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Differential impact of causal and statistical evidence in counteracting belief perseverance: Changing prior beliefs about Acquired Immune Deficiency Syndrome

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DIFFERENTIAL IMPACT OF CAUSAL AND STATISTICAL EVIDENCE IN COUNTERACTING BELIEF PERSEVERANCE: CHANGING PRIOR BELIEFS ABOUT ACQUIRED IMMUNE DEFICIENCY SYNDROME

by

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A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE DOCTOR OF PHILOSOPHY

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ABSTRACT

DIFFERENTIAL IMPACT OF CAUSAL AND STATISTICAL EVIDENCE IN COUNTERACTING BELIEF PERSEVERANCE: CHANGING PRIOR BELIEFS ABOUT ACQUIRED IMMUNE DEFICIENCY SYNDROME

MORGAN PAUL SLUSHER

Research on belief perseverance - the finding that people cling to initial beliefs to an unwarranted extent - has demonstrated that a belief persists to the extent that there are more explanations available to the believer to support the original belief than to support alternative beliefs. Thus, explanatory evidence that supports an alternative target belief may be more effective in changing prior beliefs than statistical evidence. In an experiment testing this hypothesis, subjects read explanatory (biological) information and/or statistical (epidemiological) information supporting the belief that Acquired Immune Deficiency Syndrome (AIDS) cannot be spread by casual contact. Subjects' beliefs on this issue were assessed before and after reading this information. Subjects also evaluated the evidence they read. Finally, the availability of explanations supporting the target belief was assessed. Results indicated that: (1) explanatory evidence produced significant belief change, whereas statistical evidence did not; (2) evaluations of evidence were biased in accord with subjects' initial beliefs; (3) information polarized attitudes, although attitudes changed in the appropriate direction; (4) final beliefs were more congruent with the target alternative belief after subjects read explanatory information than after they read statistical information. Evidence was mixed regarding whether explanatory evidence was less subject to evaluation bias and subsequent attitude polarization than statistical information. In addition, explanation availability mediated the effectiveness of information in determining final beliefs, and evaluations of the evidence mediated the effect of initial beliefs on attitude polarization. A motivational construct, attitudes toward gay men, was related to initial beliefs and belief change - those with negative attitudes had more inappropriate beliefs and displayed less change in beliefs than those with moderate attitudes. However, evaluations of evidence were better predicted by initial beliefs than by attitudes toward gay men. This study has clear implications for those attempting to change beliefs, including those responsible for AIDS education: explanatory evidence is more effective than statistical evidence in changing beliefs.
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It is always a pleasure to acknowledge the assistance of friends in completing a project such as this. In this case, my friends in the choir at St. Paul's United Methodist Church provided more than their usual loving support. They also gave of their time to serve as subjects in this experiment. I would also like to add a special thanks to Craig Farrell for helping me check the accuracy of my data, a job which one would do only out of true friendship. Other friends have been supportive in so many ways, and I am indeed grateful.

Throughout the years, my parents and family have remained a source of support, love, and encouragement. I would like to thank them again for all they have given me and all they have meant in my life. I can only hope that I will be able to contribute to society in a way that will make them proud.

Finally, I would like to dedicate this dissertation to Eddie and to Gary, friends who have died in the horror of the AIDS epidemic, and to acknowledge other friends who continue to struggle to maintain their lives and their dignity in the face of this crisis. If this work contributes in any way to their benefit, or can keep even one person from having to face that struggle, it will have been well worth the effort.
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DIFFERENTIAL IMPACT OF CAUSAL AND STATISTICAL EVIDENCE IN COUNTERACTING BELIEF PERSEVERANCE:

CHANGING PRIOR BELIEFS ABOUT ACQUIRED IMMUNE DEFICIENCY SYNDROME

"I think it's important to know what does and does not transmit the (AIDS) virus, so that you can take measures not to become infected, and so you will not become unjustifiably alarmed or take measures against people who cannot infect you"

- Dr. Alan Lifson
San Francisco Department of Public Health

"If we want people to believe they can't be infected (by casual contact), we have to start giving them some technical information about why it can't happen"

- Dr. Deborah Dawson
National Center for Health Statistics

Introduction

Education often involves filling a void with information. However, in many cases, education involves changing people's beliefs. This has been the case with regard to educating the public about the facts concerning Acquired Immune Deficiency Syndrome (AIDS). Educational efforts associated with the AIDS epidemic often appear to be ineffective in changing the public's scientifically invalid beliefs. Public health officials find themselves in the position of having to overcome prior beliefs (e.g., that mosquitoes can transmit AIDS or that you can catch the disease by being in the same room with a person with AIDS). Such beliefs, and the consequent fears that accompany them, have resulted in discrimination against individuals suspected of having AIDS, as when children have been forced out of schools or when employees have lost their jobs. How did these prior beliefs develop? What are the processes that make them resistant to change? How can we enhance efforts to effect such change? Some insight into these issues may be gleaned from our understanding of the processes of belief perseverance.

The purpose of this dissertation is to explore these issues and further refine both our understanding of belief perseverance processes in general and our ability to apply this understanding to the important issue of AIDS education.
Social Theories.

The beliefs people have about the spread of AIDS constitute what are known as social theories. Social theories are our beliefs about the relations between variables in the social environment. They are by nature causal belief systems. That is, social theories are beliefs about how, why, and in what way the variables in question are related (cf. Anderson, Lepper, & Ross, 1980). With regard to AIDS, people have beliefs relating their degree of interaction with people who potentially carry the AIDS virus and their risk of contracting the disease themselves. This degree of interaction may range from simply living in the same neighborhood to experiencing close physical contact. Many social theories may be devised to relate these variables. For example, one social theory may be that it is risky to live in the same neighborhood as a person with AIDS because mosquitoes could carry the virus throughout the neighborhood. Another social theory would be that it is risky to shake hands with a person with AIDS because the virus may be spread by physical contact. Still another social theory may be that it is not risky to be sexually involved with someone you met last week because he or she seems to be perfectly healthy. The most scientifically valid social theory available at this time is that there is risk only if certain bodily fluids are exchanged with a person who harbors the AIDS virus, because these fluids are where the virus resides.

Placed in this framework, the task of AIDS education becomes clear. The task is to change people's inaccurate social theories to coincide with the scientifically valid social theory. The clue to the difficulty of this task is, however, contained in the statement of each social theory above - the word "because." As will be explained in the next section, it is the causal nature of these theories that makes them difficult to change. Fortunately, the accurate social theory also contains the word "because," and with the proper use, this may become our most potent weapon for destroying the inaccurate beliefs.
Belief Perseverance

An introduction. It often appears that people stubbornly persist in their beliefs even when some degree of belief change would seem to be most appropriate (cf. Jelalian & Miller, 1984; Ross & Anderson, 1982; Ross & Lepper, 1980). This has been demonstrated in cases where the beliefs have involved self-impressions (Davies, 1982; Fleming & Arrowood, 1979; Jennings, Lepper, & Ross, 1981; Lepper, Ross, & Lau, 1986; Ross, Lepper, & Hubbard, 1975), impressions of other people (Carretta & Moreland, 1982; Ross et al., 1975, Experiment 2), and a variety of social theories (Anderson, 1982, 1983; Anderson et al., 1980; Anderson & Sechler, 1986; Kellam, 1985).

Our current understanding of this phenomenon can be summarized fairly briefly. By nature, people seem inclined to think in causal terms. In fact, theoreticians have referred to humans as "naive psychologists" (Nisbett & Ross, 1980; Ross, 1977; Ross & Anderson, 1982) for echoing the efforts of professional psychologists in trying to piece together social experience in a causal framework. This phenomenon has been demonstrated explicitly in the domain of social theories (e.g., Anderson, 1983). Thus, social theories are not simply beliefs about whether variables are related, but are beliefs about why they are related. As for the perseverance of social theories, the picture that emerges from the relevant research is one in which the causal nature of these theories is the key ingredient. Essentially, a social theory persists to the extent that there are relatively more explanations available (Kahneman, Slovic, & Tversky, 1982; Tversky & Kahneman, 1973) to the believer to support the theory than to oppose the theory or support alternative theories (Anderson et al., 1980; Anderson, New, & Speer, 1985).

Explanation availability as a mediator. This summarization of the belief perseverance phenomenon, as it applies to social theories, is supported by a substantial body of empirical research. A study by Anderson et al. (1980) was the first to examine the perseverance of social theories. This study utilized a debriefing paradigm in which subjects were first induced to hold a belief about a topic they were unlikely to have thought about previously. Based on weak case-study data (two cases), subjects were asked to "discover" and explain either a positive or a negative relation between the risk orientation of firefighter trainees and their later success or failure as firefighters. After being informed that the case studies were,
in fact, fictitious, and that no data were available to assess the true relation, subjects were asked to give their personal opinion of the true relation. Subjects generally continued to believe in the relation they had just explained. Furthermore, correlational data and the results of a second experiment in which explanation activity was manipulated both suggested that explanation availability was a mediating factor in the perseverance phenomenon.

Normatively, initial beliefs based on only two cases of dubious representativeness should be weak and easily changed. However, Anderson (1983) demonstrated that beliefs of this type are, in fact, particularly tenacious. Anderson compared the degree of belief perseverance that occurred when initial beliefs were based on reliable, yet abstract, statistical data or on unreliable, yet concrete, case-study data. The results showed significantly more perseverance in the concrete data condition. An additional experiment revealed that subjects frequently engaged in spontaneous causal processing in this task, especially when examining the concrete data. This further strengthened the evidence that explanations are responsible for belief perseverance.

The studies cited above are both suggestive of the role of explanations in belief perseverance, but they were not designed to measure directly the availability of competing arguments and to relate such availability to perseverance. This was accomplished in a study by Anderson et al. (1985). Using the debriefing paradigm described previously, this study measured the availability of competing arguments at the time the final beliefs were assessed. The degree of perseverance was substantially (but not entirely) accounted for by the relative availability of supporting explanations. Anderson et al. also suggested that other forms of causal thinking, for instance, the creation of causal scenarios, may play a part in the perseverance of beliefs.

**Counteracting the perseverance effect.** A logical extension of the finding that explanation availability mediates perseverance is that increasing the availability of counterexplanations (i.e., explanations supporting alternative relations) should decrease or eliminate the perseverance. Anderson (1982) tested such a "debiasing" technique, again using the debriefing paradigm. In this study, subjects were asked explicitly to consider both possible relations that could exist between risk-preference and firefighter performance. Some subjects were "inoculated" against belief perseverance by requiring them
to write explanations for both the positive and negative relation prior to seeing the case studies suggestive of one or the other relation. Other subjects wrote counterexplanations only after being debriefed about the fictitious nature of the case studies. Both procedures were effective in significantly reducing belief perseverance. This significant finding offers the clue that causal thought may be the key to changing as well as maintaining beliefs.

In the debriefing paradigm used in all of these studies, initial beliefs were based on purportedly valid information, however weak that information may have been. Then, in the course of the experiment, the validity of this information was destroyed, leaving the subject with no valid information in the belief domain. Under these circumstances, it was demonstrated that people base their beliefs on the relative availability of explanations. One might ask, however, what would happen if a person were confronted with new information rather than the discrediting of old information. Would the new information be assimilated in a biased fashion under the influence of the original belief in such a way that the original belief would remain?

Belief perseverance in the face of new information. Lord, Ross, and Lepper (1979) demonstrated that such biased assimilation of data can take place, resulting once again in the perseverance of original beliefs. Lord et al. selected subjects for their study on the basis of prior beliefs regarding the deterrent effect of capital punishment. One group of subjects strongly supported the death penalty and believed in its deterrent effect, whereas a second group of subjects was strongly opposed. Both groups were presented with information about two purportedly genuine studies that had been designed to test the deterrent effect of capital punishment. Both studies were statistical in nature, looking at crime rates either before and after the enactment of capital punishment laws, or between states with and without such laws. The results of the studies were manipulated, however, to support opposite conclusions. Each subject saw one study that supported his or her beliefs and one study that opposed those beliefs. Thus, the overall evidence presented to the subjects was neutral and inconclusive. Logically, when faced with new information such as this, subjects' beliefs should have moderated, causing both groups to move toward a less extreme position. In fact, the groups became more polarized in their beliefs, with each group more entrenched in its position than ever. What could account for such polarization? Lord et al.
found that the evidence itself was evaluated in a biased fashion. Subjects did not simply accept all the information at face value, but selectively subjected the study that opposed their views to closer critical evaluation. As a result, they concluded that the study supporting their view was the better conducted of the two, and therefore, was more convincing. As such evidence was assimilated into the existing belief system, the evidence that had been evaluated as less convincing altered that system to a lesser extent than evidence that was perceived to be more valid.

In a followup study, Lord, Lepper, and Preston (1984) found that this bias was diminished when subjects were encouraged to "consider the opposite," meaning that subjects were to consider how they would evaluate a study had its results come out the opposite way. The similarity of this result with the effects of Anderson's (1982) counterexplanation technique suggests that a similar process may have occurred in each study. Perhaps as subjects considered the possibility that a study could produce opposite results, they also generated explanations in support of each result.

Ego-involvement. Together, the works of Anderson, Lord, and others indicate that cognitive processes work to maintain beliefs in spite of new or discredited information. However, these studies did differ in an important way other than whether information was added or subtracted. The very nature of the beliefs involved in the two paradigms differed considerably. Specifically, they differed in the level of ego-involvement likely to have been felt by the subjects. In the debriefing paradigm, subjects' beliefs were newly formed, and involved a topic (risky firefighters) which subjects were unlikely to have thought about previously or have considered important and relevant to their lives. However, subjects in the "capital punishment" studies were selected for their strong prior beliefs about capital punishment, beliefs that were probably an integral part of each subject's sense of identity as a certain kind of person (e.g., conservative, liberal, moral, religious, etc.). Perhaps such beliefs were so entwined in an overall network of beliefs that it is not surprising that they were resistant to change in light of inconclusive evidence. Would biased evaluation of data occur for less strongly held beliefs?

Anderson and Sechler (1986) performed a conceptual replication of the Lord et al. (1979) study, using less well-formed beliefs. In fact, the beliefs were induced in the subjects merely by having them explain why the target social theory might hypothetically be true. When subsequently given
inconclusive evidence (purportedly valid) concerning this social theory, subjects did not show biased assimilation of these data. However, their final beliefs about the social theory continued to reflect their hypothetical explanations, weakened but not eliminated by the data.

Thus, it appears that when a belief is firmly established, or even when it is newly formed and explained, that belief can persevere in the face of nonconfirmatory data. However, it is important to recognize that in both the Lord et al. (1979) study, and the Anderson and Sechler (1986) study, the data provided were inconclusive and in fact, neutral. As Kellam (1985) pointed out, "It may simply be that, for most people, inconclusive information appears to be no information at all, and so they see no reason to change their opinions. But as soon as data reflecting a reasonably clear-cut relation is available, people may change their opinion to reflect that relation. Thus conclusive, new information provides a more difficult test for the perseverance effect." (p. 7).

Conclusive data. A number of studies have examined how prior beliefs affect the detection of covariation in data (e.g., Chapman & Chapman, 1967, 1969; Golding & Rorer, 1972; Hamilton & Rose, 1980; Starr & Katkin, 1969; Wright & Murphy, 1984; see also discussions by Arkes & Harkness, 1983, and Jennings, Amabile, & Ross, 1982). Kellam (1985) extended the issue of covariation detection to examine the perseverance of weakly held beliefs in the face of conclusive data supporting an alternative belief. Kellam found that subjects' judgments of covariation in scatterplot data (reflecting a definite relation between variables in the belief domain) were not biased by the initial weakly held beliefs. However, initial beliefs continued to have subtle effects in spite of the conclusive scatterplot information. Whereas subjects' stated opinions changed in response to the data, their predictions for the results of additional hypothetical experiments were influenced more by their initial beliefs than by the data. Thus, it appears that "under the surface," the initial beliefs persevered even in the face of conclusive evidence.

The study by Lord et al. (1979) also provided evidence regarding the treatment of conclusive data. Although the major issue addressed by that study was the effect of "mixed" data, the individual pieces of data that constituted the mixed data were themselves conclusive. Those individual pieces of data were evaluated in a decidedly biased fashion. Subjects with strong prior beliefs evaluated belief-supporting
evidence positively and belief-opposing evidence negatively. (Note that in this study, the quality of data was evaluated, in contrast to other studies in which the degree of covariation in data was assessed.) And although beliefs shifted in the appropriate direction in response to each study, the shifts were larger for those subjects who initially agreed with the study results.

Suppose then that one's goal is to change the social theory of another person. Will abstract statistical data, however strong and conclusive, be effective in overcoming a belief supported by an easily available explanation? The studies cited above show that data are often no match for a well-established explanation. We have seen that when inconclusive data fail to support strong prior beliefs, the data are evaluated in a biased fashion and assimilated into the belief system in such a way that the beliefs persevere. We have seen that when conclusive data contradict weak yet readily explainable beliefs, the covariation in the data is detected in an unbiased fashion, but the beliefs appear to persevere, at least under the surface. We have also seen that belief perseverance can be diminished, however, as people are induced to generate explanations counter to their beliefs.

