Cognitive–Behavioral Approaches to Farm Community Safety Education: A Conceptual Analysis

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Abstract

For many years, farm health and safety education efforts have focused on the presentation of safety rules and guidelines. This method of instruction tends to ignore the contingencies that influence the actual behavior of farmers. Consequently, while most farmers understand the safety instruction messages they receive, they frequently continue to engage in risky behaviors. They do so even when they are aware of the injury consequences that can result from engaging in risky behaviors during farm work. Consequently, educational programs for the delivery of farm health and safety knowledge have been judged to be of questionable effectiveness. Yet, current political, social, and economic realities suggest that safety and health education will remain a favored methodology for the foreseeable future. These observations suggest that farm safety education efforts may need to be reconceptualized. This article examines the learning of safe and unsafe work practices from three historical learning theory perspectives: behaviorism, constructivism, and socioculturalism. The conceptual analysis is illustrated through case study examples. The analysis may provide insights into why transmission of knowledge by itself is not effective for replacing risky behaviors with safe work practices. It may also assist the design of farm health and safety education programs that impart knowledge, as well as change attitudes and behavior that support safe work practices.

Keywords. *Farming, Safety, Education, Learning, Instruction.*

In discussing the tradition of agricultural health and safety education efforts, many researchers have noted the relative ineffectiveness of such approaches for changing farmers' attitudes and behavior (Merchant et al., 1989). Murphy (1992) provides a detailed examination of this problem in Chapters 7 and 8 of his *Safety and Health for Production Agriculture* text. He notes that the few federal regulations that apply to farm health and safety have not been effective for a variety of reasons. From 85% to 90% of farms are family owned and operated and are exempt from most federal safety regulations. Even laws that do apply to family farms (like the appropriate use of slow–moving vehicle signs) are frequently ignored and rarely enforced. Murphy notes that the tractor and machinery portions of the OSHA

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regulations and the content of traditional farm machinery safety instruction are similar sets of prescriptive rules that direct farmers to "stay off slopes too steep for safe [tractor] operation," to "not carry extra riders" [on tractors], and to "keep all [machine] guards in place." In his excellent historical review of farm safety education efforts, Murphy mentions two points that are very important. He notes that most health and safety education ignores the "working contingencies" that explain *why* farmers do or do not follow safety advice and rules. He also notes the role of well–established habits in maintaining behaviors and preventing the adoption of new behaviors. Later, he reviews social psychology theories of learning that underlie farmers' adoption or failure to adopt safety rules and guidelines.

This article builds on Murphy's analysis by examining farm safety education efforts from three learning theory perspectives. The article begins with a case example of a farmer who died in a tractor overturn. Questions are raised about why the farmer failed to adopt safety measures that he knew could prevent injuries during a tractor overturn. Next, the three learning theory perspectives are described. Finally, the farmer's beliefs, habits, and behavior of driving tractors without rollover protective structures are analyzed from each perspective. The purpose of this article is an analysis of how farm health and safety education can be conceptualized and implemented so that it has a greater impact on attitudes and behavior. The premise is that most farmers are aware of farm hazards and safety practices that can prevent injury events related to these hazards. But this knowledge alone is not sufficient to promote farmers' consistent adoption of safety attitudes and behaviors (Cole, 2000).

A Case Example

A farmer (let's call him Mr. Simms) owned two tractors, both without rollover protective structures (ROPS). He and his wife worked their hilly 300–acre farm for 42 years without an overturn. Mr. Simms knew five people who died in tractor overturns and four others who survived overturns on tractors without ROPS, including one person who never fully recovered from his injuries. He saw many stories and photographs in newspapers and farm magazines about fatal tractor overturns. Extension agents and equipment dealers encouraged him to install ROPS and seat belts on his tractors to protect himself and his family. He had the money and time to do so, but when questioned about why he didn't have ROPS on his tractors he replied, "Until I get a bigger and newer tractor, I'm not going to worry about getting a ROPS. And when I get a newer tractor it won't be for the ROPS!" How can Mr. Simms' statement be explained given his knowledge of the frequency of tractor overturns in his community and the severity of the injuries that often result from overturns?

Three Historical Perspectives of Learning and Instruction

During the 20th century, three major theories dominated thinking and practice with respect to how people learn and how to design instruction (Bereiter, 1994; Mayer, 1996). These were:

1. The behaviorists' view of learning as "response strengthening" through reinforcement of behavior that leads to the development of habits.

2. The constructivists' view of learning as acquiring attitudes and organizing information with which to construct mental representations that direct behavior and problem solving.
3. The socioculturalists' view that attitudes, knowledge, and problem–solving strategies are learned in the social interactions of groups of people as they work together on the ordinary tasks important to their daily lives and work.

