the same story presented in print and on video, students' abilities differ in the identification of the different points of view discussed in the story. More of the students who watched the video about the use of animals in experiments illustrated the justifications of the different sides by describing aspects of the images that were presented in the video which particularly corresponded to the comments in the soundtrack. For example,

". . . There are lots of animals, there's like not a shortage of cats or anything like that and they're breeding them, they're breeding them especially for that, it's not like they're going to your house and like taking pets and stuff like that so" (VM5).

Students who read the print version of the story, on the other hand, addressed the propositions expressed in the print story in their justifications when they identified the different points of view in the story.

"Okay, some people feel that in testing on animals they're almost violating their rights, *they can't speak out for themselves*, they're just animals and they feel, they can feel things too. They have feelings, well I don't mean emotional, I mean nerves and that. They can feel it happening to them and it's not fair to the animals to be put through pain for human benefit, and other people feel that well, if we didn't use the animals, we'd be so far behind on technology now the life span um would be 25 years less. We added 25 years to it and if we hadn't tested on animals well we wouldn't have done that, and the only way to test new drugs is on animals, and they say that they're using lots of precautions, that they rarely ever hurt the animals and if there is permanent damage, well they would just do an overdose of drugs and the animal wouldn't wake up. So they feel it's fine as long as they use precautions" (PF2).

This feature in student responses too seems to lend support to the proposition that television tends to highlight the action properties of a narrative while print versions of the same materials highlight figurative language. This is probably because viewers place the narrative in an imagery framework and print readers place it in a temporal descriptive, propositional one.

Summary of the Chapter

Students' responses to story information show that students identified and framed the issues in the story in quite different ways. Compared with the responses given to the print story, responses from students who watched the

video story tend to be less confident, briefer and less detailed, more empathetic to animals and often framed more or less to describe a chronological sequence of events rather than an identification of the issues. Responses also seemed to have a gender difference, with responses from female students being relatively detailed and more empathetic to the treatment of animals, whereas males tend to give brief, less confident and less complex responses.

When students were specifically asked to give the different points of view in the story, students who watched the video tended to give responses that conveyed a general sense of difference. Students who read the print story were more apt to identify different justifications that were used to identify the different positions on the issue.

In identifying the different points of view on the issue, students who read the print story frequently referred to the statements made in the story as a basis for their arguments. Responses from students who watched the video gave references to story information that are closely linked to the images and scenes described in the story. More females than males drew on the images in the story as justifying referents for the sides opposed to the use of animals in research. They also seem to empathize with the fact that because animals cannot speak for themselves, someone ought to speak out for them.

CHAPTER V

Discussion of Results (II)

Introduction

This chapter presents the second part of the data on students' points of view on the use on animals in scientific and biomedical research. It primarily discusses the features of students' own points of view about this socioscientific issue and further explores the features of these views when students are presented with a second, related story that is more personally relevant.

1. Students' Points of View

Upon discussing the different points of view in the story, students were asked to give their own points of view about the use of animals in scientific and biomedical experiments. This offers students an opportunity to clarify their own ideas in the light of information from the story about the different points of view on the issue. In this regard, students' points of view enable the researcher to discern the influence of the presentation format of the story on students' understanding of and reaction to story information.

It is important to note at the outset that there are generally less pronounced differences in the distribution of students' points of view on the issue by the mode of presenting the issue. Students equally expressed views that support the use of animals in research as long as the experiments are important and help find cures for life-threatening human diseases. In both the print and video responses, students expressed views that support the use

of animals in as far as the experiments do not cause pain and suffering. There were also views that are generally not supportive of animal testing because animals have as much right to live as humans.

More females, however, are against the use of animals because animals have as much right to live as humans. In contrast, a majority of the male respondents support the use of animals in experiments that are important and that help to find cures for human diseases. They further support the view that animals should be used in research as long as the experiments do not cause pain and suffering.

The general features of students' points of view on this issue following exposure to either presentation format are discussed under the following headings:

Acknowledgement of the Conflict

Most of the responses to the print story abstracted the different points of view on the central issues and showed an understanding of the arguments of the different sides of the issue. When asked to give a point of view, a noticeably large number of students who read the print story were uncertain about which side of the issue to support. For example,

"I don't know, I don't feel that animals should be used, but on the other hand if they weren't some cures wouldn't have been found" (PF3).

They did not, however, seem resigned to support a particular point of view on the issue, perhaps because students who read the print story did not seem prompted to evaluate the premises of the arguments of the different sides. The seeming reluctance showed by students who read the

print story to give their own point of view on the issue seems to be a significant feature of the responses given to the print story.

In expressing their points of view, students who read the print story seemed to be reflective and acknowledged the need to research with animals, and at the same time, recognize that animals have rights. It was quite clear that a sense of despair and a feeling of helplessness clouded most of the students' points of view. Statements, such as "I don't know what we can do instead" or "I know that we have to find things about life, but I don't know why they have to use live animals . . ." convey a sense of student predicament on this issue.

By contrast, students who watched the video tend to be inclined to support one point of view on the issue and they are rather inconsiderate of the arguments used by the different sides.

"I think, I know it's necessary, but I'm against it because I think animals have lives too so I don't think they should be just taken lightly. I think what they're doing at SFU is better because they're taking care of them and it's very clean and everything, but I've seen, I've seen places where they're just torturing the animals. I think that's wrong" (VF7).

Giving a point of view on the issues seems to be strongly guided by the beliefs one holds about our relations with those persons or animals in our environment. The principle that it is wrong to hurt others generated appreciable empathetic feelings amongst students and was frequently used in students' responses to explain why they felt strongly against the use of animals in research. As one student put it:

"I think it was maybe the way I was raised up that it's not right to hurt anybody. It's not right to cut down people, sort of like since I've been a little kid, right, I've been exposed to many things that are in a way killing things too because it sort of breaks down your

morals and it hurts you a lot because you um, it's like saying humans are a lot better than animals. Animals have their own abilities, like we can't fly, sort of but not with our own body like birds can. But I think it was like the way I was brought up" (PF4).

There are also gender differences in the ways students give their points of view. In general, females identified with caring and conserving views toward the treatment of animals which stems in part from the attitude that animals are defenceless and need to be protected. The response below given by a female respondent is a good illustration.

"I don't think they should use animals for experiments cause it's not really fair to the animals and um, they could find other things to use instead because, uh I like animals. I don't think it's very nice what they're doing. . . If you like the animals then you'd care and you wouldn't want to see them get hurt" (PF5).

Males generally favour the view that, if the research done with animals is bound to be for humans' good, then we should continue to use animals in experiments.

"I'm not like against animals or anything, but I actually care about animals, but if they are our only way to advance, like the knowledge about medicines and things that can eventually save human lives, I think it's alright to use the animals as long as we don't use them unnecessarily and as long as we do use precautions to protect the animals" (VM2).

It is noteworthy that some students who watched the video were prepared to question the validity of what they had seen previously on television programmes about the treatment of animals. After watching a program on television, this is what the student made of the experience:

I've seen some interviews but I'm not sure I could trust them because it was just, it was one-sided so they didn't really give a defense for themselves. It was just reporters going there and

taking pictures so the people in that medical laboratory really didn't get a chance to say anything, so it was pretty biased" (VF7).

Apparently in a commonly referred to movie on the use of animals in research, "Project X", in which the monkeys were put through tests to determine how much nuclear radiation a fighter pilot could withstand in the event of a nuclear war, one student noted that "they might do that, but I didn't know if their view was very realistic, so I couldn't really judge from the movie" (PM3).

In the subsequent attempt to grapple with the issue, strong feelings toward the use of animals and recognition of the realities pursued by the scientific community to seek cures for terminal diseases seemed to emerge. Where we are seeking cures for life-threatening diseases such as cancer and AIDS, to some students using animals while ensuring little pain and suffering is understandable and acceptable. Sometimes it is acceptable to use animals because animals have in the past been deliberately culled to keep their numbers down. A male student who read the print story used this observation to support his position about what we might as well do with the animals:

"I think you should do research on them (animals) to help other people live because if you don't use them, there are just gonna be too many of them anyways and then all we have to do is either feed them and keep them alive, and they get more and more and you have to kill them and if you have to kill them you may as well research on them" (PM4).

The diverse situations that students brought to bear on their interpretations of the story illustrates students' understandings of the story and the influence of the mode of story presentation on students' points of view. Responses from students who read the print story also tend to be

reflective of the information in the story and generally acknowledge that it is the differences in values that form the centre-piece of most disputes. In contrast, responses from students who watched the video story tend to be more critical of the information in the story probably because of the kinds of experiences exposure to the visual medium tends to evoke. It also seemed that the points of view from these students tended to favour only one side of the arguments. And in terms of the gender of the respondents, females tended to give points of view that emphasize caring and protection of animals whereas males perceive the conflict in utilitarian terms.

Expressiveness of the Points of View

When giving their points of view on the issue, students who watched the video offered polarized views about the use of animals in research. These responses are definite about the positions on the issue they support and particular about the reasons for the positions.

"I'm totally against it because I just, I don't believe that, I think they can find different ways of doing it, such as using um computers and um I've read that they can like take cells and of humans I just believe that there're alternatives to using animals" (VF3).

Interestingly, most of these views are sympathetic to the pain and suffering that the animals in research experience, claiming that it is not fair to hurt animals or that animals ought to be respected because they too have lives.

"I don't think it's very good just to do like they did, they bred animals just for experimentation. The animals didn't even have a life, they were just, all their lives they were just kept in a cage and they weren't let out and just, they were just like they said, bred to die" (VF7).

On the contrary, points of view mainly offered by students who read the print story tend to be considerate of the conflict on both sides of the story. These kind of responses tended to mirror the arguments of both sides of the issue. Often such responses supported a position with a conditional justification of that position. These quite reflective responses tend to take into account the information given by each of the sides before the student offered his or her own position. If reflectiveness could be associated with the amount of emotion brought to bear on ones' expression of a point of view, it would appear that responses given to the print story are significantly less emotional than the video responses.