A gap does remain in our understanding of the interactions of prior beliefs, explanation availability, data evaluation, and the assimilation of data in the formulation of new beliefs. What happens when conclusive data are themselves causal in nature? Explanations, after all, need not be generated within each individual, but can be provided by the external environment. Furthermore, such explanations need not be hypothetical, but can carry the weight of validity just as statistical evidence can. Will people whose beliefs are contradicted by such evidence evaluate this kind of evidence more negatively than other people? How will their subsequent beliefs be affected? In other words, will evaluations and new beliefs respond differently to this kind of data than to statistical data? In the previous studies of data evaluation (Lord et al., 1984; Lord et al., 1979), data on the deterrent effect of capital punishment were statistical, presented in the form of crime statistics. Would the results have been different if, for example, the study opposing the death penalty had involved interviews with death-row inmates in which they described their crimes as crimes of passion in which they had no thought of the consequences? The evidence in such a study would not only provide evidence to oppose the effectiveness of capital punishment, but it would also provide an explanation for why such penalties often do not deter crimes. Likewise, in Kellam's
(1985) study, evidence was presented as precisely the kind of abstract, statistical data Anderson (1983) found least likely to invoke causal processing. Had the weak initial beliefs been challenged with more concrete explanatory evidence, might the results have been different?

**Belief perseverance in AIDS education.** AIDS education efforts may now be placed within the theoretical framework outlined above. The message that public health officials wish to convey is quite definite - AIDS is spread only in certain ways (through the transfer of blood or semen, or from mother to fetus) and not in other ways (such as shaking hands, sneezing, sharing water glasses, or through biting insects). The alternative social theories held by members of the public are quite ego-involving, viewed by many as a matter of life and death. The information provided in education efforts often has been statistical in nature, the result of epidemiological research. In other cases, the information has consisted of the simple statement of facts, such as "AIDS is not spread by casual contact." In light of the research findings, it is not surprising that such information is ineffective in changing people's beliefs, no matter how many times it may be repeated. (Excessive repetition may, in fact, have a negative effect. See Cacioppo & Petty, 1979.) However, the research also points in the direction of a possible solution. Information that provides alternative explanations to counter erroneous social theories may be effective in changing those theories. An investigation of this problem offers the tantalizing possibility of expanding our theoretical understanding of belief perseverance as well as addressing a vital applied issue.

**The origins of inaccurate beliefs.** The analysis above suggests that AIDS education materials should provide explanations that counter the explanations people currently hold to support their beliefs. To understand what explanations may be useful in this capacity, first it is necessary to consider the source of the erroneous beliefs and the nature of the explanations that support them.

How have inaccurate beliefs about AIDS come into being in the first place? Many beliefs people hold about AIDS may result from inaccurate information set forth by political, religious, and social leaders. However, studies cited earlier suggest that beliefs may also come into being on the basis of the most tenuous of data (e.g., 2 case studies, as in Anderson et al., 1980), or even on the basis of no data at all (e.g., via hypothetical explanations, as in Anderson and Sechler, 1986). In the case of AIDS, it seems likely that many inaccurate beliefs came into being essentially on the basis of hypothetical
explanations. In the early days of the epidemic, there was little information about the causes of the disease and people were free to speculate about possible causes and modes of transmission. With the discovery of HIV (the "AIDS virus") and its presence in blood, people had ample fuel for their imaginations. For example, while there have never been any data to suggest that mosquitoes were transmitting this disease, people could easily produce explanations for why they could do so. An essential finding of the Anderson and Sechler (1986) study and the Kellam (1985) study was that relations that could be explained could easily become firmly held social theories. Unfortunately, many inaccurate beliefs about AIDS have readily available explanations associated with them. Although research has not addressed this issue, one could speculate that this has much to do with people's prototype of a "virus," which would probably hold a close resemblance to a common cold or flu virus. People have extensive experience with these viruses, and have readily available explanations and scenarios associated with their spread (e.g., coughing, sneezing, or drinking from the same glass). By applying these explanations inappropriately to the AIDS virus, people have generated the inaccurate beliefs that public health educators wish to dispel.

Another bias in social judgment that appears to be playing a role in the development of inaccurate beliefs about AIDS is "illusory correlation" (Chapman, 1967; Crocker, 1981; Hamilton, 1981). In judging the degree of relation between any two variables, people generally are overly influenced by "confirming" cases. A dramatic demonstration of this phenomenon has been the ongoing concern over various highly improbable modes of AIDS transmission. In this case, confirming cases are those involving a person who has engaged in some activity and has contracted AIDS. However improbable that it may be that an activity will result in infection, even one case where it occurs is often enough to raise considerable alarm. (For example, a report revealing that 3 health-care workers contracted AIDS through working with patients caused considerable alarm, despite the fact that thousands of professionals have worked with AIDS patients with no ill effects.) It is even possible that as people imagine the possible ways in which AIDS could be spread, they become more convinced that such events do occur (Slusher & Anderson, 1987).

Unfortunately, all of the research on belief perseverance suggests that a tenuous basis for a belief is
no guarantee that the belief will be easy to change. As noted earlier, if a belief is supported by highly available explanations, that belief may be very difficult to change. Research suggests that the most effective technique to change beliefs is some form of counterexplanation (Anderson, 1982). The explanations that support the erroneous beliefs are "common-sense" - mosquitoes can spread AIDS because they fly around and suck different people's blood; handshakes can spread AIDS because germs can be on people's hands; silverware can spread AIDS because germs live in people's mouths. What these common-sense explanations have in common is a generally biological nature. It is people's naive understanding of biology that provides the explanations to support their beliefs. Fortunately, biological research can provide the explanatory concepts to counter these beliefs. This suggests that appropriate counter-explanations are to be found in the realm of biological information. Perhaps if people are presented with explanatory biological evidence supporting scientifically valid beliefs, the inaccurate beliefs about AIDS be changed.

For the purposes of this discussion, research in public health can crudely be divided into two types, referred to here as epidemiological and biological. Epidemiological research is concerned primarily with the statistics of who gets a disease, how quickly it spreads, and so forth. Biological research is concerned with the biological processes responsible for the spread of the disease. Essentially, biological data are explanatory whereas epidemiological data are statistical. Each kind of research provides data that are extremely valuable to the scientists who understand them. They may not, however, be equally valuable when presented as educational information. The preceding discussion suggests that many inaccurate beliefs about AIDS have persisted, in part, because epidemiological evidence has been presented in educational materials, and such evidence may be ineffective in countering many people's prior beliefs. Of course, in some cases the biological processes may not be known. In other cases, biological explanations may be available, yet simply not reported. For example, the biological reasons that mosquitoes do not transmit AIDS are fairly well established. They have to do with physical characteristics of mosquitoes, the length of time the virus can live outside the human body, and the inability of the AIDS virus to infect mosquitoes. Yet, a recent AIDS educational book (AIDS: A Guide for Survival, 1987) emphasizes that "Overwhelming scientific evidence of the fact that mosquitoes don't
spread AIDS comes from the pattern of cases. If AIDS were spread by mosquitoes, we would see a lot of cases where there are a lot of mosquitoes. And the people who got AIDS would be children and outdoor types such as farmers, hunters, and campers because they are the ones bitten the most. This has not happened." (p. 25). For those who believe that mosquitoes pose no danger, this passage may be reassuring. To those who believe the opposite, this passage may be inadequate to change their beliefs. In fact, it is possible that such a statement could strengthen the inaccurate belief. This would happen if the reader interprets the statement as indicating that even the experts do not understand the biological processes involved.

Clearly, scientists need to be careful in their attempts to educate the public. Even the language of science can be problematic in the presentation of evidence. One has to wonder what the reaction of the average parent is when a public health official states that there is almost no chance of children being infected in the classroom. Careful scientists generally avoid statements of absolute certainty. This, of course, leaves open the possibility of biased evaluation of what scientists would regard as conclusive evidence.

An Empirical Study.

Design. The present study was designed to test the relative effectiveness of biological (explanatory) information and epidemiological (statistical) evidence in changing beliefs about the spread of AIDS. Theory suggested 2 major issues that needed to be addressed in this regard. First, if biological information does prove to be more effective, can it be shown that this effect is due to the mediating role of explanation availability? Second, we know that conclusive statistical information can be evaluated in a biased manner, leading to attitude polarization. Is explanatory information less subject to this bias?

In the present experiment, subjects were presented with different kinds of information about the spread of AIDS within a 2 X 2 between-subjects factorial design. One factor was whether or not epidemiological information was presented. The other factor was whether or not biological information was presented. Thus, some subjects received epidemiological and/or biological data and others did not.
Beliefs about the spread of AIDS were assessed both before and after subjects read this information. Subjects also evaluated the information they received and indicated the explanations they had available to support the conclusions offered in the information. Measures were also taken of demographic variables as well as some social attitudes (e.g., attitudes toward gay men).

**Hypotheses.** Several hypotheses were developed on the basis of established theory and previous research. These are outlined below, along with the rationale for each.

The first three hypotheses arise directly from our understanding of the theoretical mechanisms that underlie the belief perseverance phenomenon, i.e., that a belief perseveres to the extent that more and better explanations are available to support that belief than to support alternative beliefs. In the present case, biological information is expected to provide explanations to support the appropriate alternative belief, thus changing the relative availability of explanations more in favor of that alternative. Therefore, the first hypothesis states:

**Hypothesis 1:** Biological evidence will effectively change people's incongruent beliefs to be more congruent with the information provided.

The second hypothesis follows from the same rationale. Epidemiological information will not alter the relative availability of explanations between beliefs. Therefore it is not expected to change beliefs, as reflected in the following:

**Hypothesis 2:** Epidemiological evidence will not be effective in changing people's incongruent beliefs to be congruent with the information provided.

As noted earlier, social theories are causal in nature and people spontaneously consider such beliefs in causal terms. Therefore, the relative availability of explanations between beliefs is not completely a function of explanations generated in the external environment. In fact, cognitive response theory argues that belief change occurs primarily as a function of internal thoughts and elaborations provoked by
stimuli in the external environment (for a review, see Fiske & Taylor, 1984, Chapter 12). The degree of internal elaboration depends on the characteristics of both the person (e.g., Cacioppo & Petty, 1982; Cacioppo, Petty, Kao, & Rodriguez, 1986; Petty & Cacioppo, 1981) and the external stimulus (e.g., Chaiken, 1980; Sawyer, 1981; Wood & Eagly, 1981). Clearly, people may generate explanations themselves as they consider alternative beliefs, even in response to the epidemiological information. Therefore, explanation availability will be related to changes in beliefs within information conditions as well as providing the mechanism for producing differences observed between conditions. The role of explanation availability as a mediating variable is suggested in the following hypothesis:

**Hypothesis 3:** Explanation availability will mediate the relation between the information provided and the subjects' final beliefs.

The remaining hypotheses are related to the biased evaluation of evidence and the attitude polarization that can follow from such bias. In comparing the studies of Lord et al. (1979) and Anderson and Sechler (1986), it appears that the ego-involvement of initial beliefs, rather than the conclusiveness of the data, determines whether biased assimilation of data occurs. Lord et al.'s study involved strong ego-involving beliefs and found evidence of bias, whereas the latter study involved weak beliefs and did not find bias, regardless of the conclusiveness of the data. As noted earlier, the beliefs considered in this study can be very ego-involving, insofar as they are concerned with the spread of a life-threatening disease. This study does differ from Lord et al.'s study in one major aspect. Lord et al. selected subjects on the basis of strong opposing views on the relevant social issue. No such selection was attempted in the current study, so initial beliefs were expected to range across the full spectrum. Aside from this factor, the design of the current study is similar to each individual half of Lord et al.'s study, in which information was given in support of one particular conclusion. Lord et al.'s results suggest the following hypothesis:
Hypothesis 4: Subjects' evaluations of the evidence will be biased by their initial beliefs such that evaluations will be positively related to the congruency between initial beliefs and the evidence.

Lord et al. (1984) addressed the issue of whether evaluation biases arise from motivational sources or from errors in cognitive processing. Their success in overcoming bias by having subjects "consider the opposite" suggested that cognitive processes played the major role, and that motivational constructs were unnecessary to explain the phenomenon. In the current study, motivational forces may arise as subjects consider the spread of AIDS in light of their emotional response to the social group most closely associated with the disease in this country - gay men. However, in keeping with the findings of Lord et al. (1984), it is expected that the motivational factors will have their effect through their influence on a cognitive variable, the subjects' initial beliefs. This leads to the following hypothesis:

Hypothesis 5: The evaluations that subjects give to the evidence will be biased by the subjects' social attitudes, but this effect will be mediated through their initial beliefs.

Where the biased evaluation of evidence has been observed (Lord et al., 1984; Lord et al., 1979), the evidence in question has been statistical in nature. The current study provides an opportunity to test whether such evaluation bias will occur for explanatory evidence. First let us consider how evaluation bias may occur for statistical evidence. For the person whose beliefs are congruent with the evidence, explanations are presumably already available to support the beliefs supported by the evidence. The explanations themselves, however, may have been formed on the basis of weak or even hypothetical grounds. Statistical evidence in support of the belief can then be quite informative to this person, providing evidence that existing explanations may be not only reasonable, but true. On this basis, this person evaluates the data positively. On the other hand, consider the person whose beliefs are incongruent with the statistical evidence. This person may have relatively few explanations available to explain the new evidence, and because the evidence is statistical in nature, it does not inherently provide explanations. In fact, evidence that does not provide convincing explanations may prompt the person to
engage in counterargument (Petty & Cacioppo, 1979). Thus, statistical evidence lacks a key ingredient necessary to change this person's beliefs and may therefore be evaluated lower.

Now consider what might happen if the evidence to be evaluated is explanatory rather than statistical. In general, it might be expected that explanatory evidence would be evaluated more positively than statistical evidence because it can be more easily understood. Furthermore, for the person with congruent beliefs, the evidence may contribute additional explanations in support of those beliefs, or it may confirm explanations that are already available. Therefore, the person with congruent beliefs may be expected to evaluate explanatory evidence positively. On the other hand, for the person who has incongruent beliefs, explanatory evidence provides information that can potentially change beliefs, depending on the final relative availability of explanations for the alternative beliefs. Because the evidence can be informative in this case, and because the explanations may be clear even to those with opposing views, the explanatory evidence may once again be evaluated positively. This suggests that evaluation bias should be less pronounced for explanatory evidence. In the current study, this leads to the following hypothesis:

**Hypothesis 6:** Evaluations of biological evidence will be less biased by initial beliefs than will the evaluations of epidemiological evidence.

It follows from this line of reasoning that subjects with incongruent beliefs will lower the mean evaluation of epidemiological evidence but not of biological evidence, suggesting the following:

**Corollary 6a:** The mean evaluation of biological evidence will be greater than the mean evaluation of epidemiological evidence.

The final 3 hypotheses are expected on the basis of Lord's work on biased evaluation of evidence and attitude polarization (Lord et al., 1984; Lord et al., 1979). Although the major point made by Lord et al. (1979) was that beliefs were polarized overall by the presentation of "mixed" data, the attitude change
they reported as a result of each individual piece of conclusive evidence also showed a polarization effect. People with opposing views changed their views by differing amounts in response to each study in such a way that the gap between their views widened. Thus, Hypothesis 7 reflects the expectation that a similar polarization will occur in this study and Hypothesis 8 indicates that the polarization is a product of the biased evaluations.

**Hypothesis 7:** Attitudes will be polarized by the evidence presented, as people with beliefs congruent with the communication report greater belief change in the communication-congruent direction than those with initially incongruent beliefs.

**Hypothesis 8:** The polarization of attitudes will be mediated by the evaluation of evidence.

The final hypothesis is a natural consequence of Hypotheses 6 and 8. If attitude polarization is a result of biased evaluation of evidence, then these two measures should vary together.

**Hypothesis 9:** Less polarization will occur when biological information is provided than when epidemiological information is provided.

Together, these hypotheses and the study designed to test them should extend our knowledge of the relations between social theories, conclusive evidence and the explanations that can bind them together. With an increased understanding of these relations, the implications for the applied problem of AIDS education (as well as other efforts to alter people's beliefs) can be more clearly drawn.
Method

Overview

This study assessed subjects' beliefs about the spread of AIDS both before and after providing them with different kinds of relevant information. At the beginning of the experiment, all subjects provided data on demographic variables, social attitudes (such as attitudes toward gay men), and their beliefs about the spread of AIDS through casual contact or mosquitoes. Subjects then were provided with information about the spread of AIDS in accordance with their random assignment to conditions within a 2 X 2 factorial design. One factor in the design was whether or not subjects received statistical information arising from the epidemiological studies on the AIDS epidemic. The second factor was whether or not explanatory information arising from biological studies was provided.

After reading the information appropriate to their condition, subjects were given the opportunity to evaluate the evidence and conclusions they had read. They were then asked once again to indicate their beliefs about the spread of AIDS. They were also asked to indicate how much their beliefs had changed in light of what they had read. Finally, the availability of explanations about why AIDS is not spread by casual contact or mosquitoes was assessed.

Subjects

A total of 167 people participated as subjects in this study. Of these, 23 had missing data on at least one item and were removed from all analyses, leaving a total sample size of 144. Participants were drawn from two sources. One hundred-and-eight were students in undergraduate psychology courses on the urban campus of a large public university in Houston, Texas. The other 36 subjects were members of a large urban mainline protestant church, also in Houston, or family and friends of members. Taken together, this sample provided a fairly diverse group of people, although this was clearly a sample of
convenience and was not intended to be a random sampling of any definable population. Because the content of this study concerned AIDS, it is important to note that all subjects were from the Houston metropolitan area, an area with a high concentration of people with AIDS and probably higher-than-average public awareness of the issues surrounding this disease. The study was conducted in late April and early May of 1988.

Subjects taken from the university setting participated for class credit. Experimental sessions at the university were held on a come-and-go basis to allow participants to fit the study into their class schedules. Subjects completed their booklets in the presence of the experimenter. The number of participants in a session at any one time ranged from 1 to approximately 20. Subjects taken from the church setting participated without compensation. They were given the booklets to work on at their own convenience, and were asked to return them as soon as possible. Those booklets used in the analysis were returned within 2 weeks.

