Resistance to Change: Unconscious Knowledge and the Challenge of Unlearning

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I refuse to accept the view that mankind is so tragically bound to the starless midnight of racism and war that the bright daybreak of peace and brotherhood can never become a reality. Martin Luther King, Jr.

Abstract

The goal of this chapter is to propose that widespread evidence of our failure to achieve individual, organizational and social change may be due, in part, to the impact of automated and unconscious knowledge. After a brief review of the results of personal and collective change programs and the accuracy of self-reported change, the discussion turns to an overview of research on the learning, operation, self-monitoring and unlearning of automated knowledge. Evidence from task analysis is presented to make the case that about 70 percent of adult knowledge is fully automated, unconscious and not inspectable even when it is active because: 1) Adults are largely unaware of many of the goals they are pursuing and the strategies they are using. The consequence of this situation is that we are largely unable to accurately report our attempts to change; 2) When change strategies fail, one of the important but largely unexamined causes is the interference caused by the automated and dysfunctional cognitive behaviors we wish to change, and; 3) We know very little about how to unlearn dysfunctional automated and unconscious knowledge to clear the way for new covert and overt behavior. The chapter ends with a suggestion that if we increase the resources invested in the study of the unlearning of automated knowledge we may increase the success of attempts to achieve and recognize successful personal and social changes.

Think if a time in your past when you worked alone or with others to achieve a major change in your thinking, attitudes or behavior. Was your effort successful?

If you answered "yes", your experience may have been an exception.

How successful are our attempts to change?

Evidence for successful individual and collective change is extraordinarily elusive. In recent years, a number of change strategy evaluations have been reported by groups such as the U.S. National Academy of Sciences, the National Research Council and a number of university research centers (See for example Druckman and Bjork, 1991, 1994; Druckman, Singer and Van Cott, 1997; Golembiewski and Sun; 1990; Kluger and DeNisi, 1998; Pfeffer and Sutton, 2006 and Wegner, 2002). These reports demonstrate a large gap between what we think we are able to change and evidence from systematic evaluations of change efforts. For example, the National Research Council reports that 70% of all major organizational change strategies in business, government and educational institutions fail within two years and are abandoned (Druckman, Singer and Van Cott, 1997; Pfeiffer and Sutton, 2006). The actual failure rate is most likely much higher since failures are more often hidden or "reframed" rather than publicized. The Academy has also reported on our continuing failure to change inequities in our public health system to improve the dismal medical and psychological treatment of ethnic minorities (Smedley, Stith & Nelson, 2002).

The Council concluded that change strategies reported as successful in one social or organizational context seldom transferred effectively to another context (Druckman and Bjork, 1991) which leads to questions about whether the initial reports were accurate. In a meta-analytic review of the feedback used in most tutoring and mentoring strategies used for interpersonal and social support of change, Kluger and DiNisi (1998) reported that approximately 2/3 of the most common approaches either had no effect or had a reverse effect and appeared to both prevent change and intensify the behavior people were attempting to change. Even more distressing results are reported for change strategies in critical areas such as attempts to help adolescent boys modify extreme aggressiveness (Shechtman, 2003), attempts to reduce the very high recidivism rate for our prison systems (Furby, Weinrott and Blackshaw, 1989); and the destructive effects of domestic violence (Sartin, Hansen and Huss, 2006) . Equally distressing is the finding that as the rigor of evaluation strategies used to monitor change programs increases, the evidence of successful change tends to decrease (see for example a review by Golembiewski and Sun; 1990).

The Reliability of Self Reported Change

Perhaps the only optimistic indication of change occurs when people are asked to report on their own attempts to change. And yet while self reported change is often positive its reliability has been challenged when self reports are compared with more direct measures of change (Dunning, Heath and Suls, 2004; Trivers, 2000. For example, in a broad study of self reported experiences in psychotherapy Lunnen and Ogles (1998) conclude that

patients are inclined to give unreliable and overly positive reports of desired changes due to therapy experiences and not to report failures to change or deterioration in their condition. Overly optimistic and inaccurate results are also reported for a variety of behavioral changes such as, for example, personal reports of reductions in acts of workplace aggression (Jocklin, Arvey and McGue, 2001) changes in emotional states (Eid and Diener, 1999), physical activity (Motl, Dishman, Ward, Saunders, Dowda, Felton and Pate, 2005) and drug use (Mitchell and Mackenzie, 2006) as well as underestimating our emotional reactions to business downturns and loosing a job (Dunning, Heath and Suls, 2004)

This phenomenon also occurs regularly in social settings where people work in teams to accomplish work goals. There is evidence that executive teams in business consistently misreport failures to make organizational change, the effects of their business decisions in novel market environments and the extent to which their organizations engage in socially desirable organizational behaviors (Trivers, 2000). Analyses of disasters have uncovered many instances where people working together engaged in (or did not discourage) the self deception of colleagues about a dangerous situation and so contribute to the loss of lives. Trivers (2000) analysis of the deceptive interactions between the pilots of Air Florida flight 90 in January of 1983 before the plane crashed is particularly chilling. An equally distressing analysis of the way that organizational self deception by NASA management contributed to the Challenger disaster is provided by the Nobel physicist, Richard Feynman (1988).