There is also an apparent difference in the language students used to express their points of view. Those who watched the video appeared to phrase their responses as a reaction to the video images of animals, using language that was significantly emotive compared to the print responses. For example,

"I sort of agree on how they shouldn't use animals but I really didn't think its fair to keep an animal in a cage where it only has certain amount of room to move, I just didn't like that. I don't like it when scientists do it"" (VM7).

Or

"I don't like it. I think that they can do it other ways than doing it on animals, like they said in the video through um tissue samples and stuff, but the animals shouldn't be used 'cause they've got no choice in the matter" (VF4).

Such an emotional involvement on the use of animals in laboratories translates the issue to a more personal context and seems to

tune students to the idea that researchers always inflict pain and suffering on animals.

"I think what they're doing at SFU is better because they're taking care of them and it's very clean and everything, but I've seen places . . . where . . . they're just torturing the animals. I think that's wrong" (VF7).

Most students' conception of the treatment of animals is linked to that accorded pets. It would appear that due to the apparent conflict between students' prior ideas about the common treatment of pets, for example, and the visual images in the story depicting the possibility of animals suffering during scientific experiments, responses from students who watched the video tended to be emotionally-charged.

Students' Experiences

Use of prior experiences with the treatment of animals in order to interpret the information in the story markedly influenced students' points of view on the issue. In both the print and video responses, students used their experiences with the treatment of animals to guide the framing of their points of view on the use of animals in research.

What is significant in students' responses to the treatment of animals, and indeed in the case of any socioscientific issue, are the kind of experiences they draw on when responding to the conflicting opinions that are associated with these kinds of issues. In deciding upon real public questions, it appears that it is not the argument that is difficult to follow. Rather it is the task of determining whether certain premises of the argument are in fact true. In doing so, the focus of our experiences could either be at a personalized level or at a level which is wider in scope and at which most people can relate.

More often than not, therefore, what students described as influencing their points of view on the issue seemed to fit two kinds of experiences: personal and social experiences.

Personal Experiences

As distinguished from social experiences, personal experiences are unique, individualized, and different from those commonly experienced by students from the same grade-level. These are the kind of experiences that are often witnessed at an individual level. In drawing on these experiences, the focus on the individual and on an experience that is unique to that individual at that age-level is unmistakable.

When asked whether there had specific experiences on the use of animals in research that were significant in the formulation of their own points of view on the issue, this is what one of the students said:

Student: At one time I figured that they were just animals and then I saw my dog get hit by a car and what happens to them when they get cut open, so it is sort of like, ooh gross.

Interviewer: So that sort of makes you feel that this is the same thing that happens in research.

Student: Yeah. The only difference is they're probably, most likely asleep but still it's gross and cruel. That's the way I look at it (VM7).

It is interesting that, even when the student is aware that the two instances are quite separate, only those incidents that seem to strike the students as episodic were referred to in the students' point of view to the issue of the use of animals in research.

Student: Well, I've seen like animals being killed and stuff and it's not very nice, for something not very important they're just being killed, it's not very fair to them cause they can't say anything, they can't stop anyone.

Interviewer: Do you recall this particular incident?

Student: Um yeah, my neighbors, they had rabbits or something and they bought rabbits and they killed them to make food or something. I just thought that was cruel.

Interviewer: So what you saw was something that was not for an experiment?

Student: Yeah, but still, it's just, it's still like not being, it's still cruelty to the animals (PF5).

These kinds of experiences frequently lead the student to empathize with the pain and suffering of animals. One student put it this way:

Student: Well, I've seen animals suffer before so if they, if they do suffer that's pretty bad 'cause they're helpless, they can't, they can't fight back or anything like that so.

Interviewer: Where did you see that from, where do you see them suffer from?

Student: Well like at home and stuff like that. I have a dog and some cats and then I've seen them like when um, the dog had a broken leg once and it like was crying and all that, so they do suffer when they get hurt, so they do have pain and all that, that kind of stuff (VM5).

It is worth noting that responses from students who watched the video story tended to greatly draw on personal, episodic experiences in interpreting the story and in formulating their points of view on the issue. And it is perhaps for this reason that responses from students who watched video greatly empathized with the pain and suffering of the animals much more than was the case in the responses to the print story.

Social Experiences

Sometimes students associate their experiences to what they had watched on television, seen in the movies or encountered in other media. Social or everyday experiences refer to the kind of experiences that could be universal and familiar because they are disseminated from public sources.

Although the points of view that students who read the print story expressed were not explicitly in support of one side of the story, they tended to draw for their justifications reflective arguments stemming from their everyday experiences with the treatment of animals. A revealing example of the kind of experiences that relate to animal testing is given below:

"Well um, I don't know, I guess it depends, like if, like there are some times when it's really cruel, like they'll put them through like pain tests and stuff, um, that's cruel. But if it's, if it's just like a medicine, like say an animal's got, I don't know if an animal can get diabetes or whatever, or if it's got arthritis or something, um, and they've developed some sort of new medicine or something that they don't really wanna use on animals right away, um, I guess it would be fair if it wouldn't cause any pain to the animal to give it to it, the animal and see if it survived and stuff like that, um something to benefit the animal would be fair, but something just to destroy it, to see how it reacts, I don't think would be very fair" (PM2).

Most females argue that if some cosmetic products are advertised in the Body Shop as "not tested on animals," and yet these products are just as good, it would appear that it is possible not to use animals unnecessarily in research. Research involving the use of animals then should be done only in experiments that are really important.

Student: You go into The Body Shop and they have all the, like, well actually a lot of things are written on the package now "Not Animal Tested", I'm talking about make-up

here, like not tested on animals. I guess that kind of made me think about the testing on animals and so I do buy make-up that's not tested on animals, like, well because it is environmentally friendly, so that's kind of good. I haven't had like had any experiences with like stuff being tested on like a dog or anything.

Interviewer: So it means that you have actually thought about this issue before.

Student: Yeah, before that I didn't even know it was tested on animals and then I started thinking, well if it's tested on animals it can't be too good, so, well, why make it suffer? It's not just that animals, if they're, if some make-up companies can do it without testing on animals, there's no point in other companies still testing it on animals if they don't have to. Obviously there's a way of not to do it (VF3).

In the issue of the use of animals in experiments, students strongly argue for the use of alternatives to testing involving animals such as computer models, because their experience with the cosmetics now leads them to believe that alternatives to using animals in research is feasible. One student reports having taken it upon herself to educate her classmates in a classroom project on the testing of cosmetics on animals.

"We chose to do this topic for our classroom project because it is not known, like people don't realize what the animals go through. . . . Even I wasn't aware. We just wanted to make ourselves more aware, we could have done a topic such as the ozone or global warming but we've heard about it before. We know basically what that is, but we just felt that this was an issue that needed to be expressed and for people to be more aware of" (VF3).

Students' understanding of the treatment of animals in the laboratories is linked to their experiences in everyday life of suffering

animals, from which they infer the treatment of animals in research. To one of the students, this is what comes into mind when discussing this issue:

"I have seen pictures from the SPCA where they've shown the animals lying there and then it is going through needless pain, they've knives sticking out of them and they've got sores and then it is not even, doesn't even have anaesthetic, so I think that is really cruel to them" (VF7).

Some students also offered, what I may call, *realist views* on the use of animals in research. The insistence that animals be used in circumstances where there are no alternatives, in which case as a last resort, and only in situations where the experiments are important, was widespread:

"I like animals and everything but there are just some diseases that should be cured and I guess killing animals is the only way, but only for those ones, but I'd rather they didn't have the animals die and everything. . . . Um there was this one show and they froze an animal like a dog and he was clinically dead for an hour and then they thawed him out and they just did it to see if they could do it and I think that's stupid" (VF5).

Students report that they do not remember discussing this kind of topic in Science or Social Studies classrooms. Instead, most students say the closest they came to discussing this issue in school is when they wrote essays about it in English and Social Studies classes, but not in Science. Students, however, report doing or seeing demonstrations of dissections in their science classes, but they see the arguments about the use of animals in research differently from doing a dissection:

Interviewer: Have you ever done a dissection or even seen a demonstration of a dissection?

Student: What I've done is cutting up an eyeball or a cow's eye and a worm. That's about it.

Interviewer: Do you see the arguments in this video as applying to a dissection of an eyeball?

Student: Um well one I know, the cow was butchered anyways all for meat, so why not, I mean it's gonna go to waste anyways. Why not put it towards learning? And yeah, I think that's okay I mean cause it would just be discarded anyways, so why not use it towards education?

Interviewer: What about in the case of the worm?

Student: Now I'm not sure exactly how that was. Um, I think yeah it is a bit gross, taking a worm, but it depends on how they're bred, so, you know, worms are really easily bred, they breed fast (PF6).

This illustrates that a wide-range of experiences are brought to bear on the interpretations of socioscientific issues. The more reflective points of view offered to this issue seem to come partly from those experiences on the issue that are rooted in students' interactions with animals in everyday life, such as in conservation and hunting of wildlife, in television programmes, or even from their experiences with dissections in science classrooms. It also appears that the students who read the print story mostly tended to draw rather extensively on a variety of societal experiences and, as a result, offered relatively more reflective points of view.

Substantively, however, more students are in favour of the view that animals have as much rights to live as humans and they should not, therefore, be used in experiments. And fewer students agree with the use of animals if the experiments involved no pain and suffering, or if the experiments could be shown to be important.

2. Consistency of Students' Points of View

This aspect of the study explores the consistency of students' earlier points of view on the issue and their views on a new and related story that requires students to make a personal choice and evaluate the consequences of that choice. It also provides the student the opportunity to defend and possibly modify his or her earlier point of view on the issue. To investigate student responses, the researcher read this second story to both the students who saw the video story and to those who read the print version of the story.