Demographically, the sample consisted of 69 males and 75 females. Ages ranged from 14 to 68, with a mean age of 26.9. By race, the sample consisted of 98 Whites, 7 Blacks, 21 Asians, 17 Hispanics, and 1 Other. English was the native language of 120 subjects, with the other 24 subjects listing a variety of other native tongues. There were 109 subjects who were currently in college, consisting of 42 freshmen, 34 sophomores, 18 juniors, 11 seniors, and 4 graduate students. Of those not currently in college, 4 had no college experience, 6 had completed some college work, 12 were college graduates, and 13 had done graduate work. Politically, 38 subjects generally supported the Democratic party, 66 supported the Republican party, 31 described themselves as Independents, and 9 indicated that none of these categories described them. The sample included 11 Atheists, 15 Agnostics, 47 mainline Protestant Christians, 24 self-described "born-again" Christians, 31 Roman Catholics, and 18 people of other religious beliefs. Finally, with regard to social issues, subjects rated themselves on a 5-point scale from Very Conservative to Very Liberal. Eight rated themselves Very Conservative, 33 were Somewhat Conservative, 61 were Moderate, 32 were Somewhat Liberal, and 10 were Very Liberal.
Procedure

Materials. All materials for this experiment were contained in a booklet which subjects were told to work through at their own pace. Subjects explicitly were told to complete items in the order presented and not to look ahead in the booklet.

Subjects were randomly assigned to one of 4 conditions, 3 of which received information about AIDS and 1 of which was a control condition in which no information was given. Materials in the 3 information conditions differed only in the type of information included in the imbedded communication (see Appendix 1). In the Epidemiological condition (n=35), the communication conveyed information that was statistical in nature, arising from epidemiological studies showing that AIDS is not being spread by casual contact or mosquitoes. In the Biological condition (n=38), the information was explanatory in nature, conveying scientists' current understanding of the biological processes that prevent AIDS from being spread by casual contact or mosquitoes. In the Full Information condition (n=35), the communication included both the epidemiological and the biological information. The fourth condition, the Control condition (n=36), did not provide any communication concerning AIDS at all. Instead, at the point in the experiment where other subjects read the communication, control subjects completed an unrelated task that required about the same amount of time as reading the communications (approximately 5 to 10 minutes). Specifically, control subjects completed the 18-item version of the Self-monitoring Scale (Snyder, 1987) and the Attributional Style Assessment Test (Anderson, Horowitz, & French, 1983). Because control subjects did not receive a communication concerning AIDS, their booklets did not include those dependent measures referring to the communication (e.g., those asking subjects to evaluate the evidence).

Upon entering the experiment, all subjects were assured of the anonymity of their responses, and subjects in the university setting were asked to sign consent forms. Each subject was then given a booklet, thereby determining in which condition that subject would be. All subjects provided demographic information before proceeding with the remainder of the experiment.
**Attitudes toward gay men.** The next page of the booklet contained 21 randomly ordered items comprising two separate scales. All items were rated on a 9-point scale (1 = Strongly Disagree, 3 = Somewhat Disagree, 5 = No Opinion, 7 = Somewhat Agree, 9 = Strongly Agree). Ten of these items made up the Attitudes Toward Gay Men (ATG) scale, with a reported internal consistency (alpha) coefficient of .91 (Herek, 1987). For the present study, the alpha coefficient for this scale was .93. ATG scores can range from 10 to 90, with higher scores indicating more negative attitudes toward gay men. The items of the ATG scale are reported in Appendix 2.

**Dogmatism.** The other 11 items on this page (mixed with the items of the ATG scale) were selected from among the 40 items of the Dogmatism scale (Rokeach, 1960). Although the inclusion of these items in this study might be regarded as exploratory, they were selected according to the following rationale. In the development of the full Dogmatism scale, 7 of these items were designed to measure intolerance and 4 were designed to assess relationships among a person's belief and disbelief systems. As part of the construct of dogmatism, more dogmatic people are regarded as being more intolerant and showing greater separation of belief and disbelief systems while allowing greater contradictions within the belief system. With regard to AIDS, it was thought that these characteristics might affect a person's potential for changing beliefs. For people who associate AIDS with gay men, intolerance toward this group may limit their willingness to adopt more positive attitudes toward people with AIDS. Also, the perceived "gay lifestyle" may represent a disbelief system for these individuals in contradiction to their belief system supporting a more "traditional" lifestyle. Dogmatic individuals who separate belief and disbelief systems may adopt more of an "us versus them" attitude toward both gay men and people with AIDS. Finally, by allowing contradictions within the belief system, dogmatic individuals may not be as troubled with the conflicting beliefs that "I am a compassionate person who cares about sick people" and "I have negative beliefs about people with AIDS."

Although the 11-item scale included in this study will be referred to throughout this report as the Dogmatism (DOG) scale, it should be kept in mind that it is only a part of the original 40-item scale and probably does not fully capture the construct of dogmatism. The 11 items are listed in Appendix 3.
DOG scores range from 11 to 99, with higher scores representing greater dogmatism. For this study, the alpha coefficient for this scale indicated an internal consistency of .68.

**Initial beliefs about AIDS.** Subjects were introduced to their next task with the following instructions:

Now that you have given us some general information about yourself and your beliefs, we are interested in exploring some of your beliefs about Acquired Immune Deficiency Syndrome (AIDS). AIDS is a disease caused by a virus that attacks and destroys the body's immune system. Persons with AIDS are then likely to come down with a variety of life-threatening illnesses.

The AIDS virus was identified in 1983. Since that time, much research has looked at how this virus can be spread from one person to another. On the next three pages, we will ask you some questions about how you believe this virus might be spread and about how you might act toward a person carrying this virus. Please answer these questions according to your personal opinion, based on your own beliefs at this time.

Subjects next completed 56 items assessing beliefs about AIDS, responding to each by making ratings on 9-point scales (1 = Strongly Disagree to 9 = Strongly Agree). Eight items were filler items (e.g., "There is no known cure for AIDS."). These items allowed subjects to express their knowledge of certain basic facts about AIDS, but were unrelated to the topic of the communication they were about to read. The other 48 items constituted the Beliefs about AIDS (Belief) scale, which covered a diverse range of issues all related to the potential spread of AIDS through casual contact or by mosquitoes. The items comprising the Belief scale are listed in Appendix 4. Items were designed to be counterbalanced for direct/reverse scoring, positive/negative wording, and objective/personal perspective. Two unique random orders were used in this study. Belief scores could range from 48 to 432, with higher scores indicating beliefs more congruent with the experimental communication (and with current scientific evidence, i.e., that AIDS is not spread by casual contact or mosquitoes). The initial Belief scores showed a high level of internal consistency, with an alpha coefficient of .98. Relations that emerged between the initial Belief scores and various demographic and social attitude measures are examined in detail in Appendix 7.
**Prediction measures.** In addition to the 48-item Belief scale, initial beliefs also were assessed with 3 items that required subjects to predict the likelihood that AIDS would be spread in different situations. These items were included in light of past studies (Kellam, 1985) in which subjects' stated beliefs on a given topic did not necessarily coincide with the beliefs they apparently used in making predictions. In the present study, each item introduced a situation in which AIDS might potentially be spread. One question assessed the perceived likelihood of AIDS spreading in an airplane cabin, another asked how much the spread of AIDS would increase as more families and friends take care of people with AIDS, and the third question asked whether mosquitoes would spread AIDS between monkeys in a controlled experiment. Subjects answered each question on a 9-point scale. The complete text of these questions is provided in Appendix 5. Together, these items formed the Prediction scale, with an alpha coefficient of .71. With each item reverse-scored, Prediction scores could range from 3 to 27 with higher scores indicating beliefs more congruent with the experimental communications.

**Communication about AIDS.** After subjects' initial beliefs about the spread of AIDS had been assessed, they were asked to read a communication concerned with this topic (except in the Control condition). The following instructions introduced the reading assignment:

Now we would like you to read some information related to the spread of AIDS. For this study, we collected a number of newspaper articles that have appeared in recent months. One of those articles is on the next page. Different people in this study will be reading different articles, chosen at random from those that we collected. Please read the article on the next page carefully and try to understand the major points. You will not be asked to remember specific details from the article, but we will be interested in how much you learn about the main ideas presented.

In reality, of course, the "newspaper articles" were designed for this experiment to convey the information appropriate for each condition (i.e., Epidemiological, Biological, or Full Information). However, every effort was made to make the articles appear authentic, including the use of a "UPI" heading, narrow justified columns, and a print font similar to those found in newspapers. The text itself was a mixture of actual newspaper articles plus original writing using information gleaned from public
health sources. Although fictitious names were used in the articles, the research studies cited and
statistics presented were either based on actual research or were fabricated to be consistent with research
findings.

The articles used in the three conditions are reproduced in Appendix 1. In an effort to equate the
articles as much as possible on irrelevant dimensions, they were written in parallel form. The
Epidemiological and Biological articles were roughly equivalent in length, but the Full Information
article was about 50% longer since it combined information from both other articles. Reading level was
assessed for each article using a computer program designed to calculate the Gunning Fog Index, which
represents complexity in writing as an average grade level at which the text could easily be read. All
three of these articles had reading levels below the college level (12.6, 10.4, and 12.2 for the
Epidemiological, Biological, and Full Information articles respectively). Considering the relatively high
level of education of the study sample (all but 4 subjects had some college education), all of these
articles should have been quite readable.

Perceived strength of conclusion. After reading the communication about AIDS, subjects were
presented with a short discussion about the nature of scientific inquiry and how scientists "try to find as
many clues as possible, and then reach their conclusions based on this evidence." It was noted, however,
that "conclusions can never be absolutely certain since the evidence is never complete." Subjects were
told that "in some articles, the scientists felt justified in reaching strong conclusions based on their
studies. In other articles, the scientists were less certain about their conclusions." Subjects were then
asked to answer the following 2 questions: "What conclusion did this article present about the spread of
AIDS by casual contact (for instance, to friends or family members living in a household)?" and "What
conclusion did this article present about the spread of AIDS by mosquitoes?" Responses were made to
each question on separate 9-point rating scales (labeled 1 = "Very strong conclusion - AIDS is not spread
by (casual contact/mosquitoes)," 5 = "This article presented no conclusion," 9 = "Very strong conclusion
- AIDS is spread by (casual contact/mosquitoes)"). The instructions and wording were designed to stress
that the question was addressing the conclusions presented in the article, not the conclusiveness that the
subject felt was justified by the evidence in the article. These items were strongly correlated ($r=.75$), so they were combined to form the 2-item Conclusion scale with an alpha coefficient of .84. Conclusion scores can range from 2 to 18, with lower scores indicating stronger perceived conclusions in the communication-congruent direction. Materials for the Control condition subjects did not include the Conclusion scale.

**Evaluation of evidence.** The next page of the booklet contained 8 questions asking subjects to evaluate the evidence presented in the communication they had read. Instructions indicated that subjects were to "answer the questions on the basis of your own opinion and evaluation of the studies presented (without looking back)." Responses were made on 9-point rating scales. With separate questions referring to studies concerned with spread of AIDS by casual contact or by mosquitoes, subjects were asked how well the studies were conducted (1 = very poorly done, to 9 = very well done), how convincing the evidence was for the conclusions given (1 = completely unconvincing, to 9 = completely convincing), how satisfied the subject was with the evidence presented (1 = completely unsatisfied, to 9 = completely satisfied), and whether the evidence gathered had been appropriate (1 = not at all appropriate, to 9 = very appropriate). Taken together, these 8 items formed the Evaluation scale, with an internal consistency (alpha) coefficient of .95. Evaluation scores can range from 8 to 72, with higher scores indicating a more positive evaluation of the evidence presented. Materials for the Control condition subjects did not include the Evaluation scale.

**Post-communication beliefs about AIDS.** The next section of the experimental booklet contained the second administration of the Belief scale. In the instructions, subjects were reminded that they had answered these questions earlier, but that they were not to go back and look at their previous answers. They were also instructed, "Although you may want to consider the information we gave you in the article, we are not asking you to recall the beliefs or conclusions stated there. Rather, we are asking that you answer these questions according to your own personal opinion based on your own beliefs at this time." Subjects then completed the identical scale administered earlier. For a given subject, the ordering of the questions was the same on both occasions. For the second administration, the alpha coefficient
for the Belief scale was once again .98. Following the Belief scale, subjects also answered the 3 prediction items for a second time. The alpha coefficient for the Prediction scale was .80 for this administration.

In the Control condition, the instructions asked the subjects to answer the questions again, without looking back or trying to recall earlier answers, but did not mention any "article."

**Self-reported attitude change.** Because attitude polarization effects are difficult to detect using a difference score analysis (see Lord et al., 1979), a direct measure of self-reported attitude change was included in this study. However, since subjects had already been asked to complete the rather extensive Belief scale twice, it was not considered feasible to have subjects consider each of the items from that scale again and report an attitude change regarding each. Instead, attitude change at a broader and more applied level was assessed. Subjects were asked to consider changes in their opinions regarding 2 laws that have been discussed with regard to AIDS. The first law would force employers to allow people with AIDS to work among other people. A brief discussion presented supporting and opposing arguments in terms of differing views on whether AIDS could be spread in this setting (i.e., the issue of spread through casual contact). Using 9-point rating scales, subjects were asked how they felt about such a law, compared to when they started the experiment (1 = more opposed, 5 = no change, 9 = more in favor), and whether they had more or less belief that such a law would increase the spread of AIDS (1 = less belief, 5 = no change, 9 = more belief). Addressing the issue of mosquitoes spreading AIDS, subjects were asked to consider a law that would isolate people with AIDS from society on that basis. They were asked about their change in support (1 = more opposed, to 9 = more in favor) and whether they had more or less belief that such a law would stop the spread of AIDS (1 = less belief, to 9 = more belief). To measure attitude change in the direction congruent with the communication, the first item was scored directly, whereas the latter 3 items were reversed scored. Taken together, these items formed the Attitude Change scale, with a possible range from 4 to 36 and higher scores indicating greater attitude change in the direction congruent with the communication. The alpha coefficient for this scale was .79. The full text of these items is given in Appendix 6.
**Explanation availability.** The final task for subjects was to indicate how available explanations (supporting the belief that AIDS is not spread by casual contact or by mosquitoes) were for them at that point in time. Two approaches were taken to assess explanation availability. First, subjects were asked to write out explanations after reading the following instructions:

> The common cold and the flu are easily spread by casual contact between people. Malaria and yellow fever are known to be spread by mosquitoes. Strong scientific evidence indicates that AIDS is not spread by casual contact or by mosquitoes. Can you think of the reasons why this is true? If you can, please write down as many of those reasons as come to mind easily, placing one reason on each of the numbered lines below.

The second approach was to have subjects rate the ease with which explanations could be brought to mind. Two questions ("How easy is it for you to think of reasons why AIDS is not spread by (casual contact / mosquitoes)") were answered on 9-point rating scales (1 = very difficult, to 9 = very easy). These items were positively correlated ($r = .69$), and were combined to form the 2-item Explanation Availability (EXP) scale, with a coefficient alpha of $.82$.

**Debriefing.** At the conclusion of the experiment, all subjects were provided with a written debriefing, explaining the purposes of the experiment. It also was revealed that the "article" they had read was a fabrication, but that it was based on genuine research and that the conclusions did reflect the best scientific knowledge available. Finally, the debriefing sought to reassure subjects that even the most knowledgeable persons had to struggle with some issues raised in this study, and they should not be upset if they found some of these issues difficult to think about. They were assured that by participating in this study, they were making a positive contribution to the educational process, making it "possible for public health authorities to be more effective in keeping people healthy and saving lives."
Results and Discussion

Belief Change - Epidemiological and Biological Information

Pre- and post-communication difference scores. Subjects' beliefs concerning the transmission of AIDS, as assessed by the 48 item Belief scale, were examined both before and after reading a communication strongly concluding that AIDS is not spread by casual contact or by mosquitoes. A Belief Change score was calculated for each subject, such that positive change reflected a change congruent with the communication, whereas negative change was incongruent with these conclusions. Subjects in the control condition did not read a communication concerned with AIDS, but did complete the Belief scale twice, before and after working on an unrelated task. Change scores in this condition were calculated in a fashion identical to those in other conditions.

The Belief Change scores were examined to test whether biological (explanatory) information and epidemiological (statistical) information had different effects. A 2 X 2 (Biological Information: Presented, Not Presented X Epidemiological Information: Presented, Not Presented) analysis of variance (ANOVA) was conducted on Belief Change scores. The results are presented in Figure 1.

Figure 1. Belief Change Scores
The pattern of change scores shows that biological and epidemiological information interacted in determining the changes in beliefs, $F(1,140)=7.89$, $p<.01$. Item order (with 2 unique random orders) did not affect this pattern. Relative to subjects in the control condition, whose mean change score ($M=4.67$) did not differ reliably from zero, $t(35)=1.45$, subjects who received epidemiological information only ($M=22.00$) showed significantly greater change in the information-congruent direction, $t(69)=5.22$, $p<.0001$. In other words, in the absence of any other information, epidemiological information did produce a significant change. However, in the presence of biological information, epidemiological evidence was not effective in producing change. Change scores did not differ whether epidemiological information was present ($M=43.49$) or absent ($M=50.34$), $t(71)=.64$. On the other hand, biological information produced significantly greater change scores whether in the presence or absence of epidemiological information, $t(68)=2.52$, $p<.02$ and $t(72)=6.60$, $p<.0001$ respectively. Finally, the most straightforward test of whether biological information and epidemiological information had different effects is to compare the Epidemiological and Biological conditions directly. Change scores resulting from biological information ($M=50.34$) were significantly greater than those produced by epidemiological information ($M=22.00$), $t(71)=3.25$, $p<.002$. In sum, biological evidence produced strong changes in beliefs, and completely overrode the relatively small effects of epidemiological evidence.