Unreliable personal change reports may also occur frequently in educational settings. Clark and Estes (2002) and Dunning et al (2004) describe instructional experiments where students significantly over estimate how much they had learned under different conditions. Student or trainee reports were unreliable and uncorrelated with tests of learning. In many cases, the correlation between self reported learning and more objective test data was significantly negative (Clark, 1982).

In general it appears that people may be accurate at reporting what they are capable of doing on self-efficacy measures (Bandura, 1999; Bong and Clark, 1999; Hoogstraten, 1985) but not very accurate at reporting what they have accomplished if the accomplishment involves change. In many of these examples, lower reliability of self reported change can be attributed to social desirability distortions or to an attempt to avoid punishment for illegal behavior. Yet Wegner (2002) and others (Schunk, & Zimmerman, 1997; Trivers, 2000; Wolters, 1998) argue that even when changes are socially or emotionally neutral or positive most people either overestimate or are unaware of their own influence over personal change.

Regardless of the cause, our reports of important personal and collective change experiences tend to be overly positive and unreliable. Exceptions to this optimistic bias occur with moderately to severely depressed individuals who tend to report overly negative experiences with change (Bullington, 1990).

Why are our impressions of whether or how much we have changed so unreliable and why is personal, organizational and social change so difficult to achieve?

Barriers to Our Intentions and Awareness of Change

The issue at stake in a psychological discussion of the accuracy of our self reports of change stems from a very early question raised by William James and others before the turn of the century. James (1884), in a discussion of will and volition, described an armchair experiment where he imagined an angry exchange during which one person verbally insults and attacks another. James wondered whether the attack was due to the attacker's perception that he was angry because the other person insulted him prior to the attack. Or, he muses, do we fail to realize that we feel angry only after an attack begins primarily because we perceive ourselves as defensively attacking someone? Over the years, James' question evolved into a lively discussion about our personal control over a wide range of psychological processes such as "fight or flight", strong emotions and our ability to accurately monitor and interpret our own behavior (e.g. Bargh, Gollwitzer, Lee-Chai, Barndollar & Trötschel, 2001; Carver & Scheier, 1990; 1998; Farrell & Lewandowsky, 2000; Koriat, Ma'ayan & Nussinson, 2006; Wegner, 2002).

Wegner (2002) has argued persuasively that human beings often misperceive themselves as the agent of their own will and conscious intention when in fact, much of our behavior is automated and under the control of interactions between external conditions and automated cognitive processes. He points to a variety of studies to make his point including neuroscience evidence that neural areas signaling intention often activate after areas that signal preparation for action. He also makes the claim that since the research on self-regulation of change asks learners to report on the regulatory strategies they used and their own success (Schunk, & Zimmerman, 1997; Wolters, 1998) it is doubtful that self-report data accurately reflects either change or the actual cognitive regulatory mechanisms that are thought to control change. He argues that our perceptions of self control help maintain our sense of general efficacy but may not often be accurate accounts of causal events.

Trivers (2000), an anthropologist interested in the evolutionary origins of self deception, argues that over the millennia we have learned and automated (and perhaps inherit the capacity) to deceive ourselves in order to more persuasively deceive predators and control social situations. He presents evidence that self-deception is a highly generalized, unconscious strategy that is used unintentionally in most social situations where we perceived that our sense of control and effectiveness are at stake. He points to evidence for example that 94% of professors rank themselves in the top half of their profession and 80% of high school seniors rank themselves as above the average in ability when compared with other seniors (Trivers, 2000). Dunning et al (2004) suggest that self deception may also help us maintain personal and organizational control in life threatening situations caused by terminal illness and injury or imminent organizational failure. Continued striving made possible by self deception may increase longevity or help solve seemingly hopeless problems even when death or destruction is highly likely.

Koriat, Ma'ayan and Nussinson (2006) also provide compelling evidence that when personal and social behavior is under the control of automated cognitive processing we tend to misattribute not only the cause of the behavior but also the impact of our intentions. They acknowledge that the issue of control and accurate attribution for our own behavior "…continues to be a subject of intense debate among cognitive scientists in different disciplines …" (p. 66). Bargh et al, (2001) attribute much of the debate to different views about an "automated will" and argue that "…the skill acquisition literature has always assumed that (skill acquisition) processes are started in motion by an instigating act of will … regardless of how autonomously these procedures may then operate. What we are adding … is the idea … that goals can be put into motion without requiring conscious choice and instigation." (p. 1015). They provide evidence based on priming experiments that support Wegner's (2002) position. They claim that with repeated conscious activation in specific situations, goals gradually automate along with the necessary procedural steps and motivational processes that encourage persistence and overcome distractions.