As in the articulation of students' own points of view on the issue, there is little variation between students' points of view on this second story and the format in which the issue was first presented. However, there are interesting features of how students evaluated the consequences of using their initial views on the use of animals in research in the second story.

Evaluating the Options Presented

Faced with relatively discrete choices to choose from, most students actively sought an understanding of factors that were clearly not mentioned in the initial story and that clearly were guided by the the students' own daily experiences. Students elaborately questioned the safety of the methods of carrying out the experiments and extensively explored the flaws of each of the options in the second story. For example,

"I don't like the idea of them injecting a fluid into the monkey and have it grow a tumor in the brain because that would probably be fairly painful. But on the other hand, if they just do it on a computer, then it's not very realistic and if you work on me they don't have the dimensions and it's not really three dimensional, they don't have the experience" (VF7).

Students also tended to elaborately examine some of the premises behind the justifications for the various positions on the issue much more in some modes than in others.

Some students saw the argument in this hypothetical scenario as one focusing on the experience gained from practising on the "real" thing as opposed to one gained from practising on a "simulation". There was no mention or even hint of any of these kinds of distinctions in the original story. To the students, the experiences gained in these two cases are qualitatively different and not comparable. For instance, one of the students who had expressed the following point of view on the original story,

"Well I think it's okay if it's controlled like after the animals have surgery, they have a terminal overdose and they don't experience any pain, that's okay. And I think it's okay if they have to find, y'know, cures for diseases and they said the cats were bred for that purpose so, I don't think that's bad but they should, I think, use computers or stuff a bit more, like if they can, it's better than using animals, but I'm pretty sure in some cases they probably have to use animals so I think that's okay" (VM5).

also attempted to evaluate the options presented in the second, related story arguing that,

Student: I'd probably go for the, the scientists that were using the monkeys because like their computer is not exactly like the real thing and if I had a tumor I would want to make sure that the operation was gonna be successful so I'd probably go with the scientists that were gonna use the monkeys because it's more like, it's real life, it's real animals, it's a real brain so, you know it's gonna be more sure proof, so I have to go with the scientists that use the monkeys.

Interviewer: So why would you not go with others?

Student: The computer model is a simulation, that's all it is, it's a simulation, like um, there, there could be things that, that they could be missing in the simulation but if they're using the monkey it's like um, you're gonna see things that are gonna happen that you might not see on, on the computer 'cause it's not a live thing, so that's why I'm for the monkeys (VM5).

Some students explicitly critiqued the assumptions behind the use of monkeys for experiments using the argument that because animal systems are so different from those of humans, what works on an animal may not necessarily work in humans. This was also picked up and used by one of the students who is not supportive of the use of animals and believes that there is all the reason to trust in technology.

Student: I'd probably choose the ones with the computer . . . because a monkey's brain may not be the same as a person's brain and also I don't agree with using animals so I'd rather have it done on a computer instead of like putting the animal in danger so I'd say I would pick the computer.

Interviewer: So you'd actually pick a computer because you don't want the other one. You'd not pick a computer for what it can do.

Student: Yeah and also, well I'd pick it because it's more like, it's the human brain not an animal's brain so it'd probably be like more exact because what works on the animal's brain may not work on a person's, so it'd be more like me, like my brain (PM6).

Students identified computers as capable of doing a thorough job and would complete the analysis to the precision that would ensure a smooth operation.

"I'd like the computer people to do, maybe because computer doesn't miss a detail, not saying that the guys who operate on a monkey would miss a detail, but the computers are so thorough

and everything and I'm sure they have a nice or a good computer to simulate the procedure" (PM5).

Perhaps what is apparent in each of these responses are the values inherent in each response. These underlying value positions and justifications were not directly addressed in the original or in the second story, and were, more often, not highlighted in the students' earlier points of view.

As to the extent to which we can trust the capabilities of the current technology, some students willingly tackled some perplexing questions:

Student: I want the monkey stuff, because if it works in the computer, they know it will work in the computer but will it work on you? But if you use a monkey to see if it will work or not, so I hate to say it, but I'd probably choose the people that worked on the monkey, because it will probably work on me too, monkeys are more or less close to us.

Interviewer: So when it actually comes down to the crunch, you prefer the old animal researchers.

Student: Yes. I hate to say it but yeah (VM2).

Grappling with these kinds of views makes it difficult to formulate an opinion on the use of alternatives to animal testing because it drags us into the unfamiliar grounds of some technical subject area. Admittedly, there isn't as yet conclusive evidence on the capabilities of the current technology to substitute the use of animals in research.

In any case, the uncertainty about technical information was a source for a flip-flop in the students' earlier points of view. Students who had earlier emphasized the use of alternatives in scientific and biomedical research and had somehow avoided taking sides on the use of animals, found it favorable to choose scientists who had practised their technique on monkeys. And as one student observed:

"I don't think the computer testing has been given a chance, I mean if it had been proven to me that yes computer testing was reliable, then yes I would choose the computer testing. I just think that part of it hasn't been looked into enough and given enough chance to be able to work" (VF3).

It may be important to note that whereas there was little observable difference in the way students evaluated the options in this second story by the formats of presentation of the original story, the insights students gained in evaluating the options in the second story seem to follow from students' earlier articulation of their points of view on the original story.

Checking with the Earlier Point of View

An attempt to understand the new information in the second story in relation to the original story encourages students to resolve any contradictions and inconsistencies between their own notions of research involving animals and those explored in the story. And since in the story there are only two groups to choose from, one has to carefully consider the consequences of choosing either group in the light of the specific information about the use of animals in research. A choice of the scientists who practised on the monkey brain would seem consistent only in as far as one's views were in favour of using animals, that is if the earlier views were expressed with conditions for the use of animals in research, say, in only important experiments. Where conditions under which animals could be used in experiments were already outlined in the students' point of view, choosing the scientists who had practised on the monkeys was easier.

Occasionally, students maintained their opposition to the use of animals in research even after they had evaluated the consequences for

choosing one group of scientists because they desired to uphold their moral standards. After some considerable reflection, one student responded in this way:

Student: I think I would want the, I'd choose the computer one, the scientists that experimented on the computer.

Interviewer: So what would be your reason for not choosing the ones who experimented on monkeys?

Student: If I said, when it comes to me, if I said that I wanted them to use the ones with the monkeys then it would be, it would make me very hypocritical, I mean, because I'm sitting here and I don't want them to use animals for experiments but when it comes to my benefit and I say "Okay use the animals" then it would be very unfair, so I think I'd, I would tell them get the ones that use the computer to operate on me.

Interviewer: Regardless of the consequences?

Student: Yeah I think so.

Interviewer: So you would actually pick the ones that used the computer, not out of the fact that you want to recover, just for the fact that you want to be consistent with the way you are arguing?

Student: Yeah (VF7).

Students also attested to choosing the scientists who practised on a computer-simulated model for quite different reasons. They have faith in the precision of the current technology; they hold the view that the capabilities of the current technologies are enormous and for this reason computers can be trusted to successfully accomplish delicate tasks:

Student: I would, I'd probably go with the computer and take a risk.

Interviewer: You'd risk your brain

Student: Em, em.

Interviewer: Okay,

Student: I know, it sounds crazy though, but I do have faith in like computers and all these modern technology cause if you do it on a monkey you only do it once and then you think you got it, you do it on a computer they probably do it like five hundred times, from every aspect, and if you have a different brain tumor than the monkey, its not like that you're going to live anyways (VF6).

In some other responses students had it that scientists who practised on monkeys should first compare their results with those who practised on that computer-simulated model of the brain so as to increase the chances that both results would equally be good. In this situation, they argue, scientists who practised on a computer-simulated model are the appropriate choice to carry out the operation, after all, in order to design and use a computer to that level of precision, these scientists must equally be apt at doing whatever they are doing with it.

Student: Well even though I'd probably know that the ones being used on monkeys would probably work better, I'd, the computer one could work just as well if they had, if they did like the study really accurately, then they'd probably be able to work the same thing the right way, like with, I would probably not choose the monkeys even though they may be, they may know what they're doing, but if they came up with the same results in the end, then the computer ones work just as well and that'd probably be the ones I choose, the computer team.

Interviewer: So you are saying you would not choose the scientists who used the monkeys. Why would you choose the computer team?

Student: Well they're probably, they probably really know what they're doing to be able to use the computer like that. They probably know exactly what they're doing, and if

they test, if they were working on the computer then they probably had it all right, I think (PF5).

Indecision arose when the students could not choose between the two methods based on the information provided. That is which of the methods would enhance a smoother and successful surgical operation. Because there are enormous trade-offs involved in each of the sides, some students opted to seek more information before they would take the operation. As in,

"Well I'd have to look into more information because for one thing, the computer program you know, a computer program can't become a human brain, so it could be wrong um and it's no where close to a human brain so how do you give a computer medicine anyway? But anyway, see that's the problem. I guess that a computer does not really simulate an actual brain so I wouldn't really trust it too well but I would, like using the animal like give it injections so that it has a tumor, um I guess it's cruel, so I wouldn't really know who to go for. I'd have to like look into further information because um there's both faults in each" (PM2).

When specifically pressed to outline the kind of information that they would seek, the focus point became the question about the process the research was conducted in order to justify the product of either research. "Did the monkey live after the operation? Which one bears more risk: scientists who practised on a computer model or those who practised on monkeys?"

Consistent Points of View

The foundation for students' points of view on the use of animals in research seems to rest on the argument that practising the technique on a "real" thing, in this case a monkey, affords scientists "real" experience. Subsequently, such scientists make less mistakes when it comes to effecting the surgical procedure to remove, say, a tumor from inside the human brain.

This idea of 'real' experience was not only very convincing to students, it was very popular as well. Students' decision on which scientists to choose to carry out the operation seems to rest on the belief as articulated by one student that "The scientists using the monkeys have hands-on experience but the scientists using the computers don't. They use keyboards and I don't think keyboards will help them when they do a human being" (PM4).