Behaviorism and Habits

From the 1900s to the 1950s the behaviorists reinforcement and response–strengthening paradigm prevailed. This approach came to be known as the A → B → C model of behavior (Skinner, 1953). Antecedent conditions (A) are things a person can see, hear, feel, and remember that cue a particular behavior in a certain situation. Behaviors (B) are the actions that a person exhibits in the presence of antecedent conditions. Consequences (C) are the outcomes or effects of the person's actions or behaviors. Behaviors that frequently lead to desirable outcomes (consequences) are said to be positively reinforced (rewarded) and become habits. Behaviors that are not reinforced (unrewarded) by desirable outcomes tend to disappear (become extinguished). Under this model, behaviors that are reinforced (rewarded) by relatively immediate desirable outcomes compete with behaviors that may sometime in the distant future provide desirable outcomes (rewards) (Cole, 1995; Mayer, 1996). An example is a company safety and health inspector who was 40 pounds overweight and had early–stage heart disease. His doctor advised the inspector to change his dietary and exercise habits. The inspector wanted to lose weight, exercise, be healthy, and live a long life. These were the long–term reinforcers for his adoption of healthy lifestyle behaviors. But every day at work he continued to drink large amounts of strong coffee and eat 10 to 12 donuts. The coffee and donuts were free, tasted good, and made him feel better when he was tired and stressed. These immediate reinforcers and his heavy work schedule competed against his healthy diet and exercise behaviors. Unable to change his lifestyle behaviors, in a few years his cardiovascular disease worsened, he became disabled, and died prematurely. It is important to point out that fear of the severe but relatively remote punishment of serious illness and premature death did not deter this man's dangerous lifestyle behaviors. Why is this? Because punishment works well only when it is relatively immediate, inescapable, and severe. That is why when the elevators are backed up and people are in a hurry to get to the lobby of a hotel they do *not* jump from the third floor balcony. They know to do so will result in immediate, inescapable, and severe punishment.

Although generally not recognized, safety behaviors like having a ROPS and a seat belt installed on a tractor and then always wearing the seat belt are maintained *not* by fear of punishing overturn injuries. The probability of an overturn and an injury is small and uncertain. Maintaining consistent compliance with safety behaviors like always driving ROPS–equipped tractors and always wearing a seat belt requires frequent positive reinforcers. Recently, as part of a larger study, 59 farmers who retrofitted their tractors with ROPS were asked why they did so. Nearly all reported that having a ROPS on their tractor made them feel safer every time they drove the tractor. They said having the ROPS and wearing the seat belt made them "feel better" because they were protecting their family and farm; they could look to the future with more assurance of seeing their children grow up and sharing retirement with their spouses. They also said that they felt greater peace of mind when other members of their family drove the tractor (Cole et al., 2001a). These feelings and thoughts are the

immediate positive reinforcers that maintain the habitual use of ROPS and seat belts. They are similar to the immediate positive reinforcers that maintain other health and safety behaviors like flossing teeth, exercising regularly, and eating moderate amounts of healthy foods (Cole et al., 1988).

Competition among immediate and delayed reinforcers is also apparent when a farmer who wants to work safely and avoid machinery entanglement injuries continues to operate a machine with missing shields. By delaying replacement or repair of the shields, the farmer saves his precious time, effort, and money — all three of which are immediate and powerful reinforcers. *Not* replacing the shields is a behavior that has been rewarded many times in the past because the farmer saved time and effort and completed the work without an injury event. The farmer's reinforcement history teaches him that it is likely he will continue to be rewarded for *not* replacing equipment shields and that he is unlikely to be punished by an injury on a short–term basis. Thus he develops a habitual behavior of working around unguarded machinery, a habit that is difficult to break.

Although it is very useful for understanding aspects of behavior, the A → B → C model gives little credence to attitudes, beliefs, and intentions as *influences* on behavior. Rather, the habitual learned behaviors are seen as *causing* specific expressed beliefs and attitudes. The behavioral model is still widely used in industries with highly structured work settings (Cole, 1995). Structuring learning situations to provide positive reinforcement for desired safety behaviors is effective in almost all situations. The behavioral approach is also useful for understanding how safe and unsafe work practices are learned and become habits. However, in all settings the A → B → C model has limitations related to the influences of human thinking and social interaction as these apply to both individual and group behavior. The model is also less adequate for explaining behavior in the more open, self–directed situations that describe the typical family farm operation.