Prediction measures. Change scores could also be calculated for the Prediction scale. This measure provided further evidence that biological information was more effective than epidemiological information in changing beliefs. The 2 X 2 (Biological Information: Presented, Not Presented X Epidemiological Information: Presented, Not Presented) ANOVA conducted on the change scores for the Prediction measure did not yield a significant interaction, $F=1.84$. The main effect of Epidemiological Information was also nonsignificant, $F=2.10$. However, there was a significant main effect of Biological Information, $F(1,140)=18.41$, $p<.0001$, such that change scores were greater when biological information was provided (unweighted marginal mean, $M=2.64$) than when it was not provided ($M=0.30$). (Note that where marginal means are given throughout this paper, the appropriate unweighted means are reported.) Individual cell means are shown in Figure 2.
When item order (2 orders were used) was introduced into this model, there was a main effect of order, $F(1,136)=6.32$, $p<.05$, but this factor did not interact with other effects in the model.

Once again, a direct comparison between the Epidemiological ($M=1.06$) and Biological ($M=2.61$) conditions also yielded a significant difference, $t(71)=2.15$, $p<.05$, indicating that the belief change produced by the biological information was greater than that produced by epidemiological information.

**Self-reported attitude change.** The Belief and Prediction scales yield change scores when difference scores are calculated from pre- and post-communication administrations. An additional measure of belief change is provided by the self-reported Attitude Change scale. This indicates the subject's own perception of how much his or her beliefs have changed. The 2 X 2 ANOVA on Attitude Change scores yielded no interaction, $F=.58$, no effect of Epidemiological Information, $F=.48$, and a significant main effect of Biological Information, $F(1,140)=13.11$, $p<.0005$ (marginal means, $M=21.80$ and $M=25.50$). Cell means are shown in Figure 3. A score of 20 represents no change on this scale. Clearly, self-reported change was greater in response to biological information. Means in the Epidemiological ($M=22.54$) and Biological ($M=25.53$) conditions differed from one another with marginal significance, $t(71)=1.98$, $p<.06$. 
Interactions with demographic variables. These results clearly demonstrated that biological information was more effective in changing beliefs than was epidemiological information. It is useful to ask, however, whether this pattern was consistently true for people with varying demographic and social attitude characteristics. The interaction of other variables with this pattern of belief change could represent methodological effects or theoretically interesting effects, depending on the variables involved. It should be noted, however, that since these other variables were measured and were not experimentally manipulated, interpretations of any findings must be made cautiously.

Demographic and social attitude variables were entered into the ANOVA analysis as both main effects and in interaction terms with the 3 primary effects (Biological Information, Epidemiological Information and their interaction). Although a more complex analysis could include multiple demographic and attitude variables, the analyses presented here include each such variable entered separately. The dependent variables considered were the 3 measures of belief change - the Belief Change scores, the Prediction Change scores, and the Attitude Change scores.

The first demographic variable to be entered into the model was the sex of the subject. This produced no significant main effects or interactions, indicating that the pattern of belief change did not differ for males and females.
Age did have significant effects on the Belief Change scores. When the linear component of age was entered into the model, a significant main effect emerged, $F(1,136)=11.30, p<.001$, such that Belief Change decreased with age. An interaction of age with the effect of Biological Information, $F(1,136)=13.35, p<.0005$, indicated that the positive impact of biological information dramatically decreased with increasing age. This effect can be seen by looking at different age groups. For those receiving biological information, unweighted marginal mean Belief Change scores were 66.1, 34.2, and 23.5 for those between ages of 15-24 ($n=38$), 25-34 ($n=19$), and 35-44 ($n=9$), respectively. For those not receiving biological information, the respective means were 9.1 ($n=46$), 7.7 ($n=13$), and 2.3 ($n=5$). The meaning of this finding is unclear. This may reflect cohort effects, different thought processes for college students and nonstudents, development of skepticism, differences in education, or even factors unique to this study sample, where younger subjects were generally recruited in a university setting while older subjects were not. The nature of this study precludes any definite interpretation.

Four major racial groups were represented in the study sample, Whites, Blacks, Asians, and Hispanics. When entered into the ANOVA, race produced no significant main effects or interactions. The same was true for native language, where no effects were found for native English speakers versus non-native English speakers. It should be noted, however, that cell sizes were small for both non-Whites in the race analysis and non-native English speakers in the language analysis, possibly preventing any true differences from reaching statistical significance.

Subjects who were currently college students indicated their level in school as freshmen, sophomores, juniors, seniors, or graduate students. No significant main or interaction effects emerged for level in college. Those subjects who were not college students were classified as not being college graduates, being college graduates, or as having completed some graduate work. Education level interacted with Epidemiological Information on Belief Change scores, with college graduates changing beliefs more when epidemiological information was presented than when it was not (unweighted marginal means, $M=21.6$, $n=6$, and $M=-0.0$, $n=6$, respectively), whereas the opposite was true for both nongraduates ($M=6.25$, $n=3$, and $M=13.5$, $n=7$) and those with graduate work ($M=6.0$, $n=6$, and $M=14.4$, $n=7$).
For those subjects stating that they generally supported either the Democratic or Republican political parties, this factor was entered into the ANOVA. A main effect occurred for the Attitude Change measure, $F(1,96)=5.03, p<.05$, such that Democrats reported more positive change (marginal mean, $M=25.8$) than did Republicans ($M=22.9$). Since the Attitude Change measure concerned changing law to reflect more positive beliefs, a decidedly political action, it is not surprising that political party had an effect here.

In addition, a significant 3-way interaction resulted for the Belief Change measure, $F(1,96)=5.54, p<.05$. Mean values for this interaction are given in Table 1.

<table>
<thead>
<tr>
<th>Table 1. Belief Change Scores for Democrats and Republicans</th>
<th>Biological Information</th>
<th>Epidemiological Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Political Party</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>Democrats</td>
<td>24.00 (9)</td>
</tr>
<tr>
<td></td>
<td>Republicans</td>
<td>24.47 (19)</td>
</tr>
<tr>
<td>Yes</td>
<td>Democrats</td>
<td>32.78 (9)</td>
</tr>
<tr>
<td></td>
<td>Republicans</td>
<td>53.65 (17)</td>
</tr>
</tbody>
</table>

The means suggest that the interaction occurred because Democrats changed beliefs more when given full information, whereas the Republicans showed the most change when given biological information alone.

Religion was entered into the model for those subjects who fit into the 5 major groups represented in this sample (atheists, agnostics, mainline protestant Christians, "born-again" Christians, and Roman Catholics). No main effects or interactions were statistically significant.

Interactions with social attitude variables. Social attitudes (i.e., liberalism vs. conservatism, attitudes toward gay men, and dogmatism) represent a potentially more interesting set of variables that could possibly affect belief change. In this data set, these attitudes were assessed by the ATG scale, the
DOG scale, and a self-rating as very conservative, somewhat conservative, moderate, somewhat liberal, or very liberal.

Looking first at conservatism versus liberalism, subjects were classified into 3 groups, conservatives (including strongly and somewhat conservative), moderates, and liberals (somewhat and strongly liberal). When entered into the ANOVA, this factor produced only a single main effect, wherein Attitude Change scores differed for these groups (unweighted marginal means, M=21.8, M=23.9, and M=25.2 for conservatives, moderates, and liberals respectively), F(2,132)=3.24, p<.05. This pattern of means indicates that conservatives were less willing overall to change their attitudes toward proposed laws based on the information given. The fact that the conservatism-liberalism factor did not interact with other factors in the ANOVA (p's>.08) shows that the effects of epidemiological and biological information were similar across this dimension.

Related to the conservatism-liberalism dimension is another social attitude variable that may be more directly related to people's beliefs about AIDS. Negative attitudes toward gay men, as measured by the ATG scale, were correlated with conservatism when subjects' self-ratings on the conservatism-liberalism question were coded as a 5-point scale, r=.45, p<.0001.

In the overall study sample, ATG scores were related to the Belief Change scores with a significant positive linear effect, F(1,141)=6.80, p<.01, and a negative quadratic effect, F(1,141)=7.21, p<.001, resulting in an inverted U-shaped curve. These effects resulted from an interpretable pattern in the data. Those with the most positive attitudes toward gay men (i.e., those with the lowest ATG scores) also had the highest scores on the initial Beliefs scale, as confirmed by linear regression, F(1,142)=73.72, p<.0001. As a consequence, these people also showed the lowest Belief Change scores since their beliefs were already congruent with the communication. The positive linear relation between ATG scores and Belief Change scores resulted as those with increasingly negative attitudes had more latitude to change their inappropriate beliefs. However, the negative quadratic effect demonstrates that those who could change the most did not. In fact, setting the derivative of the quadratic regression equation equal to zero indicates that the peak of this inverted-U function lies at an ATG score of 50, which is exactly at the midpoint of this scale. Moving up the scale past this point, in spite of declining initial Belief
scores, Belief Change scores also declined. Thus, those individuals with extremely antigay attitudes were also those with the most inappropriate beliefs, yet they were also most unwilling to change those beliefs in response to the communication.

Neither linear nor quadratic effects of the ATG score interacted with the information effects in the ANOVA. This shows that the effects of epidemiological and biological information were similar for those with differing ATG scores.

The remaining social attitude measure assessed in this study was dogmatism. In the overall sample, the relation between dogmatism and belief change was much the same as that observed for negative attitudes towards gay men. Regression shows that as dogmatism increased, scores on the initial Belief scale decreased, $F(1,142)=34.24, \ p<.0001$. As a result of this, when dogmatism was placed in the model with the information effects, Belief and Prediction Change scores showed a main effect of dogmatism, $F(1,136)=8.15, \ p<.005$ for Belief Change and $F(1,136)=4.28, \ p<.05$ for Prediction Change. These reflect greater change for dogmatic individuals, presumably because they had more room to change. Unlike conservatism or attitudes toward gays, however, dogmatism did interact with one of the information factors in the model. For all 3 dependent measures, scores on the DOG scale interacted with the effect of Biological Information, $F(1,136)=4.64, \ p<.05$ for Belief Change, $F(1,136)=9.91, \ p<.002$ for Prediction Change, and $F(1,136)=6.93, \ p<.01$ for Attitude Change. In each case, the nature of the interaction was such that the positive change due to biological information was greater for more highly dogmatic individuals.

**Alternative interpretations.** The thrust of the analysis up to this point has been to show that the biological information provided in this study was more effective in changing beliefs than was the epidemiological information. This effect had been hypothesized on the basis of theory concerned with the basic nature of the information, explanatory for biological and statistical for epidemiological. However, the results presented here could have arisen from factors of considerably less theoretical interest. Two alternative interpretations that could be applied to these data are discussed in this section. Additional analyses suggest that these alternatives are not responsible for the obtained results.

The first alternative interpretation is that biological information is not necessarily more effective in
changing beliefs, but that the particular biological communication used in this study was perceived as presenting stronger conclusions than was the epidemiological communication. The argument would be that if the biological article is perceived to draw stronger conclusions than the epidemiological article, then naturally it would lead to greater belief change. To assess this possibility, the 2-item Conclusion scale was included in this study. A direct comparison of the Conclusion scores in the Epidemiological (M=3.63) and Biological (M=2.55) conditions shows that indeed there was a significant difference, F(1,71)=5.17, p<.05. Because lower scores on this scale represent stronger conclusions in the appropriate direction, it does appear that the perceived conclusion of the biological communication was stronger. However, because we have a perceived Conclusion score for each subject, it is possible to partial out any effect due to this discrepancy. Within a general linear model, Belief Change was regressed on Conclusion score, condition (Epidemiological, Biological), and the interaction of Conclusion with condition, with the Conclusion score entered first into the model. The result was a highly significant effect for condition, F(1,69)=8.07, p<.006. Thus, even with the perceived conclusions partialled out, the Biological condition was more effective in changing beliefs than the Epidemiological condition.

A second alternative interpretation for the greater effect of biological information is that it represented new information, whereas statistical information was already familiar to the subjects before entering the experiment. One could not expect already familiar information to produce great changes in beliefs. To test for this possibility, the basic ANOVA was conducted once again, using only those subjects least likely to have been previously exposed to any kind of information, i.e., those with the lowest initial Belief scores. One would be suspicious of the overall results if these subjects failed to demonstrate the superiority of biological evidence in producing belief change. The third of the subjects (n=48) with the lowest initial Belief scores was used in the analysis. The model yielded no main effect of Epidemiological Information, F=.06, a very highly significant main effect of Biological Information, F(1,44)=25.36, p<.0001 (marginal means, M=5.24 and M=67.32), and a significant interaction, F(1,44)=5.68, p<.05. Cell means are shown in Table 2. The pattern corresponded to that of the study sample as a whole, and indicated that even where prior information had been minimal, biological information was more effective in changing beliefs. Simple main effects showed that both the
Epidemiological condition and the Biological condition produced greater change than the Control condition, $I(18)=3.15, p<.01$ and $I(19)=5.09, p<.0001$ respectively. However, a direct comparison showed that the Biological condition had higher change scores than the Epidemiological condition, $I(21)=3.83, p<.001$.

**Table 2.** Belief Change Scores for Low Initial Beliefs

<table>
<thead>
<tr>
<th>Biological Information</th>
<th>Epidemiological Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>No</td>
<td>-7.89 (9)</td>
</tr>
<tr>
<td>Yes</td>
<td>83.58 (12)</td>
</tr>
</tbody>
</table>

It appears that neither of the alternative interpretations can account for the pattern of data observed in this study. Although every effort was made to equate the epidemiological and biological communications as much as possible in the conclusions that they presented, they were not perceived to be equal. Yet, when this inequality was partialled out, beliefs still changed more in response to the biological information. Likewise, the issue of prior exposure fails to account for the observed data. Even for those least likely to have been exposed to prior information, the superior effects of biological information were clear.

**Evaluation of Evidence**

**Epidemiological and biological information.** Each subject who read a communication concerning the spread of AIDS (i.e., those not in the control condition) was given the opportunity to evaluate the evidence presented in the communication. The 8-item Evaluation scale assessed how well done, how convincing, and how appropriate the studies were perceived to be, as well as how satisfied subjects were with the evidence presented. In addition, the 2-item Conclusion scale assessed what the perceived conclusion of the communication was and how strongly that conclusion was perceived to be drawn.
Because the biological communication provided explanatory information, it was hypothesized that it would be evaluated more highly than the epidemiological communication. In fact, the Evaluation scores for the Biological condition ($M=57.61$) were significantly higher than the scores for the Epidemiological condition ($M=50.89$), $t(71)=2.40, p<.02$. Differences in the Conclusion scores were discussed earlier, where it was shown that Conclusion scores were also higher for the Biological condition.

**Bias related to initial beliefs.** Each subject's score on the Evaluation scale and the Conclusion scale was regressed on his or her pre-communication score on the Belief scale. Both regression analyses showed significant relations such that the more congruent the initial beliefs were with the communication, the more positive the evaluation of the evidence, $F(1,106)=48.00, p<.0001$, and the stronger the perceived conclusion, $F(1,106)=16.06, p<.0001$. Thus, we find not only that evidence was evaluated in a biased manner according to initial beliefs, but also that the conclusions based on the evidence were perceived differently by people with differing initial beliefs.

**Bias effect for different types of information.** Although biased evaluation of evidence was clearly present overall, further analysis was necessary to see if this effect was equally present with regard to biological and epidemiological information respectively. Comparing the Biological condition with the Epidemiological condition, the regression slope of Conclusion scores on Belief scores did not interact with condition, $F=1.11$. However, the slopes of the regression lines relating Evaluation scores to Belief scores did differ between conditions with marginal significance, $F(1,69)=2.89, p<.10$.

Further analyses revealed that the pattern of the Evaluation data did indeed differ in the two conditions. Subjects were classified into one of two groups according to whether their initial beliefs were congruent with the communication (Belief score greater than 240, where 240 is the midpoint of the Belief scale) or incongruent with the communication (Belief score less than 240). A 2 X 2 (Beliefs: Congruent, Incongruent X Type of Information: Biological, Epidemiological) ANOVA revealed a significant interaction, $F(1,69)=4.65, p<.05$. In the Epidemiological condition, Evaluation scores did differ for subjects with congruent ($M=55.23, n=26$) and incongruent ($M=38.33, n=9$) beliefs, $t(33)=4.21, p<.0002$. This showed that epidemiological information was evaluated in a biased fashion. However, in the Biological condition, Evaluation scores ($M=58.43, n=30$ for congruent beliefs and $M=54.50, n=8$ for
incongruent) did not differ according to the initial beliefs of the subjects, t(36)=.88. Thus, biological information was less subject to biased evaluation. It should be noted that separate regression analyses conducted for the Epidemiological and Biological conditions still found positive relations between initial beliefs and evaluations in each condition, F(1,33)=28.63, p<.0001, and F(1,36)=8.88, p<.01, respectively. Thus, although the analysis dichotomizing initial beliefs into congruent and incongruent groups indicated that the biased assimilation effect was substantially reduced in the case of biological information, the regression analysis should caution against concluding that there was no bias in evaluations of biological evidence.