Partly this conception seems to reflect students' everyday experiences and specifically students' understanding of how work done with a computer proceeds as compared to that carried out with a living specimen such as a monkey.

"(With a computer) you just can't get in there. You can't use your hands, you're not using your hands to go in there, you're actually using buttons on the computer to take it out. You're not using the instruments, you're not um just standing there. It's just a screen and you're just watching it and pressing buttons and then just going in there without your hands. So if I had a brain tumor in my head and I had to get it removed, I think I would want them to experiment on the monkey . . . because I don't like the computer thing" (VF7).

The inclination also seems to be grounded on their everyday understandings that hands-on experience is superior to using a computer which they seem to perceive as only a disk, and which is not alive, after all:

"Because a computer's not something that is alive, a computer's just, just uh, it's just a disc and it's not alive or anything. Like, they don't know what could happen, it's just straight forward, the computer, but the monkey is like, they'll realize what to do if something goes wrong or something does right" (VM6).

Students are not excited about choosing scientists who practised on a computer-simulated model of the human brain, and are also not comfortable with other alternatives to animal testing because of their understanding of

the human dimension in the construction of a computer. From the common belief that humans are not perfect, a computer being a direct product of human art, is likely to malfunction during use. In addition, it may not show critical side-effects which if undetected would be fatal. One student put the idea of using animals in cases such as these in this way:

"Because monkeys are supposed to be so biologically related to us humans and I guess I would think that um, if it worked on, if it was fine on them then it would maybe be fine on, I don't know, I guess that it would probably be that, just because they're supposed to be so closely related to us" (VF3).

By this line of argument, one is at a higher risk in an operation conducted by the scientists who had practised on the computer-simulated model of the human brain than if the surgery is conducted by scientists who practised on the "real" thing. These kinds of students responses do not seem to reflect any elements of the information presented in the original story.

On the contrary, the reason for maintaining one's earlier point of view on the issue seems to be grounded in the students' belief system. To one student, switching between the personal and public contexts is just morally inappropriate.

"If I said, when it comes to me, if I said that I wanted them to use the ones with the monkeys then it would be, it would make me very hypocritical, I mean, because I'm sitting here and I don't want them to use animals for experiments but when it comes to my benefit and I say "Okay use the animals" then it would be very unfair, so I think I'd, I would tell them get the ones that use the computer to operate on me" (VF7).

Modifications of Students' Earlier Views

Not all students were consistent in their points of view on the issue. When presented with a second situation which called for a more personal

decision on the issue, some students either made a decision in contrast to their original position, or were undecided on an appropriate choice in the later scenario. For example, one student who watched the video story had this point of view on the original story:

"I think that they can do it other ways than doing it on animals, like they said on the video through tissue samples and stuff, but the animals shouldn't be used because they've got no choice in the matter. . . I just hate seeing animals suffer because they've got no way of defending themselves really" (VF4).

However, after being presented with the second story requiring the choice of one of the two groups of scientists, this is how she attempted to modify her original point of view:

Student: (I'd) most likely (choose) the one that has the monkey, but that's sick because it's not what I wanted to say.

Interviewer: What did you want to say?

Student: I wanted to say the computer one but that wouldn't be right because there's, if it's just a computer you'd, now I'm sounding dumb again.

Interviewer: Okay catch your breath first and then...

Student: I'm going back with whatever I just said and changing it around. Um...

Interviewer: So which one would you, which group of scientists would you pick here?

Student: Actually I might, I don't know which one I would choose I guess. Maybe the monkey one, but then the computers seem to be pretty good. I don't know. I guess you'd have to really look into it and see which one would be best, but I don't know which one (VF4).

Backtracking in the students' point of view was also noticeable in the second story. When the choice of the group of scientists is contradictory to the original line of argument, the change is always such as to favour the use of animals, instead of having to change one's opinion to preserve animals. This is an example of how a student who read the print story attempts to accommodate the discrepancy between an earlier viewpoint on research using animals and one on the second story:

Student: I guess the monkeys. Computers aren't always right and you have to know if it really does work and then try it on a living thing.

Interviewer: But earlier you told me you weren't too happy about that.

Student: I know, but...

Interviewer: So now you still don't look too happy, but you'd still pick the monkey.

Student: Yeah.

Interviewer: So you've changed your mind?

Student: Yeah but it's not right, but still I wouldn't trust a computer (PM1).

Students made various choices and gave varied reasons for their positions. These reasons were entirely tied to the everyday experiences of solving problems. In the process of choosing the favorable alternative, remarkable reconstruction of the previous arguments made about using animals in research was evident. This can be seen below in the discussion with one of the students:

Student: Probably the monkey group. You don't really, when you are using computer it's not like the real thing, it's just a

dot, a picture of it, you know, well they have the features and that but it's not the same . . .

Interviewer: So earlier, you said you really didn't want to use these animals, now you say you would pick those who practised on the monkey. Tell me what has happened so that you are now thinking that way.

Student: For these animals should just, now it won't make sense, ha, um, animals should just be used to test for things but not like cosmetics . . . cause . . . they are not a threat to your life but some diseases are. If they only kill like one animal to test for certain diseases it's okay than having 100 people die . . . I know that I said that it's not right to kill animals but for certain reasons they should be allowed to test on the animals (PM4).

Students realized that they couldn't possibly retain the principles they advocated in their points of view at a personal level without addressing the alternative position to the conflict. One student followed through in this way:

" . . . I understand why they test on animals. I understand their reasons for it and may be I would do it too. . . Even though I say I am against animal testing I guess I would have to (choose scientists who practised on a monkey) because it would depend on my life and that sounds selfish and I know" (VF3).

It is interesting that those who had earlier rejected the use of animals sought compromise positions after realizing that there were discrepancies between their views on the second story and what they had earlier discussed. The flip-flop tendencies are equally recurrent in responses from students who read the print story or watched the video.

On the whole, students' points of view in terms of the original story remain relatively consistent when presented with a second, related story that attempted to make the issue more personally relevant to them. But these points of view have little in common with the original story, and are least of

all affected by the presentation format of the original story. Females, more than males, tend to be more consistent in their views and continue to support views that are consistent with caring and protection of the animals.

Summary of the Results

Students' points of view on the issue show little difference in the distribution of the various points of view by the presentation format of the original story. In general, compared with the points of view given by students who watched the video, responses from students who read the print story tended to acknowledge the conflicting points of view and gave conditional points of view on the issue.

Students who watched the video gave points of view which were either supportive or not supportive of the issue and tended to use arguments that are more or less critical of the opposing sides. Consequently, responses given to the video story were relatively emotionally-charged than the responses given to the print story.

It is also interesting to note that students tended to situate their understandings and interpretations of the story in some familiar background experiences and drew on their personal or societal experiences to support their positions on the issue. In their arguments, students who watched the video tended more to draw on their personal experiences with the treatment of animals whereas those who read the print story frequently referred to social and everyday experiences. The gender feature in students' points of view seemed to show in the kinds of views that students expressed. Females tended to give views that were geared toward caring and protecting animals, whereas males correspondingly seemed to give views that were utilitarian.

In the fourth research question, it is clear that the presentation format of the original story did not have a noticeable influence on students' views on the second, personally-oriented story. Students' points of view on the original story remained fairly consistent when they were presented with the second story that presented the issue in a personal context. Females, more than males seemed to give views to this second story that were fairly consistent continuing to support views that are consistent with the caring and protection of animals.

CHAPTER VI

Conclusions and Implications

Introduction

This chapter includes four sections which discuss conclusions of the focus questions of the study:

1. What are some of the features in the ways students frame their responses to "What is the story about" after exposure to the same print or video story?
2. How do students' identification of the different points of view discussed in the print or video story compare?
3. What are the different ways students give their own points of view after watching the video, or reading the print story?
4. What modifications, if any, are there to these points of view on the issue when students are presented with a second, related story that is more personally relevant to them?

The chapter also discusses the implications for science teaching and curriculum development arising from the findings of this study. Possibilities for future research to explore students' responses to a socioscientific issue presented in different media formats are also discussed.

CONCLUSIONS

1. The Ways Students Framed their Responses

When presented with a topic for which there is no consensual agreement, it is important for us to define for ourselves what the dispute is about. Finding the central value questions over which there is a lack of

consensus is the first step to understanding the issue. Identifying the essence of the conflict enables us to critically examine and appropriately respond to the relevance and credibility of the justifications used to support the different positions on the issue.

In this study, students were presented with one of the socioscientific issues periodically appearing in the media. Grade 10 students were presented with the ongoing debate about the use of animals in research in print and video formats. Students' knowledge of the treatment of animals in everyday life together with their understandings of doing science gives students sufficient background knowledge to interpret the print and video stories and respond to the question "What is the story about?"

Students' poor efficacy with extracting and using information presented in the media is one of the features of student responses to both the print and video story. And as Salomon (1984) had earlier observed, it also emerged in this study that the way students ascribe meaning to the presented story appears, in part, to depend on students' own perceptions of their efficacy with the medium. In both the responses given to the print and video stories, students occasionally granted that they were "not good at this type of thing". In most of these cases students' were not as articulate in abstracting the issues explored in the video and in extracting information presented in the story that could be used in their arguments. It would appear that the perception of one's ability to extract information in a given medium as well, had an influence on the interpretation of the story.

Of significant importance in students' responses is the level at which they empathize with some information presented in the story. Responses from students who watched the video story tended to be more empathic to the treatment accorded to animals. This corresponds with Meringoff's (1980)

finding that exposure to the television story was associated more with the use of visual information in recall and in making inferences. In this case it would appear that the use of visual information evoked more student empathy with the animals in the story. Students' descriptions of the story showed that they were opposed to the suffering and to any implication of pain and suffering that the animals used in research experience. A commitment to one side of the issue tended to produce student responses that were sympathetic to the arguments of one side of the story. This feature was exhibited among the responses to the print story as well, but students who watched the video story gave more of these kinds of responses and tended to view the story information as a non-issue. An interesting observation also emerged in the seeming differences by gender in the framing of students' responses. More females than males exhibited more empathic views to the treatment of animals that are used in research.