When we encounter situational cues that prime automated behavior, the behavior begins and persists without our conscious awareness or choice. Most important is evidence that people are mostly unaware of the cues, the activation or the cognitive strategies they implement to achieving the goals primed by the cues.

To carry this issue one step further there is compelling evidence that people who are pursuing an automated or implicit goal tend to project their goal and believe that others in their environment are also pursuing a similar goal (Kwada, Oettingen, Gollwitzer and Bargh, 2004). Thus people who automate the competitive and aggressive pursuit of goals assume that others will not work collaboratively. The weight of evidence seems to support the claim that where performance is largely automated, our judgments about the origin of our goals to change and the goals and intentions of others may be unreliable.

On the other hand, one could argue that change always requires new learning and that novel goals require conscious processing. Since people tend to be more able to accurately report novel events (Betsch, Fiedler & Brinkmann, 1998) our self reports of changes should be less susceptible to the unconscious component of already learned and automated behavior. If accurate, this point of view would suggest that strong intentions to do something new would start a very purposeful chain of events that would be conscious, deliberate and reportable (Gollwitzer, 1999). Yet strong and benevolent intentions apparently did not help a sample of expert psychotherapists who were asked by Abreu (1999) to evaluate hypothetical patients (whose race was unspecified) after being subliminally primed with words reflecting African American stereotypes. The racially primed therapists provided significantly more negative evaluations of the patients than an unprimed group. Psychotherapists tend to be selected for their fairness and trained to avoid prejudice when conducting diagnostic tests and treating clients. Even unintended prejudicial assessment by psychologists may have devastating individual and social impact. For example, Smedley, Stith & Nelson (2002) argue that even when type of illness, income, age, and insurance status are held constant, ethic minorities receive

substandard psychological and medical care which leads to increased illness and mortality rates.

Gollwitzer (1999) describes a number of instances where intentions to change help overcome previously automated and dysfunctional behaviors such as stereotypes. Yet intention tends to help promote change and accurate reporting when people are in low stress situations and are experiencing minimal cognitive load (Devine, 1989), a condition that tends to be atypical when important changes are attempted and high stakes assessments are being conducted (Clark & Elen, 2006).

Wegner (2002) has offered an explanation for why stress and workload may defeat intentions. He proposed an automated "ironic system" in cognition that "searches for mental content signaling a failure to create an intended state of mind" (Wegner, 1997, p. 148) such as intentions to suppress a bias when assessing others or personal signs of wakefulness when trying to sleep. He provides evidence that when we are cognitively overloaded our ironic system takes over and unconsciously implements the behavior we had hoped to prevent. Shoham & Rohrbaugh (1997) argue that when we do what we intended not to do our stress is increased, we tend to ruminate about failure which increases cognitive load and decreases our sense of control over our own behavior. As the perception of loss of control increases, a cycle of despair ensues where helpful suggestions from others highlight our inability to change yet lead to more failed attempts that further increase our perceptions of loss of control.

Is it possible that automated and unconscious cognitive processes make it difficult for us to change and equally difficult to accurately assess our progress when we intend to make changes?

At some level, psychology and education have acknowledged the importance of automated knowledge in areas as diverse as memory (Schacter, 1987); causal attributions (Gilbert, 1989), social perceptions (Bargh, 1994) and mental skill proceduralization (Anderson, 1983, 1995). Yet the full importance of the "unconscious" aspect of automated knowledge in our efforts to change has been largely ignored.

Two Types of Knowledge

When Schneider and Shiffrin (1977) described controlled and automated mental processing three decades ago, it was difficult to anticipate the implications of the cognitive system they were describing. They proposed that we routinely engage in two very different types of cognitive processing and that while both processes interact in learning and problem solving, each also results in a different type of knowledge with very different qualities.

Controlled, Conscious, Declarative Knowledge

The learning and application of controlled knowledge has been studied extensively over the past century (Anderson, 1983; 1993, Fitts & Posner, 1967; Newell, 1990, Schneider & Chein, 2003). This type of knowledge has been called declarative (Sun, Slusarz and

Terry, 2005), explicit (Dienes and Perner, 1999) and conceptual (Gagne, Yekovich & Yekovich, 1993). It has been described as "knowledge that" and as answering questions such as what, where, why. Instructional psychologists have hypothesized that controlled knowledge is represented cognitively in the form of concepts, processes and principles (Gagne, Yekovich & Yekovich, 1993; Merrill, 1983). Controlled knowledge is also described as consciously inspectable (Cleermans, Destrebecze and Boyer, 1998). We are aware of our controlled, declarative knowledge through self monitoring of our learning and problem solving (Koriat, Ma'ayan and Nuissinson, 2006) and through meta-memory processes that permit us to predict the stored contents of our long term declarative memory (Nelson, Leonesio, Shimaura, Landwehr & Narens , 1982; Thompson, 1988). We are apparently able to monitor and describe to ourselves and others the declarative knowledge we are acquiring during goal directed learning and problem solving (Gagne, Yekovich and Yekovich, 1993; Jonassen, Tessmer & Hannum, 1999). Declarative knowledge is also controllable in the sense that it tends to be learned and modified more quickly than automated knowledge.