**Bias related to other measures.** Because other measures were related to initial beliefs, they may contribute further to our understanding of the biased evaluation of evidence. It could be argued, for instance, that lower evaluations should have been related to conservatism, dogmatism, or negative attitudes toward gay men, rather than to incongruent initial beliefs. In fact, regressing Evaluation scores on ATG scores did yield a highly significant relation, F(1,106)=15.59, p<.0001, showing that those with more negative attitudes toward gay men did give lower evaluations to the evidence. In addition, the effect on the Conclusion scale was marginally significant, F(1,106)=3.10, p=.08. These measures also appear to have been related to the conservatism-liberalism factor, with a significant effect on the Conclusion scores, F(1,106)=4.55, p<.05, and a marginal effect on Evaluation scores, F(1,106)=3.08, p=.08. Dogmatism showed only a marginal effect on Conclusion scores, F(1,106)=2.78, p=.10, with no effect on Evaluation scores, F=.09. None of these relations differed by condition, all interaction F's<1.8. What these individual regressions did show was that indeed the evaluation of the communications was related to the social attitude measures - conservatism, dogmatism, and negative attitudes toward gay men all were related to lowered evaluations of AIDS information in some way.

The question remains, however, whether these measures accounted for any unique variance in the Evaluation or Conclusion scores aside from any variance they may have shared with the initial Belief scores. To test for unique contributions, each measure was entered into a multiple regression model with the initial Belief scores (the interaction terms were nonsignificant in every case and were dropped from the models). Where the social attitude measures had been at least marginally related to Evaluation and
Conclusion scores when they were alone in the model (i.e., in all cases except dogmatism and Evaluation scores), none were significantly related when initial Belief scores were also in the model ($F(1,105)=2.05$, $p=.16$ for conservatism predicting Conclusion scores, all other $F$'s < 1). In contrast, the unique variance accounted for by the initial Belief scores was significant in every case (all $F$'s >12.5, $p<.001$). These results mean that virtually all of the variance in Evaluation and Conclusion scores accounted for by conservatism, ATG scores, and DOG scores was variance shared with initial beliefs. There was, however, unique variance accounted for by initial beliefs that was not shared with any of these social attitude measures.

These results strengthen the argument that biased evaluation occurred as a function of initial beliefs. That is not to say, of course, that evaluations were not biased on the basis of social attitudes as well. There was shared variance that could not be assigned one way or the other. However, these results indicate that one can best predict the level of evaluation that will be assigned by a person if one knows that person's initial beliefs. Additional knowledge of that person's conservatism, dogmatism, or attitudes toward gays will not add any predictive power.

Polarization of Attitudes

Attitude change related to initial beliefs. Lord et al. (1979) found that "mixed" evidence concerning the effectiveness of capital punishment led opponents of capital punishment to be more opposed to its use and proponents to be more in favor of its use. This polarization of attitudes occurred as people with opposing views actually changed attitudes in opposite directions. It seems doubtful that "conclusive" evidence such as that used in this study (i.e., evidence that clearly supported only one side of the issue) would have actually changed beliefs in opposing directions. That does not mean, however, that attitude polarization could not have occurred. As a result of the information provided in this study, subjects whose initial beliefs were consistent with this information could have changed their attitudes more than those subjects whose beliefs were less congruent. This pattern would also represent polarization - the distance between the beliefs of people with opposing views getting larger as a result of the persuasion
attempt. The Attitude Change scale provided a direct measure of self-reported change consisting of 4 items concerning support or opposition to laws related to AIDS. High scores on the Attitude Change scale indicated that the subjects reported change congruent with the communication (relative to their attitude at the beginning of the experiment), whereas low scores indicated incongruent change, with the midpoint representing no change at all. The relation of initial Belief scores to Attitude Change scores did not differ for the three conditions where subjects were given information, $F = .94$. Combining data from these conditions, the regression of Attitude Change scores on initial Belief scores yielded a significant positive relation, $F(1,106)=8.49$, $p < .005$, indicating that those with more communication-congruent beliefs reported more positive belief change than those starting with less congruent beliefs. This finding revealed that attitudes were polarized in this study.

**Evaluations as mediators of attitude polarization.** Lord et al. (1979) suggested that biased evaluation of evidence is the mechanism through which attitude polarization occurs. The current study allowed further investigation of this issue by examining the mediating role of Evaluation scores in predicting Attitude Change scores. As one would expect, the regression of Attitude Change scores on Evaluation scores yielded a highly significant linear relation between the two measures, $F(1,106)=9.77$, $p < .005$. Thus, in predicting Attitude Change scores, both initial Belief scores and Evaluation scores accounted for significant variance when entered separately in regression models. When both were entered, the interaction was nonsignificant, $F=1.81$, so the interaction term could be dropped, leaving a multiple regression model predicting Attitude Change on initial Belief scores and Evaluation scores with no interaction. In this model, with initial Beliefs entered first, the total variance accounted for by the Belief effect was significant, $F(1,105)=8.67$, $p < .005$, but the unique (Type III) variance was nonsignificant, $F(1,105)=2.06$, $p = .15$. On the other hand, the unique variance accounted for by Evaluation scores did reach marginal significance, $F(1,105)=3.25$, $p < .08$. Thus, the introduction of the Evaluation measure into the model reduced the effect of Belief scores on Attitude Change to nonsignificance. In conjunction with the marginally significant effect of the Evaluation measure on Attitude Change, this pattern supported the role of Evaluation as a mediating variable.
Polarization effect for different types of information. Comparing attitude polarization in the Epidemiological and Biological conditions, there was no evidence of an interaction of the regression slopes with condition, $F = .36$. However, separate regression analyses did reveal that polarization occurred in the Epidemiological condition, as indicated by a positive regression slope, $F(1, 33) = 7.48, p < .01$, whereas the slope in the Biological condition did not differ significantly from zero, $F(1, 36) = 2.68, p = .11$. Likewise, a 2 X 2 ANOVA of Attitude Change scores crossing dichotomized initial beliefs (congruent/incongruent with the communication) with condition (Epidemiological versus Biological) failed to show an interaction, yet in the Epidemiological condition, scores for those with congruent beliefs ($M = 24.15$) differed from scores for those with incongruent beliefs ($M = 17.89$), $t(33) = 3.02, p < .005$. In the Biological condition, these respective means ($M = 26.47$ and $M = 22.00$) did not differ significantly, $t(36) = 1.69, p = .10$. Just as with the biased assimilation effect, the nonsignificant interaction precludes drawing strong conclusions from these data. However, the pattern suggests that biological data may be less likely to polarize attitudes.

Final Beliefs

Epidemiological and biological information. The various change scores used as dependent variables in the analyses above provided a sensitive measure of the effectiveness of the various communications. However, one could also simply look at the final beliefs in the various conditions to see if those beliefs differed as a result of reading epidemiological or biological information in different articles. This analysis is less sensitive because it does not take into account variations in the initial beliefs of individuals. However, this fact also makes the analysis all-the-more convincing should it yield significant results.

If initial beliefs had not been assessed, the random assignment of subjects to conditions could have been assumed to have minimized any systematic differences between groups. However, since initial beliefs were assessed in this study, it is possible to test this assumption. The initial Belief and Prediction scores were subjected to a 2 X 2 (Epidemiological Information X Biological Information)
ANOVA. For both the Belief and the Prediction scores, no effects approached significance, all $F$'s $< 1.3$, indicating that the randomized groups did not differ systematically when entering the experiment.

However, the analyses for final Belief and Prediction scores both yielded significant main effects for Biological Information, $F(1,140)=5.20$, $p<.05$ (marginal means, $M=305.11$ and $M=336.55$) and $F(1,140)=10.30$, $p<.002$ ($M=19.43$ and $M=22.41$) respectively. The effects of Epidemiological Information did not even approach significance, $F=.20$ and $F=.01$, nor did the interactions, $F=.93$ and $F=.76$. The cell means associated with this analysis, shown in Figure 4, make it clear that the effect of biological information was not only statistically significant, it was also substantial in size. Finally, a direct comparison of means indicated that the final Belief and Prediction scores in the Biological condition were significantly higher than those in the Epidemiological condition, $t(71)=2.05$, $p<.05$ and $t(71)=2.18$, $p<.05$ respectively. Altogether, the pattern for the final beliefs reinforced the results obtained for the change scores. Both pointed to the superiority of biological information for effectively changing beliefs.

Figure 4. Final Beliefs
Although an effective communication would be expected to raise the mean belief scores within a condition, it would not be expected to raise individual scores within that condition uniformly. In the study sample, some individuals held beliefs congruent with the communications when they entered the experiment whereas others did not. Those with congruent beliefs would not be expected to change, but one would hope that change would be greatest among those with the most incongruent beliefs (notwithstanding the attitude polarization effect discussed earlier, which appears when self-reported change is measured). This suggests yet another route to compare the effectiveness of biological and epidemiological information in changing beliefs. When final beliefs are regressed on initial beliefs, the effectiveness of the communication that intercedes moderates the relation. When no effective communication occurs between measurements, the initial and final beliefs should be strongly related, with a regression slope of about 1. Those with a given initial belief score should have roughly the same final belief score. On the other hand, if a communication could be devised that would be totally effective in changing beliefs, then the regression slope should be 0. Regardless of a subject's initial beliefs, the final beliefs would be maximally congruent with the communication. Thus, the slope of the regression
line relating initial and final beliefs in a given condition provides a measure of the effectiveness of the communication used in that condition.

In practice, none of the communications used in this study totally overcame initial beliefs. Within each condition, a linear regression (quadratic effects did not approach significance) of final Belief scores on initial Belief scores yielded slopes significantly different from zero, all $F$s > 86.5, $p<.0001$. However, the pattern of the slopes can reveal the relative effectiveness of the communications. Specifically, the slopes were examined to see if smaller slopes were associated with the conditions where biological information was provided. In the conditions where biological information was provided, the Biological and the Full Information conditions, the slope estimates were .70 and .82 respectively. In the conditions where biological information was not provided, the Epidemiological and the Control conditions, the slope estimates were .99 and 1.05 respectively. To test the statistical significance of the difference in these sets of slopes, a contrast was created with the slopes for the Biological and Full Information conditions having weights of +1 and the slopes for the Epidemiological and Control conditions having weights of -1. The contrast was highly significant, $F(1,136)=15.57$, $p<.0001$. In addition, a direct contrast of the slopes for the Epidemiological and Biological conditions was significant, $F(1,136)=9.71$, $p<.005$. These contrasts added further evidence for the impact of biological information on belief change.

It is interesting to note the concrete benefits associated with this finding as well. The more shallow slope associated with the Biological condition means, of course, that those people who started with low Belief scores ended up with much higher scores. In fact, 21.1% of the subjects in the Biological condition scored at or below the midpoint of the Belief scale initially, but only 7.9% of the subjects scored in this range after reading the biological information. In contrast, 25.7% of the people in the Epidemiological condition fell in the lower half of the scale initially and there was no change in this percentage for the final beliefs.

**Explanation availability as a mediator.** The theoretical basis for predicting that biological information would be more effective in changing beliefs was that biological information would contain explanations to counter incongruent beliefs. It was presumed that individuals who believe that AIDS can
be spread by casual contact or by mosquitoes possess explanations (not necessarily accurate) or causal scenarios for how such spread can take place. Belief change was theorized to take place as alternative counterexplanations became available, explaining why AIDS is not spread by these means. Biological information should have provided these alternative explanations, whereas epidemiological information did not.

To determine if this process was responsible for belief change in this study, it was necessary to examine explanation availability as a mediating variable. Two measures of explanation availability were assessed in this study. The first allowed subjects to write explanations that came to mind in a free response question. The second was the Explanation Availability scale (EXP) which consisted of two questions asking the ease with which explanations could be brought to mind.

Rating the responses to the free-response question proved to be problematic. Most troubling was the uncertainty of how to code blank responses. These could have denoted a low level of explanation availability or they could have represented missing data. There was also no clear way to assess what represented a unique explanation. A single coder did make a simple count of explanations, counting blanks as zero, and using a liberal criterion on what constituted an explanation. This count correlated moderately with Explanation Availability scale scores, $r=.47$. All subsequent analyses were conducted using both measures, but only those for the Explanation Availability scale will be reported since this measure presented fewer problems in interpretation. In every case, the pattern of results was the same for the explanation-count measure.

To show that Explanation Availability operated as a mediating variable in this study, several steps were required. The first was to establish the relation between EXP scores and final beliefs. EXP scores predicted final Belief and Prediction scores in the study sample as a whole, $F(1,142)=51.94$, $p<.0001$ and $F(1,142)=43.24$, $p<.0001$ respectively, each with a positive linear relation. EXP scores should also have responded to the experimental manipulations with the same pattern as final beliefs in the 2 X 2 ANOVA, which they did with a significant effect of Biological Information, $F(1,140)=20.03$, $p<.0001$ and no other significant effects. Comparing mean values of the EXP scores in Table 3 with those of the final Belief scores in Figure 4 confirms that the patterns were reflections of one another.
**Table 3** Explanation Availability Scores

<table>
<thead>
<tr>
<th>Biological Information</th>
<th>Epidemiological Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>8.58</td>
<td>8.14</td>
</tr>
<tr>
<td>Yes</td>
<td>11.47</td>
</tr>
</tbody>
</table>

A key factor for establishing mediation is to show that EXP scores predicted final beliefs within the cells of the experimental design. Regression analyses found statistically significant positive relations in 3 cells of the design for Belief scores, $F(1,34)=13.61$, $p<.001$ for the Control condition, $F(1,36)=14.82$, $p<.0005$ for the Biological condition, and $F(1,33)=35.46$, $p<.0001$ for the Full Information condition, and in all 4 cells of the design for Prediction scores, $F(1,34)=8.75$, $p<.01$ for the Control condition, $F(1,36)=11.00$, $p<.005$ for the Biological condition, $F(1,33)=13.02$, $p<.001$ for the Full Information condition, and $F(1,33)=4.25$, $p<.05$ for the Epidemiological condition. For Belief scores in the Epidemiological condition, the estimated slope was positive, but was not statistically significant, $F=2.03$, $p=.16$. Finally, if EXP was operating as a mediator in this study, assignment to experimental condition should no longer account for significant variance when the effects of EXP are partialled out. In predicting final Belief and Prediction scores, condition and EXP scores did not interact, $F=1.82$ and $F=.09$ respectively, so models were produced with condition and EXP scores entered with no interaction term. With condition entered first into the model, the total Sum of Squares for the condition effect was significant, $F(3,139)=2.88$, $p<.05$ for Belief and $F(3,139)=4.62$, $p<.005$ for Prediction, indicating that condition entered alone did account for significant variance in final beliefs. However, with EXP also in the model, the unique (Type III) variance accounted for by condition dropped to a nonsignificant level, $F=1.16$ for Belief and $F=1.33$ for Prediction. At the same time, the unique variance accounted for by EXP remained very highly significant for Belief scores, $F(1,139)=46.98$, $p<.0001$, and for Prediction scores, $F(1,139)=33.68$, $p<.0001$. This confirmed that the effect of the experimental conditions on final beliefs was mediated through explanation availability.
General Discussion

Summary of Findings

The results of the current study generally confirmed the hypotheses set forth for this experiment. Thus, the experiment provided further support for our understanding of belief perseverance as a product of the balance in the availability of explanations supporting alternative beliefs. Furthermore, the experiment extended previous research to show that providing evidence explicitly designed to alter the relative availability of explanations is an effective means of changing beliefs.

The effectiveness of explanatory information. Specifically, this experiment showed that a communication designed to provide explanatory information (in this case, biological explanations of why AIDS cannot be spread by casual contact or mosquitoes) was more effective in changing beliefs than was a communication designed to provide statistical (in this case, epidemiological) information supporting the same conclusions. The study also replicated the phenomenon of biased evaluation of data and the subsequent polarization of attitudes first demonstrated by Lord et al. (1979). The data were not conclusive in determining whether explanatory data were less subject to biased evaluation than statistical information, but several analyses suggested that this was the case. A similar pattern of results was observed for the polarization of attitudes, with the data inconclusive as to whether less polarization occurred in the wake of explanatory evidence. Thus, support for Hypotheses 6 and 9 remains equivocal at this time.

Explanation availability as a mediator of belief change. Perhaps the most important theoretical contribution of this study involves the explicit examination of the mediating variables responsible for the observed effects. The mediating role of argument availability in the perseverance of social theories was investigated by Anderson et al. (1985) in the context of the debriefing paradigm. Those authors found that in the absence of any valid information, people's beliefs reflected the relative availability of arguments supporting a given belief and its alternatives. The current study looked at the role of explanation availability as a mediating variable for beliefs when new information had been introduced in the belief
domain. The conclusion presented in the new information could be thought of as a "target" belief in this context. The results showed that beliefs changed more in the direction of the target when explanations were provided to support the target belief. Explanation availability was shown to mirror the changes in beliefs. Furthermore, within-cell analyses demonstrated that the relation between explanation availability and final beliefs was positive and significant. Finally, as expected by the explanation availability mediation model, partialling out the effect of EXP eliminated the effects of the experimental manipulations. Thus, this pattern of results supports the mediating role of explanation availability in determining beliefs even in the presence of valid information.

Anderson et al. (1985) found that argument availability did not account for all of the perseverance effect present in the debriefing paradigm. This offered support for an additional process first proposed by Anderson et al. (1980), that is, that other forms of causal thinking could also have a mediating role in the perseverance of beliefs. Specifically, it was suggested that the availability of causal scenarios could also mediate the process. It was reasoned that some subjects could create such scenarios rather than arguments when they generated explanations. These scenarios would consist of series of causally related scenes or events enabling the occurrence of the event to be explained. Such scenarios could even take the form of internal images, rather than the form of more verbal thought.