Coupled with the video responses that do not acknowledge the arguments of the opposing side is the observation that most of the responses given to the video story were relatively less detailed than responses to the print version. These kinds of responses showed an appreciable attempt to extract and use concrete information in the story, such as names of persons or places, but with little success. This could be because the presentational pace of the visual medium does not seem to favour the extraction of specific information from the story when compared to the print medium for which Kozma (1991) has made a case as being a stable rather than a transient medium. The difficulty with using concrete information in student arguments could also be that the emotional load exerted on the viewer during the processing of information in the story draws the viewer to pay

more attention to the information that fits with his or her prior views on the issue.

Responses from students who read the print story more often appropriately referred to and successfully used the specific information in the story. However, these print responses tended to associate the points of view expressed by individuals to those individuals' private views on the issues rather than view such points of view as representative of the prevailing views on the issue. It may also be of interest to note that females were more apt at extracting and using specific information in the story in their interpretations of what the story is about compared to the males.

Different print and video interpretations of the story also show in the length of the responses. Students' responses to the video story tended to use single-sentence expressions that highlighted either the topic discussed in the story or the general differences between the various points of view in the story. The print story, on the other hand, frequently tended to produce responses that were elaborate and more aware of the arguments and evidence used by the different sides of the issue. It also happens that, on the average, such elaborate responses were mainly offered by female respondents.

The style of framing the response when responding to the question "What is this story about?" is also important. Students who watched the video much more than those who read the print story tend to sequentially recount the sequence of events in the story. Rather than be articulate of the differences in points of view in the story, responses to the video story tend to frame their responses as though the question asked was "What happened?" This feature of students' responses tends to be a video phenomenon, and tends to be more frequent among responses given by male respondents. Beagles-Roos and Gat (1983), in comparing the impact of radio and television on

children's story comprehension, reported a similar result, that children in the television condition were better able to remember plot details and sequence pictures than their counterparts on the radio condition.

Conclusion

Being aware of the basis for the arguments used by supporters of the opposing points of view is fundamental to appropriately responding to the issue in question. In framing a response to the question "What is the story about?" it is essential that a representation be made not only of the points of view on the issue one may be in favour of, but more important, of the arguments and evidence advanced by the opposing side of the issue.

As would be expected, students framed the issues explored in the print and video story in quite different ways. Students who watched the video tended not to extract much information presented in the story compared to the print story. A one-shot presentation, such as is experienced in the watching of the video story, appears to only create an awareness of the existence of an issue but not encourage the abstraction of the central issues or the use of the presented information in the students' subsequent arguments. Responses from students who watched the video tend to be superficial, more empathic to animals, short on detail and are sometimes framed more or less to describe a sequence of events rather than to respond to what the story is about.

Correspondingly, responses given by female students tend to be relatively detailed but are more empathic to the treatment of animals, whereas males tend to give brief, less confident and less complex responses.

2. The Different Points of View in the story

Unravelling an issue involves more than defining the questions under controversy. We also need to clarify arguments that various parties bring to the questions. This would require that we identify clearly what was said by the participants in the debate. Furthermore, we would want to know whether adequate justifications were provided for their claims. These justifications would include appropriate evidence or relevant reasons.

Students in this study were asked to identify specific information from the story in order to help the researcher gain an understanding of the student's ability to extract relevant information that they were to use in their arguments. They were specifically asked to identify the different points of view of what they said were the issues explored in the story. This second question was asked regardless of how the student had initially interpreted the story.

A point of view on the issue, as earlier defined in this study, is a statement consisting of a position taken on the issue with the corresponding reason to justify that position. It was found that students who read the print story were more apt to extract relevant information that was used to identify the different positions on the issue than were those students who watched the video. These latter students instead, tended to give what is referred to here as partially identified points of view, that is the kind of responses that recognize that different points of view are expressed on the issue, but which instead furnish supporting arguments for only one side of the issue. It is probable that the initial commitment to support a particular point of view tends to favour the extraction of only certain kinds of information from the story that reinforces such a position.

Identifying concrete information such as the names of the persons, and making use of the vocabulary in the story also had an interesting variation by the presentation formats of the story. It is quite clear in the responses given after exposure to the two media formats that it is difficult to accurately extract and consistently use concrete information in one's representation of the arguments in the story. Sometimes, forming an association between the talking-heads in the story and the different points of view on the issue overshadowed the generality of the points of view, and this led some students, particularly those who watched the video story, to relegate the points of view expressed in the story to those of only the persons in the story.

The emphasis on the images and the propositions in the video and print stories respectively, was also apparent. In identifying the different points of view on the issue, students who read the print story frequently referred to the statements made in the story as a basis for their arguments. From such statements students described the different justifications that are used by the different sides. Responses from students who watched the video revealed descriptions that are closely linked to the images and scenes described in the story, and attested to the use of statements in the audio part of the video presentation that closely matched certain episodic scenes. For example, students' reference to the use of cats in the research done with animals was pronounced in the video presentation, because in the story, cats were shown most. In contrast, the statement "they can't speak for themselves" also formed a centre of interest in most print responses.

The dramatic use of images and scenes in the responses to the video showed an interesting gender-difference as well. More females than males drew on these as justifying referents for the sides opposed to the use of

animals in research. They also seem to empathize with the fact that because animals cannot speak for themselves, someone ought to speak out for them.

Conclusion

In drawing on the evidence for the different sides of an argument, it is noticeable that our dispositions toward an issue can have an influence on the kinds of details we choose to use. A prior commitment to one side of the issue tends to lead to the use of information that is dramatic and that leads one to sympathize with one point of view especially. Students then who watched the video story have their scope of information on the issues limited more or less to the kinds of images and scenes in the story. On the contrary, students who read the print story tend to generate more encompassing interpretations of the story from the language used in expressing the propositions in the story which is again in line with Meringoff's (1980) work on the influence of the medium on children's story apprehension. In other words, the information in the print responses that justifies the different positions on the issue generally uses language that is reflective of an interpretation that draws of an array of social experiences.

An interesting feature in students' identification of the different points of view is that specific information extracted from the visual medium tends to highlight dramatic properties of the story which may be in the form of scenes and images; while the specific information extracted from the print story of the same material highlights figurative language of the propositions in the story.

3. Students' own Points of View

Exploring the features of responses when students were asked to give their own points of view on the issues discussed in the story was just as important. Giving their own points of view on the issues offers students a chance to evaluate the assumptions behind the justifications of the different sides, and to critically examine the credibility of these justifications.

There is little noticeable difference in the distribution of the various points of view on the issue by the presentation formats of the original story. Compared with the points of view given by students who watched the video, however, responses from students who read the print story frequently tended to acknowledge that the dispute over the use of animals in research was a conflict between the need to carry out research to improve the human quality of life and the need to save animals because they too have lives. In addition, the points of view from students who read the print story, much more than those from students who watched the video story, were conditional. They saw both points of view in the story as valid and they mainly tended to give their points of view to acknowledge that the arguments of both sides are believable and plausible.

On the other hand, students who watched the video tended to give responses that were reflective of the feeling that humans were exploiting animals, because they (animals) could not speak for themselves. Students who watched the video expressed points of view that were either supportive or not supportive of the use of animals and tended to use arguments that were more or less critical of those used by the the other sides. Consequently, responses given to the video story were more emotionally-charged than responses given to the print story.

It would appear that when new ideas are inconsistent with students' understandings, they seem to distract students from formulating a point of view on the issue. It was apparent from their waffling that students who read the print story did not adopt new ideas or change their existing ones radically in the period of the interview. Rather, students presented with a story in either media format tended to situate their understandings and interpretations of the story in some familiar background experiences and draw on their personal and social experiences to support their positions on the issue.

Conclusion

Students bring into play a variety of experiences to interpret the issues discussed in the story. Some of these experiences relate directly to those relevant to the issue of the use of animals in research. Although there are no reasonable differences in the way students articulated their own points of view, it is worth noting that the print responses tend to focus primarily on the social or everyday experiences, whereas the visual medium tends to favour the evocation of episodic, personal experiences which favour empathic and emotionally-charged points of view. It is clear that when a reader or viewer encounters a story in, say, print or video formats, the reader or viewer seems to respond to the story he or she evokes during the transaction with the print or video story. This response is the meaning that is made by the reader, and it is this response that becomes shaped into what the reader sees as the story line.

In giving their points of view on the issue, responses from students who watched the video story tend to be explicit, and often even absolute, in their views on the issue and seem to focus on the information in the story

that favours their positions. It would appear, therefore, that the points of view expressed after watching a video story of the issue are based on little information. On the contrary, points of view from students who read the print story acknowledge the conflict and give points of view in a way that reflects the complexity of the issue.

4. The Consistency of Students' Points of View

The final question sought to determine the consistency of students' ideas in a new and personally-oriented situation. This was to give students an opportunity to make a commitment to what they truly believe at a personal level and to defend that choice in the light of the point of view on the issues. The student then attempts to reconcile any discrepancies that may exist between the points of view given at the personal and general levels. To integrate such new ideas students may have to modify the organization of their ideas in a radical way, which amounts to undertaking a kind of new revolution in their thinking. This requires students to accumulate new information and ideas as a basis for reorganizing their conceptions of the issue.

The presentation format of the original story does not have any noticeable influence on the discussion of this second, personally-oriented story. What is significant in the student discussion of the issue that ensues in the second story is that students do gain insights into an issue as they make and defend their own choices, and do reflect on the consequences of their actions as well. Students rigorously attempt to establish the consequences for holding and standing-by their earlier points of view. In both the print and video responses, students actively evaluated the options in the second story using information that was clearly not presented in the print or video story.