Is it possible that because we are aware of declarative knowledge nearly all of the change strategy research and practice in education and psychology have focused on it and have largely ignored the role of automated knowledge?

Automated, Unconscious Procedural Knowledge

Perhaps because we are consciously aware of declarative knowledge, it has received considerably more attention in research and practice over the years. Automated knowledge is largely ignored. Compared to controlled knowledge, it is learned much more slowly, presumably only after it is successfully assembled and applied to the pursuit of goals in a declarative form and modified over repeated trials (Anderson, 1995). This type of knowledge has been called procedural (Anderson, 1998), latent (Vokey & Higham, 2000) tacit (Cleermans, Destrebecze and Boyer, 1998) and implicit (Dienes and Perner, 1999).

The primary function of automated procedural knowledge appears to be to help us circumvent the limitations of working memory. In the past we had estimated working memory capacity at approximately seven (plus or minus two) chunks of related information but that number has been cut in half by Cowan (2001) who lowered it to three (plus or minus one). So the benefit of procedural knowledge is that it allows us to express effective routines while leaving working memory space to handle the non automated components of tasks.

Anderson's (1995) ACT-R theory provides evidence for a three stage process for acquiring automated knowledge. The learning process begins with a cognitive stage when a performance goal leads to the gradual assembly, testing, and editing of controllable, declarative knowledge that is relevant to goal achievement. At this stage declarative knowledge is translated into procedural steps that might accomplish a task goal. Longer procedures are broken up into chunks that are governed by "subgoals". As the assembled procedure is corrected it enters the second stage where, when it is applied effectively the steps in the conscious declarative knowledge gradually automate. Once

steps automate, the connections between the subgoals (chunks of steps) begin to automate. The automation process requires that all parts of the assembled procedure be perceived as effective in achieving a goal. If application of the skill progresses long enough and both steps and subgoals automate, continual application of the knowledge in the third stage results in a speedier application of the procedure.

While important differences of opinion exist about the representational structure of automated knowledge (see for example, Dienes and Perner, 1999) for the purposes of this discussion automated knowledge is considered to be a procedure and represented as a sequence of goal and subgoal driven action and decision steps that accomplish cognitive goals. Anderson (1993) has suggested that full automation of even a minor cognitive skill requires approximately 100 hours of application spread over many weeks. When automated and expressed in the context where it was learned and practiced, automated knowledge is highly accurate and effective at overcoming the limits on working memory.

The working memory benefit of automated cognitive skills is accompanied by a potential deficit. One of the costs of automation is a significant decrease in our ability to inspect and report on the operation of automated routines.

How much of adult knowledge is automated, unconscious and not inspectable even when we are using it to accomplish goals? How accurate is our impression of our own mental activities when we solve problems?

Cognitive Task Analysis and the Seventy Percent Rule

One of the primary sources of evidence about the inaccessibility of automated knowledge comes from studies of cognitive task analysis. Traditional expert-based task analysis strategies used to develop information and curriculum materials for instruction (Clark & Estes, 1999; Jonassen, Tessmer & Hannum, 1999: Miller, 1962; Schraagen et al., 2000) have assumed that experts are able to describe the cognitive processes and knowledge they use to solve problems and achieve task goals. Similar assumptions are made about students in "think aloud" protocols during learning and problem solving (see a review by Feldon, 2004). Yet a number of studies have reported that even advanced experts make significant errors when attempting to describe how they solve problems in their area of expertise (Bresnard, 2000). This problem extends to our attempts to identify the conditions that lead to the expression of automated routines. For example Helmuth (2001) estimates that we are able to report only about 10 percent of the conditions that lead to our expression of automated behavior such as addictions. Cognitive Task Analysis (Schraagen, Chipman and Shalin, 2000) was developed to overcome this problem. It is a collection of interview and knowledge validation strategies that attempt to increase the accuracy of expert descriptions of their automated cognitive strategies for solving problems. Cognitive Task Analysis (CTA) provides a protocol that allows us to estimate the amount of automated knowledge that can be accurately reported by experts.