Constructivism and Information Processing

A second model of learning and instruction became widely influential during the 1960s through the 1990s. The initial work in this area was based on an electronic computer metaphor. The human mind was seen as being like a computer in terms of taking in information, organizing information and placing it in memory, using the information to make decisions, and constantly upgrading an organized store of information in terms of ongoing experience. Soon this more literal view of information processing was replaced with a more cognitive and less mechanistic model. Information taken in by individuals was seen as being assimilated to coherent and organized knowledge structures called schema or concept systems. Persons involved in processing and interpreting information were seen as "making an effort after meaning." Under this perspective, the learner is viewed as selecting information from the environment, organizing the information within existing knowledge and experience, and constructing meaningful and coherent mental models of the world. It is through the mental models that strategic plans are developed that direct actions toward desired goals and overcome barriers to reaching those goals (Bower and Morrow, 1990; Gentner and Stevens, 1983; Mayer, 1996).

Under the constructivist approach, instruction is concerned with presenting well–organized information to people in ways that they can easily understand its relevance to their lives and goals. People can then assimilate this information with their existing knowledge. In the case of health and safety education, this involves acquiring information to improve hazard recognition as well as the adoption of

proactive health and safety practices. Much of the traditional agricultural health and safety training reviewed by Murphy (1992) involves abstracting information derived from epidemiological studies of farm work hazards and injuries and identifying effective environmental and behavioral methods for their prevention. As Murphy notes, this information is collected and codified as sets of behavioral guides and rules that comprise the core of both the educational efforts and regulatory practices.

In Chapter 7 of his book, Murphy (1992) describes the characteristics of effective safety messages; voluntary behavior change and social psychology; causal attribution theory; the learning and interactions of attitudes, beliefs, behavioral intentions, and behaviors; and persuasive communications. He integrates much of this research and its implications for agricultural health and safety messages and instruction with the theory of reasoned action described by Fishbein and Ajzen (1975), depicted in figure 1. Beliefs include knowledge about objects, persons, and events, as well as perceptions about how others in one's referent groups expect one to behave or act in specific situations (subjective norms). Beliefs influence both attitudes about performing a behavior and motivations to do so. Attitudes are evaluative judgments about the worth or appropriateness of actions, objects, plans, etc. A person's attitude toward engaging in a particular behavior is also influenced by what he or she perceives his or her normative social groups think about the behavior. As an individual processes all this affective and cognitive information, he or she develops intentions to act or not act. According to research by Fishbein and Ajzen (1975) and many others, behavioral intentions predict behavior much more effectively than do attitudes alone (Maddux and DuCharme, 1997).

Figure 1 presents graphically the hypothesized relationships among these variables as they are mentally processed by an individual faced with a decision about

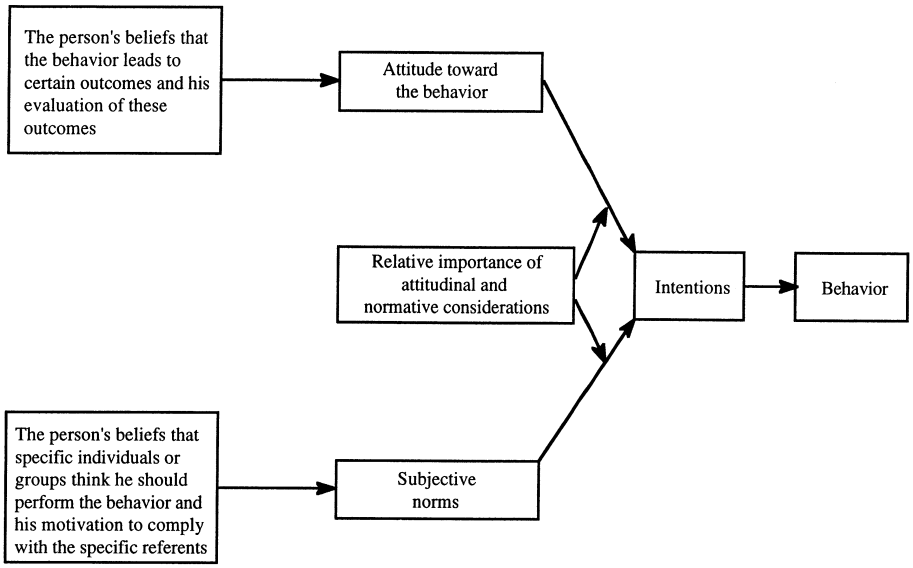

Figure 1. The Fishbein and Ajzen (1975) theory of reasoned action model.

whether to adopt or reject a safety behavior such as working around only properly guarded machinery or driving only ROPS–equipped tractors and always wearing a seat belt. The Fishbein and Ajzen model depicted in figure 1 and other similar social psychological models are constructivist, information–processing models. These mdels attempt to explain how individuals take in information from multiple sources, weigh and combine that information to make meaning from their experience, form behavioral intentions, and then act. A good example of an application of this type of social psychological model to an agricultural health and safety education is a recent study by Petrea (2001). He used the theory of planned behavior to design an intervention that increased farmers' use of personal protective equipment to reduce their exposure to pesticides.