The inferences students drew on the consequences for making certain choices were elaborate and definitely deeply grounded in their own daily experiences.

There was, however, a noticeable trend in the way students tended to follow through with their points of view. Students who had earlier emphasized the use of any sorts of alternatives to the use of animals, that is students who had given points of view with conditions, often tended to modify their views in such a way as to use animals in research. Where there were noticeable discrepancies in students' earlier views and views in the second story, students who had earlier rejected the use of animals sought compromise positions that accommodated the discrepancies. The non-consistent responses were present among both the print and video responses.

On the whole, students' points of view on the original story remain fairly consistent when presented with a second, related story that attempted to make the issue more personally relevant to them. The points of view on the second, related story are personally-oriented, and do not seem to be affected by the presentation format of the original story. Females, more than males, seemed to show more consistency in the way they thought about this issue both at a personal and societal context, continuing to support views that are consistent with the caring and protection of animals. Males mainly appear to support views that are utilitarian.

Conclusion

The findings of this study seem to reinforce Salomon's (1984) proposition that the symbolic carriers of information mainly affect the early phases of decoding but not the subsequent phases of mental elaboration of the already "recoded" and mentally represented material. The latter phases seem to draw on such operations as inference generation which are rooted in one's

belief system and seem to be independent of the format of presenting the original story.

IMPLICATIONS

The discussion of socioscientific issues commonly appearing in the media has implications for science teaching and curriculum that is intent on promoting students' critical thinking on and response to these kinds of issues.

When eliciting students' understanding of information presented in the media, teachers ought to be aware of some of the influences that the presentation format can exert on students' initial interpretation of a socioscientific issue. Teachers have to question students' use of the language they adopt from the presented story as well as the assumptions they make concerning what they see and hear.

It is quite apparent that students have a tendency to interpret new situations in terms of what they already know, thus reinforcing their prior conceptions. But interestingly, it appears that the context within which the issue is discussed is greatly altered in some presentation formats more than in others. For this reason students' ability to discern whether there is a controversy and to describe the nature of such controversy greatly varies from student to student and by the presentation format. It is helpful for educators to be aware that responses from students exposed to various presentation formats differ, for example, in the amount of detail students actually use in their arguments. Those students exposed to the visual medium, in particular, tend to give responses that are short on detail and high in the level of emotional involvement.

Students have difficulty abstracting and framing the issues in the media. This could be because they have not succeeded in translating the structures comprehended in one medium into their general knowledge of the world. Teachers should encourage students to tell, or explain and talk about what they have viewed, read, or heard in order to help them 'map' that viewing or reading into their own terms.

With this effect, the way the visual medium shapes its content, the way it sets the agenda for public discussion, the way it presents reality, all relate directly to the student's personal experience with information presented particularly on television. Some of the studies (e.g. Rowe, Goodman, Moore, & McLarty, 1990, cited in Neuman, 1992) have found that in situations involving discussion, the visual content in videodisc format allowed teachers to access children's ideas for discussion more rapidly than through print, particularly for low-achieving students with little knowledge or interest in the domain. This experience led to the development of corresponding written stories containing more indepth descriptions of the story elements. It would also suggest that it may be more efficient at times to use a combined multimedia approach in order for the different media formats to complement each other. The goal should be to get students to understand that the visual medium, like other media, is a medium of communication, and that what and how it communicates is open to discussion.

There is no doubt that the media will play a significant role in our future as information becomes more completely industrialized. Some claim that the media will change society profoundly (Postman, 1983), others see their effects as extensions, but significant extensions to already established industrial patterns which are, as well, worthy of considerable study. Therefore, to ignore the complexities found in the influence of the media

upon many political, social and socioscientific issues, and to avoid the hard task of teaching critical skills, is to leave the student with simplistic responses in a complex world. A policy to ensure or make compulsory a study of the media and, in particular television, is a necessary step to counteract the inertia to the development of specific curricula in this area.

SUGGESTIONS FOR FURTHER RESEARCH

There is an increasing realization that contemporary information on socioscientific issues reaches us through the mass media, particularly through television. There is need to further investigate students' understandings of these kinds of disputes whenever they are encountered and to examine how students evaluate the corresponding justifications of the positions taken on them.

The following are ideas for further exploration with students and similar socioscientific issues that could be compared with the present study in order to explore the influence of the presentation formats on students' responses to these issues.

1. Across Socioscientific Issues

It is clear that students' understandings of and reasoning through issues not only varies greatly across different contexts, it also varies across issues. With the print and video presentation formats, it would be interesting to investigate the features of students' responses across other related socioscientific issues.

2. The Story Materials

One of the constraints encountered in this study is the scarcity of research materials. The socioscientific issue used in this study could be presented to the students in other ways, and the responses given similarly analyzed for characteristic features. Students could, for example, be presented with the issues in the audio, or combination of media formats, in order to elicit their understandings.

3. The Response Formats

Other than the interviewing method used in this study to probe student understandings, many procedures could be employed to investigate students' understanding of information presented in these media formats. The written response modes have been used elsewhere (see Gaskell, Fleming, Fountain, & Ojelel, in press) to elicit student understandings of this and similar issues presented in print and video media formats. Students could be asked to respond to this issue in other equally expressive ways, such as graphical representations.

4. The Students

Only the responses from grade 10 students are utilized in this study. Since interacting with animals is a much more common phenomenon particularly in children, it would be interesting to explore the features of students' responses from other grade levels, especially those in lower grades, compare with the ones in this study.

5. Prior Exposure to the Issue

An extensive prior understanding of the issue is central in the selection and organization of information to be processed. It would also be interesting to examine how students respond to these issues presented in these media formats immediately after a unit on the discussion of the socioscientific issue.

6. Research Approach

Students have previously encountered and do demonstrate an appreciable understanding of controversial science-related content when asked. Within the research tradition that focuses on the learner, it is common for researchers to ask students to verbalize their predictions about the phenomena under investigation. Students' prior understandings could be elicited by presenting the students with the issue and asking them to verbalize their predictions before finally exposing them to the print and video formats of the issues and exploring their specific understanding of the issue.

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APPENDICES

APPENDIX A:

SOUNDTRACK OF THE VIDEO ON THE USE OF ANIMALS

Narrator Peter Hamilton is the President of Life Force, a Vancouver-based ecology group he formed in 1980. Hamilton dedicated his life to the cause after a visit to the lab conducting vivisection for medical research.

Hamilton And some of those animals were lying in pools of blood, slowly dying, as a result of experimental surgery. And other animals had gone what the researchers referred to as cage crazy. They were going around-and-around in circles, self-mutilating.

Narrator But on the other hand of the laboratory doors, the researchers replied that you just can't label all animal experimentation as cruel or unnecessary.

Dr. McNeil Without that information, we would be unable to even think about developing drugs, procedures and what not, to carry on in humans. So the breakthroughs in genetic engineering, and all those kinds of things, have come about through work on animals.

Hamilton Some of the researchers probably do believe that it is necessary but they themselves have television and they are set in their ways. And what the public is saying and the reason why we are urging change is because it hasn't worked over the years.

Narrator Supporters of biomedical research claim that advances through animal studies have added 25 years to the average life-span through cure or control of diseases like polio and diabetes, are new surgical techniques to repair defects or transplant organs.

But to groups like Life Force, those claims are false. They suggest that the research could have been done other ways without wasting innocent animals lives.

Hamilton I think when we look at defenceless animals, people feel that because they cannot speak for themselves we have to take special care in our treatment of those sentient beings.

Narrator What is a sentient being? Define that for me.

Hamilton An animal that is capable of psychological and physical suffering.

Dr. Horsfall Because of the way we live, the things that we do in our world, keep generating new diseases, new problems, we haven't solved all the old one yet, we will kill ourselves off. We don't either change our ways or keep the animal research going.

Lab Asst. So Dr. Horsfall this is our Mackenzie unit, as you can see . . .

Narrator Bob Horsfall is The Chairman of the Ethics Committee at Simon Fraser University that decides whether or not to OKAY research projects using animals.

Horsfall The greatest misconception, I think, is that huge numbers of animals are suffering, and suffering needlessly of course. A lot of work that is done is a straight behavioral work, where the animal is probably living a happier life that it would as somebody's pet, whether underfed or overfed.

Lab Asst. We have those rabbits that are . . .

Horsfall As you know we have an open-door policy here, anybody is welcome, pretty much any time. People by and large don't care. Animal researchers are out of mind, out of sight, for most people most of the time. And it should be a public decision.

Narrator The Animal Care Centre at SFU is regarded as one of the best in Canada—clean, orderly, and centralized. Any animal research at SFU must be done here under strict controls. SFU's Animal Care Centre also breeds cats. These kittens are born to die. But fewer cats are needed in most experiments than in the past because of quality control.

Horsfall And most of what we see now is either just behavioral observational stuff or what you call acute work, where the animal is put to sleep, surgery is done, and it never wakes up; it gets a terminal overdose after the research is done. But there is a very very strong mandate from the Canadian Council on Animal Care that no, the mandate is no unnecessary suffering and we interpret that really essentially as no suffering of any sort.

Narrator Both sides agree on development of more research using tissue samples and computer models as alternatives to vivisection. The disagreement returns just how much these methods can replace.

Hamilton What we have learnt and what they have accumulated over the years is how different an animal is from that of the human system. And they can no longer support a moral or ethical grounds for the continuance of the use of animal models.

Horsfall I do see a time when animal experimentation will only appear sort of as the last stage of the research procedure. We can't replace the animal totally. Either an animal with fur or an animal like you and me is the final test.

Narrator is Tony Glencoff, CBC Reporter.

APPENDIX B:

THE PRINT STORY

Vancouver (CM). Peter Hamilton hadn't thought much about the use of animals in scientific experiments until he visited a site that did just that. "I was shocked," he said, "to see animals dying in their own blood after experimental surgery." This experience led him to form Life Force, an organization for the protection of animal rights.