Velmahos, Toutouzas, Sillin, Chan, Clark, Theodorou & Maupin (2004) used CTA and found that when medical professors taught medical students to perform surgery, the

professors tended to accurately describe their own visible actions but consistently omitted most of the key decisions they made when describing their approach to a surgery. Clark (personal communication) one of the co-authors of the Velmahos study suggests that when asked how they describe a surgery to students, teaching surgeons indicated that they work from a visual image of themselves or others performing the surgery and report what they "see" in the image. Since we cannot directly or indirectly observe our own automated decision making processes it is most likely therefore that surgeons and other experts are largely unable to describe automated decision knowledge. One method of validating the accuracy and completeness of the procedures reported by experts is to use a CTA description and compare it with traditional teaching as the basis for teaching novices to perform the task. In the Velmahos et al (2004) study, CTA protocols of a surgery were used to train half of the annual surgical residents in a large urban teaching hospital and the other half of the surgical residents experienced a traditional "see one, do one, teach one" pedagogy. The experts who taught the traditional group were the same experts interviewed for the CTA. Surgical residents were later observed by senior surgeons who were blind to their training status for one year whenever they performed the surgery. Results indicated that the surgeons who received the CTA-based description of the surgical procedure made about 60 to 70 percent better decisions with patients than those who only observed the procedure and heard expert surgeon explanations. These decisions included the decision about where to perform the procedure, what instruments to choose when patients were seriously injured and what to do when a step did not have an intended outcome. Perhaps as a result, the surgeons who experienced the CTA-based training made no serious errors when using the procedure with patients whereas the experimental group made a number of damaging decision errors. In areas where correct procedure could be observed, the two groups performed similarly. Similar results in studies of the diagnostic expertise of top neonatal nurses have been reported by Crandall & Gretchell-Leiter (1993) who described a similar study where CTA of expert neonatal nurses exposed a strategy for diagnosing life-threatening sepsis in premature infants that was significantly more effective than the textbook method taught in universities. As evidence of the instructional value of using CTA to identify automated and unconscious expert knowledge, Lee (2004) performed a meta-analytic study of the instructional effectiveness of CTA-based training and performance improvement studies. She reported an overall average post-training performance gain of 75% ($d = 1.72$) for CTA training when compared to more traditional training design using expert-based task analysis.

Additional evidence for the hypothesis that analytical and decision expertise is largely automated and unconscious comes from studies of CTA protocols conducted with computer programming and debugging experts. For example, Chao and Salvendy (1994) studied the errors made by a number of top programming experts during systematic task analysis interviews. When a number of top experts participated in systematic knowledge elicitation interviews and were asked how to solve and debug specific programs, each expert was only approximately 31 percent accurate in their conscious recall of the successful strategies they use constantly and successfully. Simpler tasks resulted in greater accuracy than more complex tasks. As new experts were interviewed about the same set of problems they added only about 5 to 7 percent new knowledge to the solution set. This was apparently the case in a study reported by Feldon (2004) who studied the

self-awareness of personal research design strategies used by a number of well-published psychologists who teach research design. He used a computer simulation of memory experiments and reported that memory researchers were only able to report approximately 30 percent of the strategies they were using when asked how they designed memory experiments. Hoffman, Crandall and Shadbolt (1998) and Besnard (2000) have described other studies that reported similar data. Helmuth (From these studies it is possible to estimate the accessibility of procedural knowledge at approximately 30 percent expert accuracy when describing their expertise and so generate a tentative "seventy percent rule" to describe the inaccessibility of automated procedural expertise.

While the research on the accuracy of expert reports of cognitive strategies has focused primarily on experts who teach, we must assume that all of us are unaware of a large segment of our own automated knowledge. While automated knowledge is highly accurate, when contexts change or the standards that govern skill application within a context change, automated knowledge can be very difficult to circumvent or change and replace with a new or revised procedure. Part of the reason for this difficulty is our lack of awareness of the cognitive knowledge we must change in order to replace them with new covert and overt behavior.

How do we identify the knowledge we need to change? How does automated, unconscious knowledge interfere with necessary change?

Misconceptions as Automated Knowledge

Science education is an area where educators realized long ago that children start school with a great deal of naïve, experience-based but scientifically inaccurate and socially unacceptable knowledge about their environment that must be changed or circumvented. For example, as children in Northern Hemisphere countries enter school they tend to believe that gravity might cause people at the "bottom" (South Pole) of the earth to "fall off into space" (Vosniadou, 2002). Other physical misconceptions shared by most children focus on concepts such as electricity, heat, temperature, and evolution. Children also come to school with family-based social misconceptions about race, ethnicity and social-class (e.g. Banks, 2006) as well as interpersonal behaviors and problem-solving strategies that conflict with social and school norms. These misconceptions have been found to interfere with the learning of self regulatory and social skills, decision making strategies, formal science concepts and principles (Carey, 2000). Attempts to change misconceptions for children and adults have largely failed (e.g. Chinn & Brewer, 1993; Kahneman, Slovic & Tversky, 1982) Even when attempts to change naïve beliefs appear to succeed over the short term, the original knowledge tends to reassert itself over a longer time frame (Chinn & Brewer, 1993). Our past failure to change and/or replace misconceptions in educational settings suggests that they may be largely automated and unconscious. This explanation may underlie the analysis offered by Chi (2005) of more and less robust misconceptions. One way to interpret her analysis is to suggest that misconceptions that are largely declarative are more easily changed but those that are in a

procedural and automated form, resist change. This brings up the final question in this discussion.