In reality, verbal arguments and imagined scenarios probably are best thought of as extreme ends in a spectrum of causal thoughts. Many explanations combine features of both and may be thought of as lying closer to the middle of that spectrum. Such is the case with the explanations used in the current study. For example, the explanation that AIDS cannot be spread on food because the virus quickly dies outside the body and what little remains is destroyed by stomach acids has elements of both a verbal argument and a causal scenario. Likewise, the explanations that support inaccurate initial beliefs probably contain elements of both (as, for example, when a person thinks about how the AIDS virus could be spread when mosquitoes fly from person to person biting into the bloodstream). In the current study, no effort was made to distinguish the effects of arguments and scenarios. Rather, the explanations provided in the Biological and Full Information conditions took full advantage of the entire spectrum of causal
thought. Furthermore, the measure of explanation availability did not attempt to draw a distinction between types of explanations, but assessed the availability of any form of "reasons" that subjects could think of. That measure fully accounted for final beliefs in this study. This is strong evidence that the availability of causal structures in general is the major determinant of beliefs. In conjunction with the finding by Anderson et al. (1985) that argument availability alone did not account for beliefs, this is indirect evidence that other forms of causal thought also act as mediators.

The role of motivational forces in the biased evaluation of data. In discussing the mechanisms underlying the biased evaluation of data, Lord et al. (1984) brought up the possibility that evaluation bias could have occurred as a result of affective reactions to data that confirmed or disconfirmed initial beliefs. They did not entirely dismiss that possibility with respect to data on capital punishment, recognizing that this was an affect-laden domain of beliefs. They did find the argument less compelling for other belief domains, where affective reactions were less likely to occur. No attempt was made in their studies to directly assess the impact of affect on evaluations.

In the current study, several measures were obtained that could be expected to indicate the affective reactions that subjects would feel toward the evidence presented. It was anticipated that general conservatism, dogmatism (indicating general intolerance), and negative attitudes toward gay men would influence the evaluations made of the evidence. As might be expected, the affective measure most closely and specifically associated with the belief domain, attitudes toward gay men, was also the measure most significantly related to evaluations. The results indicated that negative attitudes toward gay men, lower levels of accurate beliefs about AIDS, and lower evaluations of evidence related to this topic were all related to each other. However, the affective measure did not account for any unique variance in evaluations when the initial belief measure was also in the regression model. The initial belief measure did account for unique variance, so the best predictor of evaluations was the initial belief measure.

This study cannot, however, completely clarify the respective roles of affect and initial beliefs in determining the evaluation of data. One limitation of this study is that several of these variables were correlational, and therefore, the direction of causality cannot be determined. In this case, the results
showed that the affective measure (attitudes toward gay men) and the cognitive measure (initial beliefs) were correlated with one another and both shared variance in explaining evaluations. One possibility is that the affective variable influenced evaluations entirely through a mediating impact on initial beliefs. In this scenario, variance in evaluation is entirely accounted for by variance in initial beliefs, but the variance in initial beliefs is significantly influenced by the affective variable.

However, a second and equally plausible account would posit a direct role of affect in influencing evaluations, with the affective variable influenced by the initial beliefs. This account gains credibility in light of growing concern that the causality between the particular affective and cognitive measures studied here may be bidirectional. It may seem self-evident that attitudes toward gay men have generally been in place prior to the development of beliefs about AIDS. After all, gay men have existed longer to be the subject of beliefs. In 1978, a person could have an attitude toward gay men, but could not have a belief about AIDS - it didn't exist. However, there is evidence to suggest that attitudes toward gay men have been influenced by beliefs about AIDS, once AIDS entered the social consciousness. This has been most graphically demonstrated by the increase in reported violence perpetrated against gay individuals since the onset of the AIDS epidemic (Freiberg, 1987, 1988). This evidence is also correlational, however, and may reflect increased reporting or may be related to variables other than the onset of AIDS, such as the increased visibility of the gay community. Thus, the results of the current experiment cannot be unambiguously interpreted on this issue. What can be concluded, however, is that evaluations can be predicted better by knowledge of initial beliefs than by knowledge of the social attitudes measured in this study. In the broader debate over the value of cognitive and motivational constructs (for a review, see Anderson & Slusher, 1986), this finding lends support to the position that motivational constructs may not contribute much to our understanding of social judgments.

**Evaluations as mediators of belief change.** Lord et al. (1979) reported that the overall changes in attitudes that they observed were correlated with the differences in evaluations that their subjects ascribed to opposing studies. This suggested that polarization of attitudes was brought about as a result of the biased evaluations given for the data. In the current study, it was possible to directly examine the role of
evaluations in mediating the relationship between the initial beliefs and the belief change. The results confirmed that the significant relationship that existed between initial beliefs and changes in beliefs was eliminated when evaluations were entered into the model. This pattern offered strong support for the role of evaluations in mediating the effect of initial beliefs on belief change.

**Practical Implications**

The current study dealt exclusively with the perseverance and change of social theories. However, others have studied belief perseverance with respect to beliefs about oneself and beliefs about other people (e.g., Ross et al., 1975), and beliefs also include the domain of nonsocial theories. To the extent that they may be generalized, the results presented here may be useful in these other belief domains as well as in the domain of social theories.

The practical implications of the current study are most evident in those circumstances where it is desirable to change people's beliefs in a given domain. Beliefs have their impact when they affect people's judgments and actions (cf. Anderson et al., 1985; Anderson & Sechler, 1986). Often, beliefs persist even when they are maladaptive and result in a variety of self-defeating behaviors (for a review, see Slusher & Anderson, 1988). The implications of this fact have been recognized in relation to the therapy setting as well (Arnout & Anderson, in press). With regard to AIDS education, the impact of inappropriate beliefs is twofold. Such beliefs can result in the mistreatment of those who are afflicted (or who are perceived to be afflicted) with the disease, and can also result in behaviors that further spread the disease.

The implications of this study for these types of circumstances are clear. Other things being equal, communications that provide explanations supporting a target belief will be more effective in changing beliefs in the direction of the target than communications that do not provide this information. Thus, if a belief is causing a person to engage in self-defeating behaviors, an effective intervention should be to provide explanations for why an alternative belief should be considered.

The specific implications of this study for AIDS education are also quite clear. Educational materials
must provide explanations in support of their claims, in order to be as effective as possible in changing many common beliefs. The success that has been achieved thus far in educating the public may have been accomplished among those who did not initially develop inaccurate beliefs, or as a result of the cumulative effects of less effective interventions. For those who remain unconvinced, it may be ineffective to simply keep repeating statements such as "AIDS is not spread by casual contact." By adding explanations to bolster such statements, however, the effectiveness of educational materials should be enhanced.

Limitations

Four major limitations must be pointed out with regard to this study. The first is that only one belief domain was addressed - beliefs about the spread of AIDS. This domain was chosen for its obvious applied importance and for its suitability in examining the theoretical issues of interest. However, replications utilizing other social theories, as well as types of beliefs other than social theories, will be necessary to establish the generality of these findings.

The second limitation was the short time-span covered in the experiment. In most cases, subjects completed the experiment in less than one hour. No attempt was made to determine whether the changes in beliefs would remain beyond that time. Future studies could better assess the long-term impact of communications by reassessing beliefs at more extended times. Anderson (1983) found that social theories induced by concrete data (which provoked the internal generation of explanations) persevered more than those induced by abstract data, even after a week. This suggests that beliefs established on the basis of explanatory evidence may also exhibit long-term resilience, but further research will be necessary to support this contention.

A third limitation was the lack of any behavioral measures. Although half of the items in the Belief scale were written from a "personal" perspective (designed to place the subject personally in a situation and assess his or her reaction), that is not the same as actually placing people in a situation and observing
their behavior. Although practical considerations may discourage this approach, future studies would benefit from the use of behavioral measures.

A fourth limitation of this study was its dependence on correlational data for many of the analyses. Although this was unavoidable for the current study, future studies could manipulate some of the variables merely assessed in this study. One obvious candidate for manipulation is initial beliefs. This would involve a design combining some features of previous belief perseverance studies and the current study. In previous belief perseverance studies (e.g., Anderson et al., 1980), initial beliefs were induced on the basis of weak data provided a short time before perseverance was assessed. For the current study, one goal was to assess the impact of strong established initial beliefs. However, as the results showed, those initial beliefs were correlated with a variety of demographic and social attitude variables. Situations can be devised, however, in which people are randomly assigned to situations that induce very different, yet fairly strong initial beliefs. This could happen, for example, if students were randomly assigned to class sections taught by professors who take very different perspectives within a given field. Another example might be the random assignment of college students to living units that develop very different group norms. In situations such as these, initial beliefs would be less confounded with other variables.

Concluding Remarks

The central point of this study, that offering explanations is an effective method of changing beliefs, would seem to be almost too obvious to warrant research. Yet, the impetus for this study was an awareness that many attempts to change beliefs lacked this very feature. This has been particularly true in the area of AIDS education, where many educational materials have provided a litany of factual statements (e.g., "AIDS is not spread by casual contact.") with no explanations in their support. One might ask why this has been the case. One obvious (and psychologically uninteresting) reason is that explanations have not always been available. In the case of a new disease, perhaps it is always going to be easier to gather information on who is getting it than on how they are getting it. In the case of AIDS, certain trends in
its spread were certainly discernable even before it was known that a virus was responsible.

A second possible reason that explanations have not always been included in educational materials is the need for simplicity. There would be little argument with the position that any educational materials must be written at a level that is appropriate for the intended audience in order to be effective. Perhaps those who have written materials on AIDS have felt that simple statements of fact would be the most widely read, most easily understood, and hence, the most effective statements possible. Indeed, the materials that have been written have been successful in effectively educating many people. About three-quarters of the subjects in this study sample had beliefs that were at least slightly congruent with the (factual) target beliefs. Perhaps these people had avoided forming beliefs when little information was available, so that the statements that later became available formed their initial beliefs and did not have to change beliefs. Or perhaps enough explanations have been provided over time in various media and educational contexts for effective belief change to take place. Certainly, materials that have not been optimally effective could still have had a cumulative effect over time. Nevertheless, it has been clear that educational efforts on this topic have not been as successful as health officials would like. Simple statements of fact may have had all of the impact of which they are capable. Repeating such statements may keep the public reminded of them, but may not be effective in inducing further belief change. Still, the need for simplicity cannot be denied when many who need to be reached are among our society's least educated. The challenge, then, is to create materials that are simple, yet effective. The materials designed for this study are probably too advanced for this purpose, but explanations need not be unduly complex. In most cases, simple explanations (or simple causal scenarios) stated in simple language should increase the effectiveness of educational materials.

A third possible reason that explanations are often left out of educational materials may be that scientists regard the statistical data as most convincing. One could conceivably generate many explanations for why mosquitoes should not be able to transmit the AIDS virus, but if the statistics were to show that mosquitoes were transmitting the virus anyway, all of those explanations would be worthless. Other explanations would have to be developed to explain what the statistics showed. Thus,
to scientists involved in the relevant research, the statistics are vitally important. They define what conclusions must be explained. Yet, as tools to induce belief change, statistics may not be the right tool for the job. The information that is most informative on a normative basis may not be the information that is most effective in changing beliefs. Even scientists trained to understand the value of empirical data are not immune to theory-based evaluations of data (Mahoney, 1977), though recent work by Lehman, Lempert, & Nisbett (1988) suggested that certain kinds of scientific training can be effective in lessening tendencies toward inferential biases.

How can scientists balance their responsibility for providing accurate information with their need to communicate effectively? The answer may lie in the nature of the information that is communicated. Though they can never be one-hundred percent conclusive, statistics can be conclusive enough that no reasonable doubt remains as to the underlying relations between variables. In communicating with those who understand the power and limitations of statistics, it is no doubt useful to provide the statistical information. In fact, that may be the primary function of scientific journals. (Even in journal articles, however, authors do not rely on their data to speak for themselves. If possible, most authors attempt to provide meaningful explanations to account for their data.) The evidence on the biased evaluation of data (Lord et al., 1984; Lord et al., 1979; and the current study) indicates, however, that data may be evaluated negatively by skeptics and may not be effective in changing their beliefs. On the other hand, the current study shows that explanations are effective in changing people’s beliefs. Furthermore, once beliefs have been changed through explanations, the future evaluation of relevant statistical data should be much more favorable. Thus, data that would be greeted with skepticism in the absence of available explanations could be effectively used in the presence of explanations to bolster the scientifically valid beliefs that scientists wish to promote.

To be useful as a educational tool, the concept of “explanatory evidence” should be distinguished from more speculative forms of explanation. In several places, reference has been made to “hypothetical explanations” as opposed to “explanatory evidence.” Hypothetical explanations are any explanations that are offered or generated for which no claim to truth is made. They are clearly speculative. Explanatory
evidence, on the other hand, is any explanation that is claimed to be "true." The actual veracity of the explanation is, of course, totally irrelevant to the psychological processes of belief change. Scientists, however, have a responsibility to convey "true" explanatory evidence. In this context, explanatory evidence is really a condensation of data obtained at a different level of analysis. This may be most easily explained with reference to an example, once again from the domain of AIDS education. Statistical evidence shows that mosquitoes are not spreading AIDS. This has been shown by the pattern of spread for the disease, which has not especially affected children and farmers, those most likely to come into contact with mosquitoes. If a scientist were to suggest, on the basis of this evidence, that the AIDS virus does not infect mosquitoes, that would be a hypothetical explanation. However, statistical data also exist at a different level, the level of biological examination of individual mosquitoes. Working with whatever tools they have at their disposal, biologists have determined that the AIDS virus does not, in fact, infect mosquitoes. This is a conclusion based on data. It is not hypothetical or speculative, though of course, it is not absolute, either. This conclusion is, however, "explanatory evidence" that can be used to support the belief that AIDS is not spread by mosquitoes. Its use is as legitimate as the use of the epidemiological data, because it is indeed a summary of data itself.

Perhaps the most fundamental lesson to be learned from the entire body of research on belief perseverance is that beliefs do not respond to data in a normative fashion. Therefore, normative criteria are not applicable in attempts to influence beliefs. Normatively, the "expert" may be correct in thinking that the presentation of statistical evidence should have the most impact on beliefs. In practice, this criterion is irrelevant. If the goal is to change people's beliefs, the evidence presented should be that evidence which is most effective in overcoming initial beliefs. The current study strongly suggests that explanatory evidence is an effective tool for facilitating belief change.
APPENDIX 1

Epidemiological, Biological and Full Information

Communications about AIDS

This appendix presents the text of the "articles" used in this study. In the actual experimental stimulus materials, the format of the text was designed to have the appearance of a photocopied newspaper article. Some of the text was patterned after actual articles appearing in newspapers and some was completely original. The information contained in the articles was gathered from both the mass media and public health resources. Names have been fabricated throughout, though some quotes represent actual quotes from AIDS researchers. For ethical reasons, every effort was made to convey the most accurate information possible, in spite of the fabrication necessary to produce these materials.

Epidemiological communication. The communication for the Epidemiological condition was designed to make a strong argument that AIDS is not spread through casual contact or by mosquitoes by presenting statistical information arising from epidemiological research. The first text presented here comprised the communication for the Epidemiological condition.

ATLANTA (UPI) - There is no evidence to suggest that AIDS is transmitted through saliva, tears, urine, eating utensils, casual contact or insects, federal researchers say.

"Adults are getting this through sex or through sharing needles contaminated with blood, and that's about it," said Dr. Richard Scott, an epidemiologist with the Centers for Disease Control in Atlanta.

Scott reported March 4 in the Journal of the American Medical Association that a review of every case of AIDS reported since the epidemic began indicates there are only three ways the AIDS virus is transmitted in the United States - through blood contamination, sexual contact and birth to an infected mother.

"We have studied this for six years now, and if there were other ways this virus was transmitted, we would have seen it," Scott said.

Scott said the 1,700 AIDS patients now classified as having "no known risk factors" are not examples of mysterious AIDS transmission but of inadequately investigated cases.

"If we take the time to look (for primary risk factors), we find them," Scott said.
As of February, 54,723 cases of AIDS had been reported to the federal Centers for Disease Control, and 30,715 people afflicted with the disease had died. Officials agree that many cases remain unreported.

Scott reported on a series of studies looking at the interactions between AIDS patients and their families and close friends to see whether AIDS is passed on through casual person-to-person contacts. Statistics revealed clear evidence that such casual contacts do not play a part in the spread of this disease. Explaining the logic of this study, Scott said, "You have to remember that this disease is caused by a virus. For every case of AIDS, that virus had to get from one person who was carrying the virus to another person who was not. We can look at what kinds of contacts AIDS patients had with other people who may have had this virus. If we can account for each case of AIDS by finding some kind of contact that we know can spread the virus, then we can eliminate other possibilities. So we look for evidence of sexual contact or blood contamination. If we always find these, then we can conclude that other kinds of contact, such as normal household contact, are not spreading this virus."

Of reported cases, 34,687 were classified as being transmitted through homosexual contact, 9,473 through sharing of needles and 4,016 through one or both. In addition, 1,182 women and 987 men contracted AIDS through heterosexual sex with an infected partner, and 663 children were infected by their mother, either in the womb or during birth.

Although 600 hemophiliacs and 1,415 others have contracted AIDS through contaminated blood products or transfusions, screening procedures have made the risk of more of these infections extremely low in the United States.

Noting concern over the high number of undetermined cases, Scott and his colleagues investigated 2,059 AIDS patients who were classified as having no recognized risk factors as of Sept. 30, 1987. No information could be obtained on 921 cases (due to death or refusal to the interviewed), and 32 of the AIDS patients turned out to be wrongly classified.

But 825 of the remaining 1,138 patients acknowledged high-risk behavior in interviews and were reclassified. Of 281 patients who could not be reclassified, 178 were extensively interviewed and many admitted to either a history of sexually transmitted diseases (28 percent) or sex with a prostitute (34 percent of the men). These are not yet considered high-risk categories by the CDC, but suggest that the patients may have engaged in other high-risk behavior, Scott said.