After considerable study, Mr. Hamilton became convinced that the claims by scientists about the need to use animals in research are not correct. He argues that animals are sentient beings, that is, they are capable of mental and physical suffering. "They can't speak for themselves," he says, "therefore, we must take special care in our treatment of them."

Dr. John McNeil, Dean of Pharmacy at UBC, has a different view about the use of animals in research. He argues, "Without animal research, many human lives would have been lost. We couldn't even think about developing new drugs and procedures for use on humans without first trying them on animals. New drugs for diseases such as polio and diabetes and new procedures such as transplants have added 25 years to the average lifespan. Breakthroughs in genetic engineering have come about through research on animals."

Dr. Bob Horsfall, a spokesperson for the research ethics committee at SFU argues that there are many myths about research using animals: "Most research on animals involves watching their behavior and does not involve hurting them." The SFU lab follows the strict guidelines of the Canadian Council on Animal Care, which require that there be no unnecessary suffering. "In practice, he says, "this means no suffering. If surgery is done, an anaesthetic is given so that there is no pain. If the surgery would result in a permanent injury, then an overdose of drugs is also given so that the animal never wakes up."

Both sides agree that in the future more and more work will be done with tissue samples and computer models. They disagree on how much these methods can replace work using animals. Hamilton, from the animal rights group, feels that animals are so different from humans that it is unethical to use them. Horsfall, from the university ethics committee, feels that animals will always have to be used in the last stages. "In the end," he says, "some research will always require the use of animals — either animals with fur or animals like you and me — humans."

APPENDIX C:

THE INTERVIEW PROTOCOL

Hi, I'm <interviewer name>. <Student name>, students in your class, and a few others in British Columbia, have been asked to help us get the views of students on certain topics. We hope the results will help us improve your courses.

I'm going to show you a <video/story>. Afterwards, I'm going to ask you a few questions. This isn't a test and your answers won't be marked right or wrong. We are interested in your ideas about the issues. All your answers are completely confidential. No one else in the school will know what you say and we won't use your real name when we talk about the kinds of answers students give us.

I would like, though, to tape our conversation. You don't have to take part in this if you don't want to, and you don't have to answer any question you are not comfortable with. Nothing will be held against you if you would rather not do this. However, we are really interested in what you have to tell us. Is there anything you'd like to ask me? Can we start?

VIDEO / STORY

[For the story: "This is not a reading test; take as much time as you want to read through it."]

1. OK, <student name>, could you please tell me what you think this story is about?
2. Are there different ways in which people think about the issue in the story?

Can you please describe them for me.

3. What is your point of view on the issue discussed in the story? (Can you tell me more about that?)
4. Are there any particular experiences you have had that might influence the way you think about this issue?
5. Have you studied anything about this issue at any grade level in school? (If yes, what subject area was the topic in?) (If no, what do you think would be the closest thing to it?)
6. Have you ever done, or seen a demonstration of, a dissection? Do you think the arguments used in the story also apply to doing dissection at school? In what way?
7. Have any of your teachers ever discussed this topic or something like it?
8. Have you seen anything about this on TV? in a movie? read stories about it (magazines, newspapers, fiction)?
9. A team of scientists at Metropolitan hospital had an idea about a new technique for removing tumors deep in the human brain. However, members of the team disagreed about whether to use animals to test the idea. Some scientists tested the technique using a computer-simulated model of the human brain. Other scientists tested the technique on monkeys that had been given injections so that they grew tumors in their brains.

Which group of people would you want to operate on you if you needed a brain tumor removed?

That's all.

Thanks very much for helping us out.

APPENDIX D:

SAMPLE INTERVIEW TRANSCRIPTS

FROM THE PRINT STORY

Interviewer: Could you tell me what you think that story was all about?

Student: Um about uh one side arguing with another um, like one side feeling that it's cruel to have animals put through um tests and experiments and stuff and another side um saying that uh it's fair cause they use anaesthetics and um it helps save human lives and stuff like that.

I. Could you break up those points of view again for me?

S. Okay. Um, one the one point of view um is saying that uh it's cruel to have animals used in experiments and um different tests and stuff, um testing, like testing different medicines, um and different uh types of operations and stuff, um instead of using it on a human, um, they say that that's cruel and stuff and that they have, they can be mentally and physically damaged but um they can't talk so we have to stand up for them or something like that, and um, one point of view which is lead by some guy at UBC, I think it is, saying um that it's fair, they use anaesthetics and if there's gonna be a major injury then they um, they just give them an overdose of drugs so that they never wake up and stuff like that, and saying things like um they need, they have to have some kind of animal to test it on, um so that they don't harm humans, something like that.

I. Now, what do you think about this issue? What is your point of view about the use of animals in research?

S. Well um, I don't know, I guess it depends, like if, like there are some times when it's really cruel, like they'll put them through like pain tests and stuff, um, that's cruel. But if it's, if it's just like a medicine, like say an animal's got, I don't know if an animal can get diabetes or whatever, or if it's got arthritis or something, um, and they've developed some sort of new medicine or something that they don't really wanna use on animals right away, um, I guess it would be fair if it wouldn't cause any pain to the animal to give it to it, the animal and see if it survived and stuff like that,

um something to benefit the animal would be fair, but something just to destroy it, to see how it reacts, I don't think would be very fair.

I. So have you had particular experiences that make you think that way?

S. Um not experience, well not like science.

I. Yeah just any, any experience that...

S. Like about animals being hurt and stuff?

I. Yeah whether you have seen or heard about.

S. Yeah well I guess I was sort of involved, well not really involved, but we had some poachers in the area and they were um, like we don't have very many elk in the area, and they were just ruthlessly killing all the ones that they could find, the little calves and the mothers and all that stuff and it was in the newspapers and stuff, and um I sort of got to know the conservation officer who was in charge of that and uh a man and I went up there and we sort of checked, you know we sort of looked around the area and um I took the skull home cause I collect skulls, but um, yeah I guess I was pretty mad at this, at these guys cause they were just doing it for fun. They were just going up and shooting these guys just for target practice and stuff and so I got kinda really ticked off cause you went up there and you see all these animals lying there, it's, they're sick, so I guess my uh, my views are kinda biased, I guess, I don't know.

I. So you feel a similar thing could be happening in the laboratories.

S. Well I don't think that they would be that cruel and um painful cause the elk were shot, gut shot, like in the stomach so they would die slowly, um, I don't think they would do anything like that. They would use anaesthetics and stuff, and it would be for some good probably. The elk were just killed for no reason, just for fun which was stupid. So I guess there's a difference there, quite a difference.

I. Uh huh. Have you ever talked about the use of animals in class at any grade level?

S. Um, no, not like in uses in experiments and stuff, but just like, I don't know, last year in Socials we talked about uses of animals in the Industrial Revolution and stuff, how they used them to um you know, move the windmills and stuff and all that stuff, but nothing like experiments or anything like that, no.

I. So that would mean that you are in Grade 11?

S. No I'm in Grade 10.

I. Socials was Grade 9.

S. Yeah Grade 9. We just talked um about very very briefly about how they used animals in the Industrial Revolution and the agricultural revolution to um plough and move the grain wheels and all that stuff, but that was about it yeah.

I. Uh huh. Now, have you ever done a dissection at school or have you seen a demonstration of a dissection?

S. Yeah we've um, I don't think, I think the only year was Grade 8, we dissected um a sheep's eyeball and um we did some little experiments, like um drugging those little daphne, those little water organism things, that was about it, um, there were only about one or two dissections I think we did, nothing major.

I. Uh huh. Do you see the arguments in that story about the use of animals in research as applying to dissection?

S. Well it depends on how the animal died. Um and if it's gonna benefit anyone, like um, if the animal just died naturally I suppose it's okay but if they're just raising, for instance sheep, just to kill them, um so that some kid in Grade 8 could learn what the inside of an eyeball looks like, which can't really benefit him in life, I guess it's not really fair if we're just killing them for that purpose.

I. What about if they are raised so that they could be used in research?

S. Um I guess, well it sort of depends on how they, how they use them after they did, like, well like if they just kill the whole animal for two eyeballs, I guess that's not really too fair, but if they um they use all of it, like for instance maybe the um, the um, the anatomy of it for you know, science research and stuff and um if they use every part of the body for something, then it wouldn't be too much of a waste and it, and if it didn't die painfully, if they're just gonna raise them just to kill them for two eyeballs, that's, I wouldn't think that would be very fair, no.

I. Uh huh. Have you ever seen something like this on TV or the movies, magazines...?

S. What, science experiments?

I. No, the use of animals in experiments.

- S. Yeah, um, yes it's on usually um, usually when you do see it though it's uh, it's always like um, it uh portrays them um sort of exaggerated, like the pain, like I've seen um, like just a movie last weekend about um, it wasn't an animal actually, it was an alien, but they, things like taking animals and uh you know, stabbing them and um putting needles in them and stuff, trying to test them for pain and stuff, I don't know what you call them, pain tests I guess to see how they respond, but um, yeah it's, you see lots of things like that in the movies and stuff. Usually you have a hero who goes and releases all the animals in the lab or something like that.
- I. If you saw them testing on animals in the lab or somehow some guy comes and rescues them....
- S. Well I think that's kind of maybe a little far-fetched cause you know how the movies are. I don't think that they would um put them through really painful tests and all that stuff, um and I don't think anyone would go and free them all like that, but um, I don't know, I don't think that they would actually cause it's probably just exaggerated in the movie, um, they probably exaggerated how they actually experiment with animals. I'm sure it's really not all that painful, but it's um, it's the fact that the animals die I guess, if that makes any sense.
- I. Have you ever talked to anyone about this?
- S. Um, not really, not in experiments, using animals in experiments. I've talked to my mom about those elk getting shot but that was about it.
- I. Did she agree with what you said, did your mom agree?
- S. Oh yeah she was uh, she agreed with me on what I thought about. Well everyone did because um it was just disgusting how they'd go out and kill them for no reason. But that's just about the closest I ever got to talking about using animals in experiments and stuff.
- I. Uh huh. What about controversial issues, things which kind of have two ways of looking at? Do you sometimes bring that up?
- S. Um no, not really.
- I. Let me read to you a little story here. A team of scientists in Metropolitan Hospital had an idea about a technique for removing tumors deep in the human brain. Now they disagreed on how to go about testing this idea. A group of them decided to test it on a computer-simulated model of the human brain. The other ones tested it on monkeys that had been given

injections so that they grew tumors in their brains. You need a tumor in your brain removed and you have to choose between these two groups of scientists. Who would you go for?