Another similar and newer model, called the "extended parallel process model" (EPPM) (Witte, 1992, 1994), deals with the design of safety messages and their impact on behavior. This model conceptualizes people's reaction to a safety message, particularly messages called *fear appeals* that describe a loss (injury, death, economic loss) that could result from *not* adopting a safety behavior. The model hypothesizes that when people hear or see such a message that is relevant to their circumstances, they will respond by either accepting the message and acting to control the danger or by rejecting the message to control (subdue) their fear of the event described in the message. Whether or not a fear appeal message is rejected or accepted depends on two other factors.

The first of these factors is the person's perceived threat of the event described (for example a tractor overturn). The perceived threat has two parts, the degree to which the person feels he or she is *susceptible* to the threat, and the perceived *severity* of the threat. A farmer, as in Mr. Simms' case presented earlier, might perceive he is not susceptible to an overturn. The same farmer might recognize that an overturn on a tractor without a ROPS could result in severe injury or death. Although he knows the harmful consequences of an overturn, the farmer may decide *not* to invest in a ROPS and seat belt because he thinks he is unlikely to experience an overturn.

The other factor concerns the farmer's self–efficacy and his or her belief in the response efficacy. Bandura (1989) defines self–efficacy as one's belief in the ability to exhibit control over events to achieve desired outcomes. Response efficacy is the person's belief in the worth of whatever is being recommended as a safety procedure or device. For example, Mr. Simms might see a newspaper article or hear a radio news report about a local farmer who was permanently disabled when he overturned a tractor that was not equipped with a ROPS. The message might explain how a ROPS and seat belt could have prevented the disabling injury. If Mr. Simms is to accept this message and control the risk of costly overturn injuries by installing a ROPS on his tractors, he must first believe in the efficacy of ROPS and seat belts, that they are in fact very effective in preventing injuries during overturns. Second, the farmer must also believe that it is within his or her capability to find, pay for, and have a ROPS installed on his tractor. A farmer may feel susceptible to an overturn and understand the severity of an injury from such an event, but he may also feel that he cannot find a ROPS for his tractor or cannot afford to purchase the ROPS and have it installed. In this case, the Witte extended parallel process model predicts that the safety message will be rejected as a defensive reaction to control the farmer's fear.

It is apparent that the Witte (1992, 1994) model is also an information–processing approach. All such models involve individuals taking in information, assimilating it with existing knowledge and experience, and attempting to make meaning from the information. The knowledge acquired may or may not influence the person's behavior depending upon many factors. Some factors are internal and related to established

habits and attitudes of the individual. Other factors are related to the influence of persons in the social referent groups to which the person belongs. Still other factors are related to the person's resources and capabilities that are necessary to respond or take action (Gochman, 1997).

It is important to raise a critical question that is *not* addressed in Murphy's book nor in other publications concerned with promoting agricultural safety and health. It is a question for which there are three answers, one for each of the three conceptions of learning and instruction described earlier. The question is, "Where do safety beliefs, attitudes, knowledge, strategies, and actions reside?" There are three answers to this question.

Behaviorists believe that safety attitudes, knowledge, and behaviors reside in individuals' habitual behaviors, habits that have been selected and reinforced by the consequences of those behaviors. Behaviorists do not view habits as mental models used by people to determine what they should do or how they should act. Rather, they believe that many times people are not consciously aware of the habits that govern their behavior.

The constructivists believe that individual learners take in information from their environment and assimilate this information with their existing habits, their organized knowledge structures, and their beliefs, attitudes, and motives in the attempt to make reasoned decisions about how to act in specific situations. Through a process of "reasoned action," like that depicted in figure 1, people pay attention to information from their own experience and beliefs as well as to their perceptions of the experiences, beliefs, and expectations of other people, especially people in their social referent groups. Thus, individual farmers like Mr. Simms weigh and combine in their heads all of this information from multiple sources to create functional mental models of what they believe and do as they conduct their daily activities and plan for the future. Safety attitudes and behavior are sets of organized perceptions, beliefs, habits, knowledge, and values that reside an individual's head as mental models. These models direct both behavioral intentions and actual behavior.

Socioculturalism and Shared Meaning

The socioculturalists have a very different answer to the question, "Where do safety beliefs, attitudes, knowledge, strategies, and actions reside?" They say that these things do *not* reside simply in habits or simply as mental models in the heads of individuals. Rather, these complex determinants of behavior reside in the communal everyday practices of "just plain folks" engaged in cooperative social efforts in which each member has a legitimate interest and role (Gheradi and Nicolini, 2000; Gheradi et al., 1998; Lave and Wenger, 1994).