"We're never going to be able to identify every case, because some people are going to deny engaging in some high-risk behaviors as long as there is a stigma attached to them," he said. "But the fact that we were able to reclassify 72 percent strongly suggests that it is a lack of information, and not an unidentified mode of transmission that is behind these cases. What is important to realize is that none of the identified cases of AIDS in the United States have been actually proven to have been transmitted in schools, day care centers, or through casual person-to-person contact. We look at the pattern of numbers, and draw our conclusions from that. These don't seem to be high-risk situations."

In a separate article, Dr. Geraldine Parks, a former CDC researcher now with the San Francisco Department of Public Health, reviewed 11 separate studies and concluded none had found a link between AIDS transmission and saliva, tears or urine, despite the fact that the AIDS virus can be found there. Further, there is no evidence to suggest AIDS had been transmitted by eating utensils, insects or any sort of
nonsexual familial contact.

In fact, a study of more than 100 people in families where there was a person with AIDS without the knowledge of the family and in which normal family interactions such as hugging, kissing, eating together, sleeping together, etc., took place revealed not a single case of AIDS transmission. Children did not spread the virus to other children in their families, even when intimate household activities, such as sharing toothbrushes and taking baths together, were included.

Parks noted additional studies concerned with the spread of AIDS by mosquitoes. Mosquitoes are known to transmit viruses for such diseases as yellow fever. However, a recent study of residents in Belle Glade, Fla., which has one of the nation's highest rates of AIDS, showed that the disease was transmitted mainly through sexual activity. "There was no correlation between AIDS and known mosquito-borne viral infections in this study population," noted Parks. "If mosquitoes were spreading AIDS, we would expect school-age children, who are frequently outdoors and are subject to mosquito bites, to be getting the disease. This hasn't happened."

Studies in Haiti and Central Africa have also suggested no relationship between transmission of AIDS and mosquitoes. In Africa, AIDS is largely a disease of sexually active young adults living in the cities. The disease is much less common in rural areas. In Zaire, the AIDS virus has been found in only 0.8% of healthy people in rural villages, where mosquitoes would be most likely to be spreading the disease. In contrast, studies done in cities have found the virus in more than 27% of the sexually active young adults. In some cities, this rate is as high as 88%. It has also been found that African children, who would naturally be exposed to mosquitoes, have not generally gotten the virus unless they were born to infected mothers. "This pattern is quite different from malaria," Parks noted, "a disease known to be carried by mosquitoes."

"I think it's important to know what does and does not transmit the virus," Parks said. "So that you can take measures not to become infected, and so you will not become unjustifiably alarmed or take measures against people who cannot infect you."
Biological communication. The communication for the Biological condition was designed to make a strong argument that AIDS is not spread through casual contact or by mosquitoes by presenting explanatory information arising from biological research. The following text comprised the communication for the Biological condition:

ATLANTA (UPI) - There is no evidence to suggest that AIDS can be transmitted through saliva, tears, urine, eating utensils, casual contact or insects, federal researchers say.

"Adults can get this through sex or through sharing needles contaminated with blood, and that's about it," said Dr. Richard Scott, an epidemiologist with the Centers for Disease Control in Atlanta.

Scott reported March 4 in the Journal of the American Medical Association that studies of the AIDS virus indicate there are only three ways the AIDS virus is transmitted in the United States - through blood contamination, sexual contact and birth to an infected mother.

"We have studied this for six years now, and feel that we have a good understanding of why this virus is not spread in other ways," Scott said.

Scott said the 1,700 AIDS patients now classified as having "no known risk factors" are not examples of mysterious AIDS transmission but of inadequately investigated cases.

"If we take the time to look (for primary risk factors), we find them," Scott said. As of February, 54,723 cases of AIDS had been reported to the federal Centers for Disease Control, and 30,715 people afflicted with the disease had died. Officials agree that many cases remain unreported.

Scott reported on a series of studies looking at the interactions between AIDS patients and their families and close friends to see why AIDS is not passed on through these contacts. Case studies revealed clear reasons why such casual contacts do not play a part in the spread of this disease. "You have to remember that this disease is caused by a virus," noted Scott. "If the virus isn't passed on, the disease isn't spread. It's that simple. And in this case, we are talking about a virus that is very hard to give to another person."

Noting concern over the high number of undetermined cases, Scott and his colleagues investigated 2,059 AIDS patients who were classified as having no recognized risk factors as of Sept. 30, 1987. No information could be obtained on many cases (due to death or refusal to the interviewed), but many others acknowledged high-risk behavior in interviews and were reclassified. "We're never going to be able to identify every case, because some people are going to deny engaging in some high-risk behaviors as long as there is a stigma attached to them," he said. "But our findings suggest that it is a lack of information, and not an unidentified mode of transmission that is behind these cases."

"We have looked at people who received the virus through blood transfusions (before blood was routinely tested). It was common for them to share towels, silverware, and toilet facilities with family members. In some cases, these people
shared drinking glasses and even toothbrushes. But other people in the house did not get the virus. Why? Well, for one thing, unlike the virus for the flu or the common cold, the AIDS virus is not concentrated in saliva. We have examined drinking glasses. The virus simply isn't there. It is true that the virus has been detected in very small quantities in saliva from some advanced AIDS patients. Even in these cases, there is very little to worry about. The virus has to be present in high concentration to infect another person, and even then, it must get into that person's bloodstream," Scott said.

Because concentrations of the virus are not found in saliva, there is no danger from sneezing, coughing, or breathing the air around an AIDS patient. Even in the unlikely event that any virus is present, the life of the AIDS virus is short outside the body. "This virus is very fragile," according to Scott. "It won't live in water. Certainly it won't live in water that has been chlorinated or heated, such as swimming pools or hot tubs. Chemicals kill this virus very effectively. You also won't find it on food, so there is no danger you'll contract AIDS in a restaurant. Even if infected blood was spattered on your food and you ate it, your stomach juices would kill the virus."

Scott's study also considered whether the virus could be spread through sweat. "We looked at several cases involving college athletes," Scott said. "Their workout partners did not get the virus because it was not present in sweat. The same was true for family members who assisted more advanced patients with bathing, dressing, and changing bedding. Despite contact with sweaty clothes and linens, there was no danger because there was no virus present."

In a separate article, Dr. Geraldine Parks, a former CDC researcher now with the San Francisco Department of Public Health, reviewed 11 separate studies and concluded none had found a link between AIDS transmission and saliva, tears or urine, despite the fact that the AIDS virus can be found there. Further, there is no evidence to suggest AIDS can be transmitted by eating utensils, insects or any sort of nonssexual familial contact. Parks concluded, "AIDS is not spread by casual contact for four basic reasons. First, the virus is very rarely present in saliva and sweat. Second, in isolated cases where it is present, the concentration is too low to infect another person. Third, the virus is very fragile. Even where concentrations are high, such as in blood, the virus cannot live long in the environment. Fourth, casual contact does not allow the virus to enter the bloodstream."

Parks noted additional studies concerned with the spread of AIDS by mosquitoes. Mosquitoes are known to transmit viruses for such diseases as yellow fever. She explained, "Mosquitoes do not spread AIDS because this particular virus does not reproduce inside mosquitoes, bedbugs, or any other insect that we've found. If it did reproduce, it would infect the mosquitoes salivary glands, so that the virus could be passed to another person through the mosquito's saliva the next time it fed. Since it doesn't reproduce, the virus may remain for a short time in the blood in the mosquito's stomach, but it can't be given to another person since it's not in the mosquito's saliva."

"People may also be concerned that the virus could just stick to the mouth of the mosquito," noted Parks. "The fact is that a mosquito's mouth is too small to carry enough virus to infect anyone. We know that a high concentration of virus is needed for infection to occur. Hospital workers have been accidentally stuck with AIDS-infected needles on many occasions, yet infection has been extremely rare. A
mosquito's mouth is much, much smaller than the tip of a hospital needle. Even a whole swarm of mosquitoes would be unlikely to carry enough virus to be a danger. Besides, you have to consider mosquitoes' feeding habits as well. They don't just hop from person to person. Mosquitoes rarely move from person to person in the middle of a meal, and between feedings, the virus quickly dies. For these reasons, studies do not link mosquitoes with the spread of AIDS."

"I think it's important to know what does and does not transmit the virus," Parks said. "So that you can take measures not to become infected, and so you will not become unjustifiably alarmed or take measures against people who cannot infect you."
Full Information communication. The communication for the Full Information condition was designed to make a strong argument that AIDS is not spread through casual contact or by mosquitoes by presenting both statistical and explanatory information arising from the entire spectrum of AIDS research. The following text comprised the communication for the Full Information condition:

ATLANTA (UPI) - There is no evidence to suggest that AIDS is transmitted through saliva, tears, urine, eating utensils, casual contact or insects, federal researchers say.

"Adults are getting this through sex or through sharing needles contaminated with blood, and that's about it," said Dr. Richard Scott, an epidemiologist with the Centers for Disease Control in Atlanta.

Scott reported March 4 in the Journal of the American Medical Association that a review of every case of AIDS reported since the epidemic began indicates there are only three ways the AIDS virus is transmitted in the United States - through blood contamination, sexual contact and birth to an infected mother.

"We have studied this for six years now, and if there were other ways this virus was transmitted, we would have seen it," Scott said, adding, "We feel that we have a good understanding of why this virus is not spread in other ways."

Scott said the 1,700 AIDS patients now classified as having "no known risk factors" are not examples of mysterious AIDS transmission but of inadequately investigated cases.

"If we take the time to look (for primary risk factors), we find them," Scott said.

As of February, 54,723 cases of AIDS had been reported to the federal Centers for Disease Control, and 30,715 people afflicted with the disease had died. Officials agree that many cases remain unreported.

Scott reported on a series of studies looking at the interactions between AIDS patients and their families and close friends to see whether AIDS is passed on through casual person-to-person contacts. Statistics revealed clear evidence that such casual contacts do not play a part in the spread of this disease. Explaining the logic of this study, Scott said, "You have to remember that this disease is caused by a virus. For every case of AIDS, that virus had to get from one person who was carrying the virus to another person who was not. We can look at what kinds of contacts AIDS patients had with other people who may have had this virus. If we can account for each case of AIDS by finding some kind of contact that we know can spread the virus, then we can eliminate other possibilities. So we look for evidence of sexual contact or blood contamination. If we always find these, then we can conclude that other kinds of contact, such as normal household contact, are not spreading this virus."

Of reported cases, 34,687 were classified as being transmitted through homosexual contact, 9,473 through sharing of needles and 4,016 through one or both. In addition, 1,182 women and 987 men contracted AIDS through heterosexual sex with an infected partner, and 663 children were infected by their mother, either in the womb or during birth.

Although 600 hemophiliacs and 1,415 others have contracted AIDS through
contaminated blood products or transfusions, screening procedures have made the risk of more of these infections extremely low in the United States.

Noting concern over the high number of undetermined cases, Scott and his colleagues investigated 2,059 AIDS patients who were classified as having no recognized risk factors as of Sept. 30, 1987. No information could be obtained on 921 cases (due to death or refusal to be interviewed), and 32 of the AIDS patients turned out to be wrongly classified.

But 825 of the remaining 1,138 patients acknowledged high-risk behavior in interviews and were reclassified. Of 281 patients who could not be reclassified, 178 were extensively interviewed and many admitted to either a history of sexually transmitted diseases (28 percent) or sex with a prostitute (34 percent of the men). These are not yet considered high-risk categories by the CDC, but suggest that the patients may have engaged in other high-risk behavior, Scott said.

"We're never going to be able to identify every case, because some people are going to deny engaging in some high-risk behaviors as long as there is a stigma attached to them," he said. "But the fact that we were able to reclassify 72 percent strongly suggests that it is a lack of information, and not an unidentified mode of transmission that is behind these cases. What is important to realize is that none of the identified cases of AIDS in the United States have been actually proven to have been transmitted in schools, day care centers, or through casual person-to-person contact. We look at the pattern of numbers, and draw our conclusions from that. These don't seem to be high-risk situations."

Case studies revealed clear reasons why such casual contacts do not play a part in the spread of this disease. "We are talking about a virus that is very hard to give to another person," noted Scott.

"We have looked at people who received the virus through blood transfusions (before blood was routinely tested). It was common for them to share towels, silverware, and toilet facilities with family members. In some cases, these people shared drinking glasses and even toothbrushes. But other people in the house did not get the virus. Why? Well, for one thing, unlike the virus for the flu or the common cold, the AIDS virus is not concentrated in saliva. We have examined drinking glasses. The virus simply isn't there. It is true that the virus has been detected in very small quantities in saliva from some advanced AIDS patients. Even in these cases, there is very little to worry about. The virus has to be present in high concentration to infect another person, and even then, it must get into that person's bloodstream," Scott said.

Because concentrations of the virus are not found in saliva, there is no danger from sneezing, coughing, or breathing the air around an AIDS patient. Even in the unlikely event that any virus is present, the life of the AIDS virus is short outside the body. "This virus is very fragile," according to Scott. "It won't live in water. Certainly it won't live in water that has been chlorinated or heated, such as swimming pools or hot tubs. Chemicals kill this virus very effectively. You also won't find it on food, so there is no danger you'll contract AIDS in a restaurant. Even if infected blood was spattered on your food and you ate it, your stomach juices would kill the virus."

Scott's study also considered whether the virus could be spread through sweat. "We looked at several cases involving college athletes," Scott said. "Their workout partners did not get the virus because it was not present in sweat. The same was true
for family members who assisted more advanced patients with bathing, dressing, and changing bedding. Despite contact with sweaty clothes and linens, there was no danger because there was no virus present."

In a separate article, Dr. Geraldine Parks, a former CDC researcher now with the San Francisco Department of Public Health, reviewed 11 separate studies and concluded none had found a link between AIDS transmission and saliva, tears or urine, despite the fact that the AIDS virus can be found there. Further, there is no evidence to suggest AIDS had been transmitted by eating utensils, insects or any sort of nonsexual familial contact.

In fact, a study of more than 100 people in families where there was a person with AIDS without the knowledge of the family and in which normal family interactions such as hugging, kissing, eating together, sleeping together, etc., took place revealed not a single case of AIDS transmission. Children did not spread the virus to other children in their families, even when intimate household activities, such as sharing toothbrushes and taking baths together, were included. Parks concluded, "AIDS is not spread by casual contact for four basic reasons. First, the virus is very rarely present in saliva and sweat. Second, in isolated cases where it is present, the concentration is too low to infect another person. Third, the virus is very fragile. Even where concentrations are high, such as in blood, the virus cannot live long in the environment. Fourth, casual contact does not allow the virus to enter the bloodstream."

Parks noted additional studies concerned with the spread of AIDS by mosquitoes. Mosquitoes are known to transmit viruses for such diseases as yellow fever. However, a recent study of residents in Belle Glade, Fla., which has one of the nation's highest rates of AIDS, showed that the disease was transmitted mainly through sexual activity. "There was no correlation between AIDS and known mosquito-borne viral infections in this study population," noted Parks. "If mosquitoes were spreading AIDS, we would expect school-age children, who are frequently outdoors and are subject to mosquito bites, to be getting the disease. This hasn't happened."

Studies in Haiti and Central Africa have also suggested no relationship between transmission of AIDS and mosquitoes. In Africa, AIDS is largely a disease of sexually active young adults living in the cities. The disease is much less common in rural areas. In Zaire, the AIDS virus has been found in only 0.8% of healthy people in rural villages, where mosquitoes would be most likely to be spreading the disease. In contrast, studies done in cities have found the virus in more than 27% of the sexually active young adults. In some cities, this rate is as high as 88%. It has also been found that African children, who would naturally be exposed to mosquitoes, have not generally gotten the virus unless they were born to infected mothers. "This pattern is quite different from malaria," Parks noted, "a disease known to be carried by mosquitoes."

Parks explained, "Mosquitoes do not spread AIDS because this particular virus does not reproduce inside mosquitoes, bedbugs, or any other insect that we've found. If it did reproduce, it would infect the mosquitoes salivary glands, so that the virus could be passed to another person through the mosquito's saliva the next time it fed. Since it doesn't reproduce, the virus may remain for a short time in the blood in the mosquito's stomach, but it can't be given to another person since it's not in the mosquito's saliva."
"People may also be concerned that the virus could just stick to the mouth of the mosquito," noted Parks. "The fact is that a mosquito's mouth is too small to carry enough virus to infect anyone. We know that a high concentration of virus is needed for infection to occur. Hospital workers have been accidentally stuck with AIDS-infected needles on many occasions, yet infection has been extremely rare. A mosquito's mouth is much, much smaller than the tip of a hospital needle. Even a whole swarm of mosquitoes would be unlikely to carry enough virus to be a danger. Besides, you have to consider mosquitoes' feeding habits as well. They don't just hop from person to person. Mosquitoes rarely move from person to person in the middle of a meal, and between feedings, the virus quickly dies. For these reasons, studies do not link mosquitoes with the spread of AIDS."

"I think it's important to know what does and does not transmit the virus," Parks said. "So that you can take measures not to become infected, and so you will not become unjustifiably alarmed or take measures against people who cannot infect you."
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These consist of pages:

68, 69
APPENDIX 4
Belief Scale

The items below contain the Belief scale that was designed to assess subjects' beliefs about AIDS for this study. Eight items are filler items, unrelated to the issues addressed by the communications used in the study. They are denoted below by an (X) and are not a part of the scale, but are included here because they were presented to the subjects. The other 48 items comprise the Belief scale. An asterisk (*) denotes items that are reverse scored. Subjects rated each item from 1 to 9 to indicate their level of agreement with the statement (1 = Strongly Disagree to 9 = Strongly Agree).