- S. Well I'd have to look into more information because for one thing, the computer program you know, a computer program can't become a human brain, so it could be wrong um and it's no where close to a human brain so how do you give a computer medicine anyway? But anyway um, see that's the problem. I guess that um a computer does not really simulate an actual brain so I wouldn't really trust it too well but I would, like using the animal like give it injections so that it has a tumor, um I guess it's cruel, so um I wouldn't really know who to go for. I'd have to like look into further information because um there's both faults in each.
- I. But then there are two different levels of faults here. One is having a problem with the process and the other one is with the product.
- S. Yeah. Um... I don't know what to say.
- I. Now, if you had to check out would you be looking to verify the product because you want the treatment or would you be looking the verify the process because you want some consistency in that.
- S. Most likely the product but if the process is really um dangerous, um I guess you'd be looking at both but most likely the product. If the monkey came to no pain, like it had no pain and it survived and all that, I guess it wouldn't be cruel, but the fact that you're putting it's life on the line probably would be, even though your life is on the line, so I guess it's, it's kinda hard to say cause there's two sides that are both um....
- I. Would you say reel my bed out of the ICU? I mean if you are just on the verge of taking this operation.
- S. Oh I'd probably go for the computer program I guess because it's, it's got more of a chance cause um, I don't know. Well I just hope I don't get a brain tumor.
- I. No well, really no, of course nobody would wish for that.
- S. Yeah it's kind of a hard question. Um... I don't know what to say.
- I. Well you have an option though. You can tell them roll my bed out of here and not take an operation at all.
- S. Well I guess I'd have to take the operation if my life was on the line but um do you wanna know what method I would choose?

I. Yeah.

S. I'd probably choose the um, well if the monkeys survived, well if the monkey didn't survive I wouldn't choose any operation, but um, I guess I'd probably go for the monkey if no pain, if it didn't, if no harm came to it or anything like that cause I'd, I mean I could, I'd, I'd be able to trust something that's living more than, better than a computer program. So I guess I'd just go for the monkey.

I. Okay. Thank you very much.

A STUDENT'S RESPONSE TO THE VIDEO STORY

Interviewer: Could you tell me what you think that story was all about?

Student: I think it was something about the people against using animals for experiments, medical experiments and then, I think it was mostly his, the view of one person and then well they interviewed the views of several other people who for animal, the use of animals for medical experiments.

- I. Do you think then there were different ways in which people were thinking about this issue in the video?
- S. Um the two people for it or the one person against it?
- I. So, well that would mean that there are those who are for it and those who are against it.
- S. I think the two people who are for it were saying about the same thing, and one person against it, he was bringing up several issues against it, not just one reason why he was against it. He had several reasons why he was against it.
- I. So what were the things that they were saying?
- S. Um the person for it, the people for it were saying that it was the only way that, if they didn't use animals for the experimentations, then they would have to use humans but that's not very possible because not very many people would donate themselves for the experiment, while the person against it was saying that it isn't fair to the animals because they have no say in the matter and just because like they can't talk, it doesn't give us any reason to use them and that the animals also have feelings, they're not just blocks of stone. He also says that some of them are also mistreated, that they are hurt unnecessarily and that they are put in small cages and it's very tortuous of them.
- I. What's your point of view? You touched on it before, would you state again your point of view on the use of animals in research?
- S. I think, I know it's necessary, but I'm against it because I think animals have lives too so I don't think they should be just taken lightly. I think what they're doing at SFU is better because they're taking care of them and it's very clean and everything, but I've seen, I've seen places where it's, they're just torturing the animals. I think that's wrong.
- I. Describe some of those places for me.

- S. I don't know where they are but I've seen pictures of, from like the SPCA or PAWS, it's um, like they've got, they've just got the animal lying there and then it's going through needless pain like they've got knives sticking out of them and they've got sores and then it's not even um, doesn't even have anesthetic, so I think that's really cruel to them.
- I. Hm. Have you ever seen any other things that perhaps make you have that point of view?
- S. Mm, I've seen some interviews but I'm not sure I could trust them because it was just, it was one-sided so they didn't really give a defense for themselves. It was just reporters going in there and taking pictures so the people in that medical lab really didn't get a chance to say anything, so it was pretty biased, so I can't make a decision.
- I. Was it from TV?
- S. Yeah it was from TV, it was from a news, a news um caption on TV.
- I. Did you see anything else, maybe in the movies or newspapers?
- S. Yeah I've seen it in the movies but I don't think it's very realistic.
- I. What do you remember seeing in the movie?
- S. Um it was the movie I think "Project X" with Matthew Broderick and monkeys and they were using them for um nuclear research and they were seeing how much radiation they could take before dying, so, I don't know, they might do that but, I didn't know if the movie was very realistic or not, so I couldn't really judge from the movie.
- I. What was your reaction?
- S. I thought, I think things like that do go on with the government without us knowing because if we knew about it there would be a large public outcry so I thought it was like really cruel of the government to do that, but um, I couldn't really make a judgement against the government completely either because it was just one person's point of view again, so the government really didn't have a chance to defend themselves.
- I. Now, have you ever talked to anyone about the use of animals in research?
- S. No I've never talked to anybody like who's a professional. I've just talked to my friends about it, but no one else.

- I. What did you say when you were talking to your friends?
- S. Well we were just talking about how, how cruel it was and how much pain the animal was going through, so we thought that they really shouldn't do that, and then...
- I. Did you like explore the issue ---?
- S. No not really.
- I. Have you ever talked to your teacher about this, I mean about using animals in research?
- S. I don't think the issue has really ever come up because what we do in Science, it doesn't really involve any animal um, any animal uses. It's just for dissection, but that's when the animal's already dead, so it doesn't really go through that.
- I. Have you ever done a dissection?
- S. Yes.
- I. Tell me more about that.
- S. Um we've done um a fish, I think it was perch or something and then we did a cow's eyeball and this year I think we're gonna do a worm or something, and that's about it.
- I. So that's in Grade 10?
- S. Um we did the cow's eyeball in Grade 9 and the, no we did the cow's eyeball in Grade 8 I think and then the perch in Grade 9 and in Grade 10 I don't think we do any dissection.
- I. Now do you see the arguments used in the video as applying to dissection?
- S. Um I do kind of because the animals used in dissection were also once alive but I'm not sure, it's, we didn't, we're not dissecting them while they're alive and they're not going through any pain, but they might have gone through pain when they were killed, like when the perch were killed. I don't know how they were killed, maybe chemicals in the water or something, so, or the cow's eyeball, I think it might just come from like after the slaughter of cows, just from the butcher's or something.
- I. So do you think then it is good to use animals which are not alive?

- S. Yeah I think so. I don't think it's very good just to, like they did, they bred animals just for experimentation. The animals didn't even have a life, they were just, all their lives they were just kept in a cage and they weren't let out and just, they were just, like they said, bred to die.
- I. Now, I want to read to you an illustration here that will explore some of the things we have raised. There is a team of scientists in Metropolitan Hospital who had this idea about a technique for removing tumors deep in the brain. Now this team disagreed on how to actually do research on this idea. One team said "We are going to use a computer-simulated model of the brain, of the human brain to test this technique" and then the other group said "Well we are going to use monkeys that have been injected so that they grew tumors in their brain" so that they were going to remove tumors from those monkeys' brains. You are presented with these two teams of scientists who perhaps are going to remove a tumor from your brain. Now you are required to make a decision as to which of these two scientists you would like to operate on you. Which team do you think you would go for?
- S. Well I think it's, I don't like the idea of them injecting a fluid into the monkey and have it grow a tumor in the brain because that would probably be fairly painful. But on the other hand, if they just do it on a computer, then it's not very realistic and if you work on me they don't have the dimensions and it's not really three dimensional, they don't have the experience.
- I. Let's talk about "realistic" for a minute. How is it not realistic?
- S. It's, you just can't get in there. You can't use your hands, you're not using your hands to go in there, you're actually using buttons on the computer to take it out. You're not using the instruments, you're not um just standing there. It's just a screen and you're just watching it and pressing buttons and then just going in there without your hands. So if I had a brain tumor in my head and I had to get it removed, I think I would want them to experiment on the monkey but I wouldn't want them to inject something and make it grow a brain tumor. I'd rather them take something with a brain tumor already instead of making one there, something, someone that already has a brain tumor, maybe a person who has died from a brain tumor and they just use the dead person with the brain tumor in it, cause I don't like the computer thing.
- I. But you just have these two groups. Now what do you do? You just have these two groups who have done that, who have experimented on monkeys that have been injected and you have to make a choice between these two.

- S. I think I would want the, I'd choose the computer one, the one that experimented on the computer.
- I. So what would be your reason for not choosing the ones who experimented on monkeys?
- S. If I said, when it comes to me, if I said that I wanted them to use the ones with the monkeys then it would be, it would make me very hypocritical, I mean, because I'm sitting here and I don't want them to use animals for experiments but when it comes to my benefit and I say "Okay use the animals" then it would be very unfair, so I think I'd, I would tell them get the ones that use the computer to operate on me.
- I. Regardless of the consequences?
- S. Yeah I think so.
- I. So you would actually pick the ones that used the computer, not out of the fact that you want to recover, but just because you want to be consistent with the way you are arguing?
- S. Yeah.
- I. Alright, thank you very much.