Increasing Postural Safety In A Simulated Office Setting
Using Real-Time Freeze-Frame Feedback

by

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Abstract

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Behavioral safety interventions identify safe or at-risk components of individual job performance and use interventions focused on training, goal-setting, feedback, prompts, and recently, self-monitoring procedures to reduce at-risk performances. Modern technologies have introduced real-time video procedures as an addition to the self-monitoring techniques, which may increase the salience and effectiveness of the self-monitoring procedure. The present research used a nonconcurrent multiple-baseline across-participants experimental design to assess the effectiveness of real-time freeze-frame feedback on postural safety of computer users. Results showed that freeze-frame feedback effectively increased safety performance from baseline to intervention for most targeted postures. Contrary to expectations, the addition of a self-monitoring component for half of the participants led to a decrease in safety performance across most postural targets.

Dedication

I dedicate this manuscript to the person who patiently supported and motivated me every step along the way, who is my best friend, and my source of laughter and Zen. This is to you, Mario.

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In 2006, the Bureau of Labor Statistics reported 1.2 million cases of occupational injuries and illnesses requiring days away from work (Bureau of Labor Statistics, 2008). Of the 1.2 million cases reported, 357,160 injuries and illnesses were the result of musculoskeletal disorders (MSDs) at work. MSDs are injuries such as sprains or tears, of joints, cartilage, spinal discs, muscles, nerves, tendons, or ligaments. Two types of MSDs are repetitive strain injuries (RSIs) or cumulative trauma disorders (CTDs). MSDs tend to develop gradually and can become chronic disorders (Vi, 2000). These disorders tend to be very painful and often keep employees away from work for long periods of time (Campeau, 2006).

The Cost of MSDs

The Occupational Safety and Health Administration (OSHA) estimates that the annual direct costs of MSDs are between $15-18 billion in the US alone (OSHA, 2008a). These costs arise from companies paying mandatory worker compensation that supports the employee financially while recovering from the work-related injury, and subsidizes the cost of medical payments related to the injury. It is also estimated that additional indirect costs for MSD-type injuries, spent for finding a replacement for the injured worker, or training new employees to replace the missing worker, are three to four times as high as the aforementioned direct costs (OSHA, 2008).

Population Vulnerable To MSDs: Computer Workstation Users

Within the group of workers that tend to develop MSDs, one group stands out in particular: computer users. The number of employees relying on computers at work is rising steadily, thus also increasing the potential costs related to MSD development. According to the most recent review by the Bureau of Labor Statistics, there were 77 million employees who used a computer at work in 2003 (Bureau of Labor Statistics, 2008b). This number translates into 55.5% of the US workforce. It is reasonable to assume that this number is even higher today and will continue to rise in the future. This assumption is based on the fact that the occupations with the largest percentage of computer usage in 2003 were managers, sales and office workers. According to the Occupational Outlook Quarterly Online (Bureau of Labor Statistics, 2008c), all of the aforementioned positions are expected to show substantial growth between the years of 2006 to 2016. With more and more employees using computers at work, there is an increased risk for computer-related disorders to occur in the general population.

Thus, OSHA and others have developed a renewed interest in the development in and implementation of interventions to prevent MSDs in computer users specifically. One strategy to develop these interventions is to address the causes of MSDs directly. Research has indicated that repetitive and excessively forceful movements of the extremities, such as hands and fingers, unnatural body postures and long work hours at computer workstations all contribute to the development of MSDs (Tittiranonda, Rempel, Armstrong, & Burastero, 1999). In addition, flexed wrists, working at non-adjustable workstations, typing with elbows pointing outward, and bending the neck forward from the top of the trunk are precursors to discomforts related to the development of MSDs (National Institute of Occupational Safety and Health (NIOSH), 1997; Turville, Psihgios, Ulmer, & Mirka, 1998).

Computer Workstations and the Science of Ergonomics

The knowledge about the factors of repetitive and excessively forceful movements related to the development of MSDs has been incorporated into different ergonomic treatments. Ergonomics is the scientific study of an individual's work environment that seeks to maximize an individual's well-being and performance on the job that does not cause pain, injury or other detrimental effects (American Foundation of Government Employees (AFGE), 2008). For example, an ergonomic approach to reduce injuries and at-risk posture for electrical contractors engaged in heavy lifting tasks would consist of training safe lifting practices, updating current equipment, and training workers to discriminate when to use a machine for lifting. Ergonomics has become such a prominent approach that both NIOSH and OSHA have created subdivisions solely devoted to improving workplace safety through ergonomic interventions.