Influenced by Vygotsky's work (Das, 1995), socioculturalism became an established learning theory in the United States only in the 1980s and 1990s (Bereiter, 1994; Brown et al., 1989; Bruner, 1990; Cole, 1997; Freire, 1990; Lave and Wenger, 1994; Resnick, 1987). This conception of learning grew from studies of how people learn rapidly and effectively the many complex ideas and skills related to the practice of important everyday life activities when they are part of a social group working toward common goals. It also called attention to how ineffective formal instruction is for teaching these same outcomes. The sociocultural view of learning holds that the knowledge basic to the performance of complex tasks, including health and safety behavior, is the product of an ongoing interaction with the work at hand, the tools used to perform this work, and negotiations among members of the work group. As such, the beliefs, attitudes, knowledge, and skills to perform work well and safely do not

reside in the heads of individuals but are distributed across the individuals that comprise the social group, the tools used by the groups, and the tool makers who produce tools. This view is neither widely appreciated nor embraced by many persons who plan and conduct safety training (Wallerstein, 1992; Wallerstein and Bernstein, 1988; Wallerstein and Wenger, 1992). Under this view, safety education becomes a process of helping to empower workers to better understand the constraints and plights under which they work and to better identify and use the resources, knowledge, and tools available to their social group. The goal is to help the group become more proactive in improving health and safety within their community of workers.

Wallerstein (1992) reviews a long history of social epidemiology that suggests that when people become more empowered socially and economically, they also become healthier and suffer fewer illnesses and injuries, especially those related to their occupations. She also notes that increased self–efficacy (Bandura, 1989) leads to a stronger sense of personal agency in self–direction. This not only improves the general quality of life but also results in increased proactive identification and elimination of hazards that result in occupational injuries. This effort cannot be achieved on an individual basis; it requires social problem solving by communities of workers. Wallerstein and Wenger (1992) state: "Educators can best support worker actions by working within their organizations to develop institutional structures which can respond to issues identified..." (p. 621).

Through this social problem–solving process, workers and managers are empowered to recognize, eliminate, or control specific occupational hazards that threaten their well being (Wallerstein, 1992; Wallerstein and Bernstein, 1988; Wallerstein and Wenger, 1992).

While writing about organizational learning in communities of practice, Gherardi and Nicolini (2000) stated that safety knowledge within a social group like a family farm operation or a factory is not a matter of individuals' mental knowledge but rather a form of organizational expertise. Expert practice is learned from the members' interactions with each other and their work environment. These authors then say: "It follows that efforts to increase commitment to organizational safety should be oriented from within communities of practice by actions that personally involve their members and make safety a part of their professionalism, not an obligation imposed from outside" (p. 16).

Another key feature of sociocultural learning theory is the role of narrative in the construction of meaning, the formation of beliefs and attitudes, and the prescribing of behavior. Vitz (1990) points out that for matters of practical choice and actions, stories are better guides than rules. Rules are generalizations abstracted from many specific contexts and often have little coherent meaning for the individuals to whom they are directed. On the other hand, stories reveal meanings and values in the context in which they are told. As such, these parables tend to be understood and remembered, and they tend to influence decisions including safety behavior (Cole, 1997; Cole et al., 1998).

While discussing the various domains of learning, Gagne (1984) pointed out that it is often very effective simply to tell someone how to perform a task like using a library card catalog or a computer to locate a particular book. However, when applied to teaching attitudes, direct instruction is almost always ineffective or counter–productive. A person does not change his or her attitude by being *told* to do so or *how* to do so. Gagne stated that attitudes are best learned by the observation of a model's behavior, an indirect method of instruction. In his social learning theory research, Bandura (1993) points out that a model is any pattern that can be observed and used

to direct thinking and feeling. One type of model that is highly effective for teaching beliefs and attitudes is stories. The stories or culture tales of a social group play a large role in the enculturation of its members' attitudes, beliefs, and practices.

The conceptual model depicted in figure 2 is described in detail elsewhere (Cole, 1997). Figure 2 is included here to point out how this narrative model integrates behaviorist, constructivist, and sociocultural views of learning. Traditional behaviorist learning theory deals primarily with the two right–hand boxes in the model, conduct and consequences. Behaviorists lump all the items in the two boxes on the left–hand side of the model into "antecedent conditions." These antecedent conditions are usually conceptualized in limited ways, mainly as restricted and controlled environments that motivate the animal or worker to engage in behavior that produces a desirable outcome (a reinforcer). When the individual exhibits a "correct" response, he or she receives a reinforcer (reward). Behaviors that are repeatedly reinforced become learned habits.