How do we "unlearn" automated covert and overt knowledge if we wish to change it and replace it with new knowledge? What strategies have been found to work?

Three Approaches to Unlearning Automated Cognitive Knowledge

Many unlearning models have evolved from early studies with animals where attempts are made to extinguish (or cause retroactive interference) of habits by removing the reinforcement that accompanies the behavior that needs to be changed. Boutin (2002) has argued that removing reinforcement does not lead to unlearning in primates because the original learning is not destroyed but instead new learning is stored "alongside" so that environmental cues can potentially elicit either the old or the new behavior. This claim is supported by neuroscience evidence that two functionally different neural systems are involved in extinction and learning and only one is influenced by extinction (Bahar, Smuel, Hazvi & Dudai, 2003). This duality may be part of the reason why, when we are cognitively overloaded, we tend to revert to the old covert and overt behavior we had hoped to change (for example, Shoham & Rohrbaugh, 1997).

Many other models have been proposed to understand the factors that contribute to behavior change, many of them focused on health-related or stereotype bias behaviors (see for example a review by Webb & Sheeran, 2006). Most models are designed to predict changes in conscious, willful behaviors over which individuals and groups have a large measure of control. Yet many change models assume that some element of the behavior to be changed is perceived as outside of an individual's control such as automated stereotypes. Sasaki (2002) has argued that the research on changing stereotypes reflects most of the primary strategies employed to modify automated cognitive behaviors. His overview of the range of strategies implemented in order to change automated stereotypes identifies three main types of change interventions: Overlearning; goal substitution; and activating an automated process to modify or replace maladaptive automatic processes.

Overlearning the New to Unlearn the Old

Automated behaviors are difficult to change in part because of the strength of the connections between situational cues and a dysfunctional behavior. Automation requires many hours of repeated application which results in very powerful links that must apparently be circumvented, broken somehow and/or replaced for change to take place. Overlearning of the new behavior has been suggested as a remedy. It has a very long history in psychology (see for example, Krueger, 1929) and it requires that practice extend far beyond one trial where a new strategy has been successfully applied. In most overlearning change processes participants are asked to continue to practice their changed behavior for many days or weeks beyond the point where they can be said to have "learned". Effective overlearning also requires increasing variety in practice events in many different settings or contexts accompanied by continual feedback about success (Clark & Blake, 1997). Driskell, Willis and Copper (1992) conducted a meta analysis on

overlearning studies and reported a moderate effect size for studies where the longer the overlearning was practiced, the longer the new knowledge persisted. They reported a lower effect size for cognitive tasks than for motor tasks but cautioned that motor tasks may be practiced more between immediate and delayed testing. One of the difficulties in generalizing from existing overlearning studies is that in many experiments, new strategies are not replacing fully automated knowledge.

Yet Kern, Green, Mitchell, Kopelowicz, Mintz & Liberman (2005) describe an overlearning experiment where about 60 schizophrenic patients were assigned to either symptom control treatments or the extended overlearning of three social problem solving strategies for use in work settings. The strategies were replacing previously learned (and presumably automated) dysfunctional social interaction strategies. Kern et al (2005) report successful replacement of inappropriate social responses for their subjects after two days and successful transfer when retested three months latter. Sasaki (2002) also describes a number of successful overlearning studies that succeeded in countering ethnicity stereotypes. However Sasaki cautions that overlearning is a very time consuming strategy and that the results are specific to the content of the overlearned behavior. So for example, reducing a person's inclination to stereotype a specific ethnicity does not influence their stereotyping of other ethnicities. In addition, Nelson, Leonesio, Shimaura, Landwehr & Narens (1982) offer compelling evidence that overlearning may induce overconfidence about change. They report that the strength of people's inaccurate feelings of knowing and using of overlearned strategies that they are in fact not using increases with increases in overlearning activities. Finally, both Anderson's (1993) ACT-R theory and Cognitive Load Theory (Sweller, 1994) would predict that unless the strength of the relationship between the conditional cues that elicit the new automated behaviors is stronger than the cue strength of the dysfunctional behavior, then despite overlearning, cognitive overload will most often lead to the expression of the stronger dysfunctional behavior. It seems therefore that while overlearning may help modify very specific automated behaviors that occur in specific contexts, it is a very costly process that does not generalize, may contribute to error prone self-awareness of the use of the new behavior and may not replace the old behavior when cognition is overloaded.