The items that comprise the Belief scale address the issues of casual contact and mosquitoes as potential means for the spread of the AIDS virus. In preliminary analyses, items addressing these two issues were treated separately, as suggested by a principle components factor analysis showing that these items loaded on different factors. However, no important differences were detected with regard to the hypotheses of this study, so all items in the Belief scale were combined for the final analyses. As noted in the main text, the Belief scale as a whole had a very high level of internal consistency, with an alpha coefficient of .98.

1. People do not get AIDS from cats and dogs. X
2. People with AIDS do not pose a threat to people they work with.
3. I would not be comfortable in a closed elevator with a person with AIDS.*
4. I would be afraid of mosquito bites if I slept near a person with AIDS.*
5. I would hug a person with AIDS.
6. Children cannot be born with AIDS, even if the mother is infected. X
7. People with AIDS endanger other people when they swim in a public pool.*
8. I would be afraid to share a glass of water with a person with AIDS.*
9. When a person with AIDS sneezes, there is danger that other people will catch the virus.*
10. It is not safe to be around mosquitoes when people with AIDS are nearby.*
11. There is no known cure for AIDS. X
12. I would let my children play with a person with AIDS.
13. A person can safely work beside a person with AIDS.
14. I would be afraid to use gym equipment immediately after a person with AIDS.*
15. Because of AIDS, I would not travel in areas with lots of mosquitoes.*
16. If a member of my family had AIDS, I would not handle their sweaty clothes.*
17. Drug abusers who share needles are in danger of catching AIDS. X
18. Eating with a person with AIDS, I would never share drinking glasses or silverware.*
19. I would continue to eat at a good restaurant, even if a cook there has AIDS.
20. I would not be afraid to hug a person with AIDS.
21. It is risky to rent an apartment where a person with AIDS has lived before.*
22. Women do not get AIDS. X
23. It is not safe to kiss a person with AIDS on the cheek.*
24. It is not safe to share a can of soda with a person with AIDS.*
25. It is perfectly safe to hug a person with AIDS.
26. It is not safe to use a toilet after a person with AIDS.*
27. It is entirely safe to swim with a person with AIDS.
28. It is not safe to have people with AIDS working with children.*
29. I would be afraid to live with a person with AIDS.*
30. I would not be afraid to visit an AIDS ward in a hospital.
31. I would be afraid to eat in a restaurant where cooks or waiters have AIDS.*
32. AIDS can be spread by sharing drinking glasses and silverware, if they are not sterilized.*
33. Sneezing cannot spread the AIDS virus.
34. A person with AIDS can share a meal with others without danger to those other people.
35. AIDS can be spread by some forms of sexual activity. X
36. I would not be afraid to swim in a public pool with a person with AIDS.
37. I would welcome a person with AIDS as a guest in my home.
38. A person cannot catch AIDS by sitting near a person with AIDS in a classroom.
39. I would not allow my child to be in a classroom with a teacher with AIDS.*
40. I would visit a friend with AIDS, even if there were mosquitoes around.
41. The AIDS virus cannot be spread by mosquitoes.
42. It is safe to live in a house where a person with AIDS has lived before.
43. I would be afraid of getting sick if a person with AIDS coughed or sneezed on me.*
44. You cannot catch AIDS by using gym equipment after a person with AIDS.
45. I would not be afraid to kiss a person with AIDS on the cheek.
46. Living in the same room with a person with AIDS is dangerous.*
47. I would not be afraid of mosquitoes giving AIDS to my children, even in the summer.
48. It is not safe to sit by a person with AIDS in church.*
49. I would not use the same shower or bathtub as a person with AIDS.*
50. I would not be afraid to rent an apartment where a person with AIDS had previously lived.
51. I would sit near a person with AIDS in a class or meeting.
52. Cigarette smoke can spread the AIDS virus. X
53. A person cannot catch AIDS by eating in a restaurant where a cook has AIDS.
54. Mosquitoes are more likely to carry other diseases than they are to carry AIDS.
55. AIDS can be spread by mosquitoes in swampy areas.*
56. A person with AIDS always looks sick. X
APPENDIX 5

Prediction Scale

The items below comprise the Prediction scale designed to assess beliefs about the spread of AIDS. Subjects responded to each item on the 9-point scales indicated. All 3 items are reversed scored so that higher scores on the scale denote beliefs that are more congruent with the experimental communications.

1. The passenger cabin in an airplane is a relatively small enclosed space. Many people with AIDS are healthy enough to travel. As more people get AIDS, it becomes more likely that some passengers on a plane will be carrying the virus. Suppose that a person with AIDS is on an airplane. How likely is it that other passengers will catch the virus from this person?

<table>
<thead>
<tr>
<th>Very Unlikely</th>
<th>No Opinion</th>
<th>Very Likely</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>

2. Many people predict that hospitals will become very crowded in the next few years and many AIDS patients will need to be cared for at home. This means that in many cases, family members and friends will be involved in their day-to-day care. Because of this factor, how much of an increase would you expect to find in the spread of AIDS to the families and friends of patients?

<table>
<thead>
<tr>
<th>No Increase</th>
<th>No Opinion</th>
<th>Great Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>

3. Monkeys can be infected with the AIDS virus in much the same way as humans. Suppose that an experiment were conducted in which 2 monkeys are placed in a cage with a swarm of 100 mosquitoes for 6 hours. One of the monkeys is infected with the AIDS virus. How likely do you think it is that the second monkey will become infected?

<table>
<thead>
<tr>
<th>Very Unlikely</th>
<th>No Opinion</th>
<th>Very Likely</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>
APPENDIX 6

Attitude Change Scale

The Attitude Change scale consists of the text and questions below. This scale was designed to assess subjects’ own perceptions of how much change in attitudes they experienced as a result of the experimental communications. Items 2, 3, and 4 are reversed scored so that higher scores represent more change congruent with the communications.

One major issue with AIDS has been whether people with AIDS have a right to work, attend classes, use public transportation, etc., along side other people. One side argues that people with AIDS are dangerous to other people in these settings and so they should not be allowed to do these things. The other side argues that AIDS is not spread in these settings and so people with AIDS have a right to participate in these activities.

1. Compared with when you started this experiment, how do you feel about a law that would force employers to allow people with AIDS to work among other people?

| more opposed | 1 | 2 | 3 | 4 | no change | 5 | 6 | 7 | more in favor | 8 | 9 |

2. Compared with when you started this experiment, do you have more or less belief that this law would increase the spread of AIDS?

| less belief | 1 | 2 | 3 | 4 | no change | 5 | 6 | 7 | more belief | 8 | 9 |

In some parts of the country, a major issue with AIDS has been whether people with AIDS should be isolated from society because insects such as mosquitoes could spread the disease. One side argues that mosquitoes can spread the virus between neighbors and so people with AIDS are dangerous to other people where they live. The other side argues that AIDS is not spread by mosquitoes, so people with AIDS have a right to live where they please.

3. Compared with when you started this experiment, how do you feel about a law that would isolate people with AIDS from society, based on the notion that mosquitoes spread the disease?

| more opposed | 1 | 2 | 3 | 4 | no change | 5 | 6 | 7 | more in favor | 8 | 9 |

4. Compared with when you started this experiment, do you have more or less belief that this law would stop the spread of AIDS?

| less belief | 1 | 2 | 3 | 4 | no change | 5 | 6 | 7 | more belief | 8 | 9 |
APPENDIX 7

Demographics, Social Attitudes, and Initial Beliefs about AIDS

This study was not intended to be a survey of social attitudes or beliefs about AIDS. The sample size (N=144) was not large enough to serve this purpose, nor was any attempt made to draw either a representative or random sample from any well-defined population such as the populace of Houston. However, the demographic and social diversity present in the study sample did make it possible to look at how some of these variables were related to one another within the sample. Such correlational data can provide some useful insights, though causal inferences cannot be drawn.

Several kinds of variables may have been related to one another within this study sample. Subjects' initial beliefs about AIDS may have been related to both demographic variables and social attitude variables. Social attitudes, such as attitudes towards gay men or dogmatism, also may have been related to demographic variables.

The distribution of subjects on the various demographic variables is given in the Methods section of the main text. The distributions of subjects on the Beliefs, ATG and DOG scales are given in Table A7-1 below.

Although many of the subjects were fairly well informed about AIDS, 24.3% scored below the midpoint (240) of the Beliefs scale. The median score on the Beliefs scale was 301, with scores ranging from a high of 431 to a low of 58 (the range of the scale is 48 - 432). The mean score was 293.2.
### Table A7-1  Distributions of Belief Scores, ATG Scores, and DOG Scores

**Distribution of Initial Relief Scores**

<table>
<thead>
<tr>
<th>Belief Scores</th>
<th>Frequency</th>
<th>Percent(%)</th>
<th>Cumulative %</th>
</tr>
</thead>
<tbody>
<tr>
<td>48 - 102</td>
<td>1</td>
<td>0.7</td>
<td>0.7</td>
</tr>
<tr>
<td>103 - 157</td>
<td>13</td>
<td>9.0</td>
<td>9.7</td>
</tr>
<tr>
<td>158 - 212</td>
<td>15</td>
<td>10.4</td>
<td>20.1</td>
</tr>
<tr>
<td>213 - 267</td>
<td>24</td>
<td>16.7</td>
<td>36.8</td>
</tr>
<tr>
<td>268 - 322</td>
<td>31</td>
<td>21.5</td>
<td>58.3</td>
</tr>
<tr>
<td>323 - 377</td>
<td>36</td>
<td>25.0</td>
<td>83.3</td>
</tr>
<tr>
<td>378 - 432</td>
<td>24</td>
<td>16.7</td>
<td>100.0</td>
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</tbody>
</table>

**Distribution of ATG Scores**

<table>
<thead>
<tr>
<th>ATG Scores</th>
<th>Frequency</th>
<th>Percent(%)</th>
<th>Cumulative %</th>
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<tbody>
<tr>
<td>10 - 18</td>
<td>10</td>
<td>6.9</td>
<td>6.9</td>
</tr>
<tr>
<td>19 - 27</td>
<td>11</td>
<td>7.6</td>
<td>14.6</td>
</tr>
<tr>
<td>28 - 36</td>
<td>12</td>
<td>8.3</td>
<td>22.9</td>
</tr>
<tr>
<td>37 - 45</td>
<td>16</td>
<td>11.1</td>
<td>34.0</td>
</tr>
<tr>
<td>46 - 54</td>
<td>17</td>
<td>11.8</td>
<td>45.8</td>
</tr>
<tr>
<td>55 - 63</td>
<td>21</td>
<td>14.6</td>
<td>60.4</td>
</tr>
<tr>
<td>64 - 72</td>
<td>19</td>
<td>13.2</td>
<td>73.6</td>
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<tr>
<td>73 - 81</td>
<td>18</td>
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<tr>
<td>82 - 90</td>
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<td>13.9</td>
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### Distribution of DOG scores

<table>
<thead>
<tr>
<th>DOG Scores</th>
<th>Frequency</th>
<th>Percent(%)</th>
<th>Cumulative %</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 - 20</td>
<td>2</td>
<td>1.4</td>
<td>1.4</td>
</tr>
<tr>
<td>21 - 30</td>
<td>10</td>
<td>6.9</td>
<td>8.3</td>
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<tr>
<td>31 - 40</td>
<td>22</td>
<td>15.3</td>
<td>23.6</td>
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<tr>
<td>41 - 50</td>
<td>49</td>
<td>34.0</td>
<td>57.6</td>
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<tr>
<td>51 - 60</td>
<td>33</td>
<td>22.9</td>
<td>80.6</td>
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<tr>
<td>61 - 70</td>
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<td>18.1</td>
<td>98.6</td>
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<tr>
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<tr>
<td>91 - 99</td>
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</tbody>
</table>

The distribution of ATG scores showed that negative attitudes toward gay men predominated in this sample. A total of 61.8% of the scores fell at or above the midpoint (50) on this scale, where higher scores indicate more negative attitudes. The median score was 56, and scores ranged from 10 to 90, covering the entire range of this scale. The mean score on the ATG scale was 55.0.

Scores on the Dogmatism scale ranged from 18 to 75 (with a potential range of 11 - 99), though most subjects scored somewhat below the middle of this scale. In fact, 69.4% of subjects scored at or below the midpoint (55). The median score was 49 and the mean was 48.7.

To see how these variables may have been related, initial Belief scores, representing subjects' beliefs about AIDS, were examined as a function of various demographic variables. Beliefs did not differ by sex, $F=5.8$, level of education for college students, $F=1.24$, level of education for nonstudents, $F=1.98$, or by religion, $F=0.87$. Regression analyses showed that Belief scores increased linearly with age, $F(1,142)=6.36$, $p<.02$ and that there was no quadratic effect, $F=1.40$. There were significant differences in Belief scores among races (White, Black, Asian, Hispanic, Other), $F(4,139)=2.99$, $p<.05$. Followup
comparisons showed that Asians (M=236.3) differed from non-Asians (M=302.9), F(1,142)=12.00, p<.001. Among Whites, Blacks, and Hispanics, beliefs did not differ, F=.07. Belief scores also differed with native language, with native English speakers (M=304.9) scoring higher than others (M=234.8), F(1,142)=15.13, p<.0002. When Democrats and Republicans were compared, there was an effect of political party on Belief scores, with Democrats (M=316.0) scoring significantly higher than Republicans (M=279.0), F(1,102)=5.44, p<.05.

Relating social attitudes to initial Belief scores yielded several significant results. For the self-described conservatism-liberalism measure (Conservatism), there was a significant linear effect on Belief scores, F(1,142)=11.37, p<.001, such that more liberal people scored higher on the Belief scale. There was no quadratic effect of this factor, F=0.00. A regression of Belief scores on ATG scores showed a highly significant linear effect, F(1,142)=73.72, p<.0001 (and no quadratic effect, F=.96), showing that those with negative attitudes toward gay men also scored lower on the Belief scale. The correlation of these scales was -.58. The DOG scores showed a significant linear effect, F(1,142)=34.24, p<.0001, with more dogmatic individuals scoring lower on Beliefs. DOG scores and ATG scores were correlated only moderately, r=.45, so a multivariate regression was conducted to see if each accounted for unique variance in beliefs. ATG and DOG did not interact in predicting Belief scores, F=.41, so the interaction term was removed from the model. In this case, each scale did account for unique variance in Beliefs scores, F(1,141)=42.84, p<.0001 for the ATG scale, and F(1,141)=9.20, p<.005 for the DOG scale.

The social attitude scores, ATG and DOG, were also related to various demographic variables. Scores on neither scale differed by sex, F=1.82 and F=.62 respectively. Age had both linear and quadratic effects on both scales. For ATG scores, a negative linear effect, F(1,141)=4.19, p<.05, was coupled with a marginally significant positive quadratic effect, F(1,141)=3.76, p<.06, such that ATG scores dropped with increasing age up to the mid-forties and increased after that. This same pattern was observed for DOG scores, for which a negative linear effect, F(1,141)=10.93, p<.005 occurred with a
positive quadratic effect, $E(1,141)=7.72, p<.01$.

Races differed only on dogmatism ($M=56.8$ for Asians, $M=54.1$ for Hispanics, $M=50.0$ for Blacks, and $M=46.0$ for Whites), $F(4,139)=4.78, p<.005$. Native English speakers scored lower on ATG ($M=53.0$), $F(1,142)=5.60, p<.05$ and on DOG ($M=47.3$), $F(1,142)=9.98, p<.005$ than nonnative English speakers ($M=64.6$ and $M=55.7$ respectively).

The only effect of educational level was for those not currently in college, where more education was associated with lower dogmatism, $F(2,28)=5.10, p<.05$. Democrats and Republicans did not differ in dogmatism, $F=.36$, but they did differ significantly in ATG scores, $F(1,102)=10.75, p<.005$, with Republicans having more negative attitudes ($M=62.3$) than Democrats ($M=48.6$).

Both ATG and DOG scores differed among religious groups (atheists, agnostics, protestant Christians, "born-again" Christians, Roman Catholics, and other), $F(5,138)=3.50, p<.01$ and $F(5,138)=5.08, p<.001$ respectively. Further investigation showed that born-again Christians had more negative attitudes toward gay men ($M=69.8$) and were more dogmatic ($M=55.8$) than mainline protestant Christians ($M=52.4$ and $M=43.3$), $F(1,69)=11.77, p<.001$ for ATG and $F(1,69)=19.23, p<.0001$ for DOG, or all non-born-again Christians taken together ($M=54.0$ and $M=47.0$), $F(1,100)=10.54, p<.002$ for ATG and $F(1,100)=9.94, p<.005$ for DOG. As a whole, Christians (protestant, Catholic and born-again) had more negative attitudes toward gays ($M=57.7$) than did non-Christians (atheists and agnostics, $M=46.0$), $F(1,126)=5.85, p<.02$, although these groups did not differ in dogmatism, $F=1.22$.

Regression showed that higher Conservatism scores were associated with more negative attitudes toward gay men, $F(1,142)=36.70, p<.0001$, but did not relate significantly with dogmatism, $F=2.64$. The correlations between Conservatism, ATG scores, DOG scores, and initial Belief scores are summarized in Table A7-2.
Table A7-2  Summary of correlations among social attitude measures and beliefs about AIDS.

<table>
<thead>
<tr>
<th>Belief</th>
<th>Conserv.</th>
<th>ATG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conserv.</td>
<td>- .27 *</td>
<td></td>
</tr>
<tr>
<td>ATG</td>
<td>- .58 *</td>
<td>.45 *</td>
</tr>
<tr>
<td>DOG</td>
<td>- .44 *</td>
<td>.14 x</td>
</tr>
</tbody>
</table>

* $p < .001$

x nonsignificant ($p > .05$)
REFERENCES