Cognitive constructivist theory recognizes the validity of the behaviorist theory of reinforcement learning but also recognizes that behavior is influenced by cognition (thoughts) and social interaction having to do with the items listed in the "cognition" box in figure 2. Furthermore, constructivist theory states that when people act on the environment and attend to the consequences of their actions, they do more than simply respond to antecedent stimuli and reinforcers. They also search for patterns and meaning among their actions, the context in which the actions occur, and the consequences of those actions. From these experiences, and from social interaction and observation of others, individuals construct the organized attitudes, beliefs, knowledge, and skills listed in the "cognition" box in figure 2. These cognitions become internalized representations of the world, the mental models by which people perceive, believe, know, evaluate, and act (Bower and Morrow, 1990; Bruner, 1990; Cole, 1997; Gentner and Stevens, 1983; Howard, 1991; Sarbin, 1986).

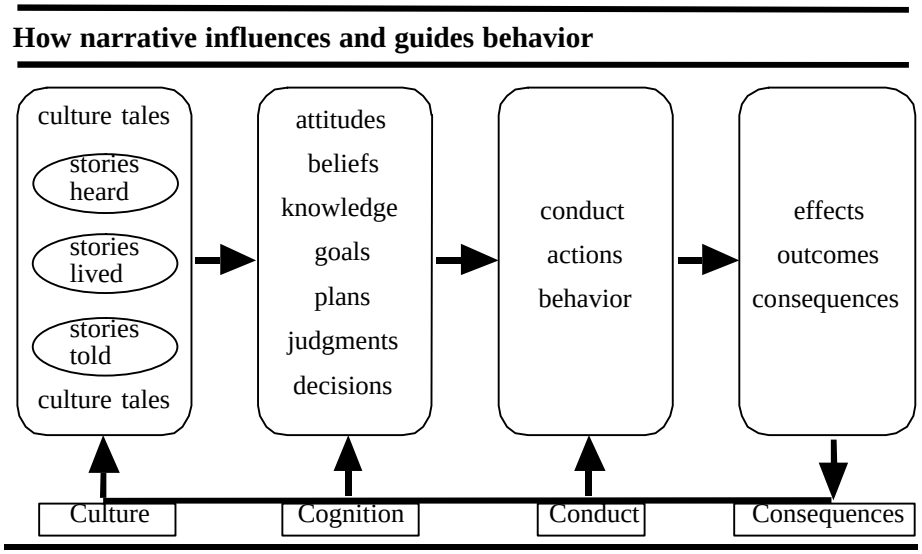

Figure 2. Theory of narrative representation (from Cole, 1997).

Socioculturalists accept the validity and utility of both the behaviorist and the constructivist viewpoints. They agree that these are useful ways of understanding the actions of people engaged in the multiple practices of life and work. But they differ in that they see knowledge and practice as a much more shared cultural experience than simply an accumulation of habitual behaviors or organized mental models by individuals. Socioculturalists recognize that the social and cultural properties of meaning making and intelligence, and the practices of a group, are different from and greater than any one individual's behavioral habits, mental models, and individual capabilities. This view is very similar to the views of Max Wertheimer, the founder of Gestalt psychology (Wertheimer, 1924).

Interpreting Mr. Simms' Case within the Three Learning Theory Perspectives

Recall that Mr. Simms owned two tractors, both without ROPS, and that he and his wife and family members operated these tractors on their hilly 300–acre farm for 42 years without an overturn. Mr. Simms knew many persons who had overturned tractors, five of whom had died. He frequently saw and heard stories in the local media about tractor overturn fatalities. He was aware of the injury consequences when tractors without ROPS overturn and the injury protection provided by ROPS during overturns. He was advised by equipment dealers and extension agents to obtain ROPS for his tractor. Yet, he stated that installing ROPS on tractors was a "waste of money." He said that the only way he would obtain a ROPS–equipped tractor was when he purchased a newer and bigger tractor for features other than the ROPS.

Behaviorist Interpretation

Mr. Simms drove tractors an average of three times a day, 20 days a month, for a total of 42 years, and his wife drove tractors about half that many times. During the 42–year period, Mr. Simms drove his tractors 30,240 times and never experienced an overturn. His wife had about 15,000 tractor–driving events and also never experienced an overturn. These consistent positive outcomes (driving without an overturn) were reinforced tens of thousands of times (Skinner, 1953). Consequently, both Mr. Simms and his wife developed strong habits of driving tractors without ROPS.