Strengthened Intentions to Change and Goal Substitution

Where a lack of perceived control is at issue, most change models propose that strong intentions to change automated behaviors are helpful. Intentions to change presumably allow us to pause before automated routines are implemented and redirect or substitute our behavior into more desirable alternative paths. Thus aggressive behavior is replaced with "counting to ten" or other self-control strategies and when we are inclined to eat candy our conscious intentions allow us to snack on a healthier choice such as carrots. This approach does not claim that old behaviors are "unlearned" but instead "circumvented". It has also been suggested (e.g. Bandura, 1998) that increased intentions to change result from an increased sense of personal control and efficacy over the behavior to be changed. Some level of self efficacy may be a necessary (but not sufficient) condition for implementing change strategies.

Gollwitzer (1999) describes a number of studies where intentions to change help overcome previously automated and dysfunctional stereotype behavior. Intentions also appear to be very important in so-called "staged" models of change such as the Trans Theoretical Model (TTM) of Prochaska, Norcross & DiClemente (1995). TTM is focused on automated health behaviors and it hypothesizes a five-stage model through which individuals and organizations progress (and relapse) in their pursuit of change. The first three stages involve *precontemplation* (I/we have no need to change), *contemplation* (I/we need to think about change) to *preparation* (I/we are preparing to change). Intention is presumed to increase dramatically from stage one to stage three when change is successful. Applications of the TTM model to treat addictive behaviors have increased success addiction treatment rates from a dismal 2 percent to a more optimistic 21 percent (Prochaska, Norcross & DiClemente, 1995). The increased success appears to be due in part to the strong impact of TTM treatments that gradually increase intentions to change.

However, a conservatively designed meta-analysis of the intentions research by Webb & Sheeran (2006) offers a more moderate view of the impact of intentions on personal and collective change experiments that averaged about 15 weeks in duration. Their data supports the generalization that moderate to strong increases in intentions to change ($d = .66$) leads to a small to medium change in behavior ($d = .36$). Another way to describe their results is to suggest that a 21 percent increase in intention to change produces an average 11 percent increase in change scores. Webb & Sheeran (2006) suggest that intentions may have a powerful effect on automated behaviors because they may activate more positive goals to pursue different behavior and that these substituted goals might be activated "…in a manner that bypassed participants' self-reported intentions." (p. 260). They also reported that features of change programs such as incentives for new behavior and for staying in the program and social support, pressure and encouragement double the average impact on both intentions and behavior change. They point to the research described by Bargh et al, (2001) as a model for the way that intentions elicit implicit goals.

Sasaki's (2002) review of attempts to change automated stereotypes suggests that an unintended "ego depletion" side effect may occur when change programs focus on increasing conscious intentions. Studies by Baumeister, Bratslavsky, Muraven, & Tice (1998) and Richeson & Trawalter (2005) provide evidence that increasing effort invested in interrupting automated behaviors results in significantly decreased persistence and performance on subsequent cognitive tasks. Sasaki suggests that when we invest conscious effort at self-control we may deplete limited inner resources for subsequent self-regulatory efforts.

Automated Unlearning Processes

Durable change seems to require that we invest intentional effort to unlearn a frequently applied but negative behavior and replace it with a more positive goal. One intriguing possibility for unlearning automated overt and covert behaviors comes from research on the "cognitive dissonance" phenomenon (Rokeach, 1971; 1975). Dissonance is presumed to occur after we make decisions and experience conflict between at least two goals – the one we chose and the one we rejected. Rokeach (1971) claimed that dissonance requires

a conflict between goals, values or attitudes. When our individual values conflict, conscious mental deliberation about alternatives (cognitive dissonance) produces changes in values and behavior. He induced value conflict in a large experimental population of college undergraduates by pointing out that they held conflicting (irreconcilable) values for both individual freedom and social equality (Rokeach, 1971). His control group read essays on freedom and social equality. He reported significantly more value change in his experimental group when change was assessed up to five months later by unobtrusively counting the number of experimental and control students who responded to mailed requests to attend meetings in support of social equity and those who responded to mail solicitations for money in support of the NAACP, a racial equity association. Rokeach (1975) later claimed that value and behavior change could occur if people simply see a discrepancy between their values and those of their peers. He provided evidence that the greater the self-peer value discrepancy the larger the value and behavior change that resulted. Rokeach (1975) described the cognitive dissonance process as a conscious and effortful process where individuals and groups analyze incompatible value conflicts and gradually increase the attractiveness of values and behavior that are more desirable while reducing the strength and attractiveness of less desirable behaviors.

In an interesting twist on Rokeach's claims, a recent study by Lieberman, Ochsner, Gilbert, & Schacter (2001) suggested that behavior-induced attitude change may be an automatic response to forcing a choice between two valued goals. They induced dissonance in population of adult amnesiacs and matched controls with intact memories and found that not only did the amnesiacs display attitude and behavior changes consistent with dissonance-reduction, but when compared with a non-amnesiac sample, they achieved change more quickly and effortlessly without actually being able to remember that the conflict that produced the change. This led Liberman et al. to claim that the conscious processing of choices may actually have inhibited the automatic process of dissonance reduction and behavior change for the non-amnesiac sample. In a second experiment, Liberman et al induced a high cognitive load in one of two groups of non-amnesiac subjects who where performing a similar task and found that the high load group achieved value and behavior changes more quickly than the low load group. The Liberman et al. (2001) study results fits with similar studies of the impact of overloading working memory (e.g. Clark, 1999; Flad, 2000, Gimino, 2000) and with studies on the impact of ironic processes (Wegner, 1997) and offer an intriguing new development in attempts to change automated behavior.