Because of their farm's difficult terrain and the narrow and hilly public roads, both Mr. Simms and his wife experienced a number of close calls in which overturns were narrowly averted. In each case, they were able to avoid an overturn through a combination of caution, driving skill, and chance. Rather than weaken his habit of driving tractors unprotected by ROPS, these events helped to developed Mr. Simms' strong self–efficacy beliefs that he and his wife were capable of preventing tractor overturns (Bandura, 1989). This complex set of memories, skills, and beliefs are antecedent conditions that shaped the attitude Mr. Simms' expressed in his statement, "ROPS are a waste of money," and in his behavior of continuing to drive tractors unprotected by ROPS.

Constructivist Interpretation

Mr. Simms' behavior can also be interpreted from the standpoint of constructivist information–processing models like the theory of reasoned action presented in

figure 1 and by the "extended parallel process model" (Witte, 1992, 1994) described earlier. First, Mr. Simms believed that severe injuries could result when tractors without ROPS overturn. He also believed that a ROPS could prevent injuries during a tractor overturn (response efficacy). Because of their past safe driving history and skilled tractor driving (self–efficacy), Mr. Simms also believed he and his wife were not susceptible to an overturn. Most of the farmers he knew and respected (his normative group) held and expressed views similar to his own and most also operated tractors without ROPS. Mr. Simms processed all this information and came to the reasoned conclusion that he and his wife could operate their tractors with little risk of an overturn and that retrofitting tractors with ROPS was a waste of time and money.

Socioculturist Interpretation

Socioculturalism accepts the behaviorists view of the role of reinforcement in establishing Mr. Simms' and his wife's habits of operating tractors without ROPS. It also accepts that Mr. Simms weighed and combined information from his own and his family's tractor driving experience with similar information from the social groups with which he was affiliated. This information was combined with other information he heard or read about tractor overturns and ROPS. He then reasoned logically that he and his wife were unlikely to experience an overturn and that it was safe and cost effective to continue operating their tractors without ROPS and seat belts. However, the socioculturalist view includes other important explanations for Mr. Simms' attitudes and behavior that are related to the "culture tales" box on the left–hand side of figure 2.

Socioculturalist learning theory calls attention to the influence of the tools used by the social group and their influence on the attitudes and behavior of group members as they engage in their work. A key tool in Mr. Simms' case is the farm tractor itself. Both of Mr. Simms' tractors and most of his neighbor's tractors were manufactured and sold before ROPS and seat belts became available. Mr. Simms, his family members, and the neighboring farmers with whom he often worked all had great respect for the tractors they used daily. From long experience, they knew that their tractors were durable, reliable, easy to maintain, and safe machines equipped with all the essential features necessary to operate efficiently. Mr. Simms, his family, and his friends expressed strong loyalty and appreciation for the various brands (often referred to as "colors") of tractors that they used as well as for the manufacturers of these machines. Mr. Simms and his peers thought that these older tractors were not originally equipped with ROPS because it was unnecessary and costly to do so. Furthermore, they believed it remained unnecessary and costly to retrofit their older tractors with ROPS. He and his fellow farmers talked and told stories about government regulations that threatened their independent way of life. They viewed tractor manufacturers equipping newer tractors with ROPS and seat belts as an expensive and unnecessary concession to meddlesome government regulations. In fact, when the first ROPS–equipped tractors became available, several farmers Mr. Simms knew removed the ROPS from their newly purchased tractors.

Over the years, Mr. Simms, his family, and friends worked cooperatively on many tasks that involved tractors. Much of their shared knowledge about how to work productively and safely was modeled by the group members and shared through stories that describe good and safe ways to work. Work performed well and efficiently was seen not only as "good" work but also as safe work. It was these stories rather than specific and well codified rules that communicated to the group members how "good" work should be performed. When group members stated safety rules, they tended to

be non–specific exhortations like, “Be careful out there!” In large part, the modeling of “good” work behaviors and the stories told within the social group about how one should and should not work were effective in promoting productivity and safety.

What Happened to Mr. Simms?

During his 43rd year of farming, Mr. Simms died when his tractor overturned. After his death, his widow installed ROPS on both tractors to protect her and other members of the family as they continued to drive the tractors and operate the farm. Injury events like this one can change attitudes and promote safety behaviors such as the installation of ROPS and seat belts on tractors, or remove the threat of an overturn by the cessation of farming and tractor driving (Scheerer and Brandt, 2001). But in such cases the costs are so severe that a family member must die or be disabled before attitudes and behavior change. How, then, can strongly ingrained risky attitudes and behaviors be changed *prior* to costly and disabling injury events?

Knowledge about tractor overturn risks, injuries, and consequences, as well as the effectiveness of ROPS and seat belts for preventing these injuries, is necessary if farmers are to adopt ROPS. This knowledge can be transmitted directly by telling or showing farmers what they need to know, which as Murphy (1992) notes, is what most farm safety instruction is. However, such direct instruction is ineffective for teaching attitudes (Gagne, 1984).

Attitudes consist of feelings (emotions), knowledge, and patterns of thought that influence beliefs, intentions, and actions. Replacing habitual risky behaviors with safe behaviors requires changes in attitudes as well as knowledge. To influence behavior, knowledge must be supported by attitudes that help individuals to perceive the relevance of that knowledge to their daily life. Otherwise, the knowledge remains inert and untapped (Resnick, 1987).

Attitudes are learned primarily though models of other people’s behavior and are internalized as stories about these models (Bandura, 1993; Bruner, 1990; Cole, 1997; Gagne, 1984; Sarbin, 1986). Some of the models are real people with whom we interact directly—people whom we respect, observe, and strive to imitate. Other models are people with whom we have no direct interaction but whose stories we hear about and identify with. Collectively, the stories about these models become internalized as social norms that guide our plans, decisions, and actions as well as our understanding of our own and others’ conduct. These stories have been called culture tales (Howard, 1991) and stories to live by (Cole, 1997).

It is helpful to ask, “What stories and culture tales may have contributed to Mr. Simms’ continued operation of tractors without ROPS and seat belts on his hilly farm?” Some of these stories were described in the previous section. Other stories include accounts that Mr. Simms read in local newspapers about farmers’ injuries and deaths during overturns. If the stories were typical of those in rural newspapers, they probably described these events as “unfortunate,” “acts of God,” “unavoidable,” and made no mention that ROPS and seat belts can prevent nearly all overturn deaths. A set of pervasive culture tales in many farm communities is that overturns “just happen,” that often they are deadly but sometimes a person can jump free and escape injury, that by being skilled and careful a farmer can avoid overturns and thus need not spend the time and money necessary to install a ROPS, and that ROPS prevent driving under trees or into barns with low entrances.

Similar community stories about the deaths of child riders on tractors are common. These culture tales usually describe how much the child loved to ride on the tractor

with his grandfather, how his daddy had done so as a child, and the valuable lessons the father had learned from this practice. The child's riding on the tractor with his grandfather is often depicted as "quality time" and "necessary" to the child's proper development and his learning to be a farmer, including learning safe tractor driving skills. For many families, the continuation of this tradition is described as a cherished enculturation practice with many benefits for both the child and adult. The rare one–time event in which the child falls from the tractor and is run over and killed is depicted in local news stories and in investigation reports as a "freak accident," "bad luck," and something for which no one is responsible.

These culture tales make it clear that the meaning made from overturning a tractor and being hurt or killed, or from riding along on a tractor and falling off and being run over, is a shared community meaning, *not* only or mainly an individual representation. To overcome and correct these problematic ways of feeling, thinking, and acting, members of the community must confront, negotiate, think about, and talk about these events to create new shared meanings and different culture tales about these events. Outsiders who admonish farm family and community members for their views and practices, or blame them for being uncaring and stupid, are ineffective and counter–productive for changing culture tales that are in need of "story repair" (Howard, 1991).

Conclusion

Replacing habitual risky behaviors with safe work practices requires changes in both knowledge and attitudes. While simply showing or telling individuals what they need to know can transmit knowledge, direct instruction is ineffective for changing attitudes. Attitudes are changed primarily through our interactions with human models and parables. Furthermore, changing attitudes of the members of a practice community is best approached from within that community. If persons from outside that community wish to assist in the change, then they must become what Lave and Wenger (1994) call "legitimate peripheral participants" in the practice activities of that community. This is not to say that behaviorist views of reinforcement and habits are not useful, or that "in the head" constructivist information processing and decision–making models are not useful for understanding and promoting farm health and safety behavior. Both theoretical perspectives provide valuable insights. But both can be more effectively used in combination with sociocultural perspectives that recognize that the performance of farm work, like all life activities, is not only or mainly about individuals but largely about the beliefs, intentions, tools, and actions of social groups and communities.

Three recent farm safety and health intervention projects move in this direction. The *Simple Solutions: Ergonomics for Farm Workers* projects (Baron et al., 2001) were part of the NIOSH Community Partners for Healthy Farming intervention activities. These two projects involved teams of researchers listening to and working with farm community members. The workers engaged in their everyday practices of picking, washing, and bagging vegetables or making cuttings from woody plants. As they did so, the researchers interacted with the farm workers. These collaborative dialogs resulted in new ways of thinking and new working practices that reduced risk of injury, improved safety and health, and increased production. Another farm community education effort to promote farmers' use of ROPS and seat belts is part of the NIOSH–supported Community Partners for Healthy Farming program. The application of sociocultural learning theory in this project was successful in

increasing in an intervention county the proportion of farmers who retrofitted their tractors with ROPS and seat belts compared to a non–intervention control county (Cole and Westneat, 2001).

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