Another unusual and tantalizing area where automated processes may serve to aid in the unlearning of automated knowledge can be found in recent research on "mindfulness", described as "…paying attention in a particular way: on purpose, in the present moment and nonjudgmentally" (p. 40, Kabat-Zim, 1993). Mindfulness is a therapy technique based on Eastern meditation where people are taught to pause and engaging in a brief meditation where they recognize what is happening at the moment (for example, focusing on their breathing or physical activity) as a benevolent observer rather than as a resisting, sometimes frightened and struggling participant. The evidence for the efficacy of this approach with very intractable problems such as serious depression relapses, is striking. For example, Segal, Williams & Teasdale (2002) report approximately 56 percent greater reduction in depressive relapses in a one year randomized clinical trial when mindfulness

therapy for high risk patients who had experienced three previous serious depressive events was compared with other therapy strategies. Segal et al's analysis indicates that the benefit was most likely due to an automated process that was unconsciously supported by mindfulness meditation training rather than helping patients consciously recognize and cope with life events that bring on depressive relapses. The mindfulness phenomenon may be associated with the finding reported in a series of studies by Custers & Aarts (2005) that when positive emotions are unobtrusively associated with desired goals it promotes the motivated nonconscious pursuit of the goals.

Socially Supported Change Feedback

The final strategy to be discussed may be the easiest to implement (compared to those described above). Dunning (2005) makes a case for constant, systematic, candid peer assessment is available and encouraged. In medicine for example, peer review of organizational, team and individual contributions to medical emergencies in "morbidity and mortality" conferences is often candid and direct. In business, encouraging the appointment of board members who are capable, independent and candid advice has been found to help chief executives and their management teams avoid or recover from the expensive mistakes that result from over confidence and faulty self assessment. Some of the more effective forms of so-called "360 evaluation" strategies may help distribute the benefits of candid feedback throughout an organization. Ericsson, Krampe and Tesch-Romer's (1993) research on the development of experts who make original contributions in all fields indicates that candid and constant feedback is an essential component of success. Those experts who achieve the most are those who engage in what he terms "deliberate practice" – defined as a consistent focus on practice of necessary skills in areas where their skill set is least developed. Some appear to get feedback from teachers, coaches, mentors, friends, family and a few seem to learn to provide their own feedback. Ericsson claims that few top experts succeed without constant corrective feedback about their weakest area of performance.

Kluger and DeNisi (1998) conducted an extensive meta-analysis of over 300 feedback studies from many cultures and contexts. Their results indicate that when people make mistakes or fail to achieve their goals, feedback that is focused on the need to modify a strategy is more effective than feedback that informs a person or group that they have failed and emphasizes the failure. They reason that negative "person focused feedback" may lead to resistance and continued self deception whereas strategy focused feedback that emphasizes self development through improving strategies is more easily accepted and implemented.

Conclusion

It appears that we may often fail more often than we realize in our attempts at individual, organizational and social change and that we routinely engage in self-deception to insulate ourselves from the implied failure that characterizes unsuccessful efforts to change. It also seems likely that one of the largely unexamined reasons for our failure to

move away from familiar but harmful behaviors is that they become automated, unconscious and highly resistant to change.

Of course unconscious cognition appears to be an essential element of thinking and problem solving. Automated knowledge allows us to overcome limitations on working memory and frees our conscious mind to elaborate and generate novel ideas. Sweller (2006) speculates about another possible benefit when he suggests that the huge amount of time and effort required to automate cognitive processes gave us a distinct evolutionary advantage because it insures that our most durable learning is highly accurate and very difficult to change. By comparison, conscious declarative knowledge is easier to learn and modify -- yet it can be very inaccurate. Learning automated knowledge requires hundreds of hours of repetition over long periods of time and only automates when it is perceived as successful. Sweller asks us to consider what would happen to us if we had the capacity to quickly and impulsively modify a large portion of our cognitive skills in ways that turned out to be inaccurate and life threatening.

Yet we must acknowledge that some of our automated cognition may, perhaps unintentionally, serve personally and socially destructive ends. This is certainly the case with racial and ethnic prejudice, poor health behaviors, and inaccurate beliefs about self control, science, social interactions and problem-solving as well as the use of violence and war to solve personal, religious and political conflicts.

If we are indeed aware of only 30 percent of our own mental processes when they operate on familiar goals and tasks, perhaps we need to invest more of our limited research funding to achieve a better understanding of unconscious cognition and ways to change automated processes that are personally and socially destructive?

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