One of the key elements of the ergonomic safety approach relates to workstation design. An ergonomic workstation allows employees to assume a neutral position while working in the absence of excessive impact on joints, tendons, muscles, nerves, spinal discs or ligaments and maintain high productivity (AFGE, 2008). The term "neutral" refers to a comfortable work position in which all joints of the body are naturally aligned (OSHA, 2008b). For employees working at computer workstations, research on ergonomics has resulted in a set of nationally accepted safety guidelines published by OSHA. These guidelines include instructions for 1) monitor height, viewing angle, and distance from viewer, 2) keyboard height, distance from user, and design, 3) mouse placement, size and design, 4) wrist and palm support design, 5) desk design and size, 6) work-chair composition and height, and 7) telephone placement and use (OSHA, 2008b).

Limitations of Ergonomic Designs

Studies that focus on workstation changes using the guidelines previously described have shown a decrease in the development of MSDs (e.g. Culig, Dickinson, Lindstrom-Hazel, & Austin, 2008). However, even a very well-designed work environment does not always guarantee safe performance, especially when there are pressures to complete projects quickly or employees must type continuously (OSHA, 2008b). In other words, the ergonomic design of work stations does not automatically result in optimal and healthy postural typing behaviors. Thus, to reduce the probability of MSDs by employees working primarily on computers, other methodologies that focus on the behavioral improvement and maintenance must be employed to complement the ergonomics approach.

Expanding on Ergonomics: Behavioral Safety

Behavioral safety is an approach that has been shown to increase desired safety responses effectively in the workplace. Behavioral safety is a systematic approach for reducing workplace injuries and illnesses using the principles of applied behavior analysis. Specifically, the behavioral safety approach consists of 5 fundamental steps (Sulzer-Azaroff & Austin, 2000):

1. Identify behaviors that impact safety.
2. Define these behaviors precisely enough to measure them reliably.
3. Develop and implement mechanisms for measuring those behaviors to determine their current status and set reasonable goals.
4. Provide feedback.
5. Reinforce progress.

The effectiveness of this approach has been well-documented in many different settings, such as improved safe performance by workers in food manufacturing (Komaki, Barwick, & Scott, 1978) construction (Austin, Kessler, Riccobono, & Bailey, 1996), managed care (Babcock, Sulzer-Azaroff, & Sanderson, 1992), and vehicle maintenance (Komaki, Heinzmann, & Lawson, 1980).

Komaki, Barwick, and Scott (1978) used behavioral safety techniques to improve the safety performance of employees in the make-up and wrapping departments within a wholesale bakery of a large food processing plant. The two departments were targeted because of their high accident rates. A multiple-baseline across- departments experimental design was used to investigate the effects of training, goal-setting and feedback on safety performance.

Before baseline, the responses leading to accidents in each department were identified by analyzing accident reports from the previous 3 years. After the desired and undesired safety behaviors were identified and clearly defined, baseline began (Komaki, Barwick, & Scott, 1978). Before the first intervention session, employees were presented with a 30-min training session that consisted of slide presentations of safe and unsafe performance samples. In this training session, unsafe performance samples were always followed by clarifications as to why a given sample was deemed unsafe, and a demonstration of the desired safe performance. After the training session ended, employees were shown a graph detailing their baseline performance, which was updated with new data after each new observation. Results showed that average baseline performance of 70% increased to 95.8% safe in the wrapping department, and baseline performance of 77.6% in the make-up department had increased to 99.3%. Thus, the behavioral safety intervention effectively increased desired safety performance in this setting.

Behavioral Safety and Computer Workstation Users

As indicated earlier, the behavioral safety process has effectively been implemented across various settings. More recently, behavioral researchers have recognized the need to develop effective procedures to increase postural safety by computer users to reduce the likelihood of developing MSDs. Thus, behavioral safety studies have focused on improving postural safety of computer workstation users both in laboratory settings (Alvero & Austin, 2004; Fante & Austin, in press; Sigurdsson & Austin, 2008) and applied settings (Culig, Dickinson, Lindstrom-Hazel, & Austin, 2008; Gravina, Lindstrom-Hazel, & Austin, 2007; McCann & Sulzer-Azaroff, 1996; Sasson, & Austin, 2004).

One of the first laboratory studies using behavioral safety with computer users was conducted by Alvero and Austin in 2004. In this study, undergraduate students were asked to engage in three tasks in a simulated office setting. Specifically, the participants were asked to transcribe a text into a computer, dial a phone number and leave a message on the answering machine, and move a cardboard box by picking it up from the floor and put it on a chair, taking one piece of paper out of the box, and placing the box back on the floor. Participant performance was assessed by measuring whether the back was straight and knees were bent during lifts; whether neck and wrist positions were safe during typing; whether back, shoulder and feet positions were safe during sitting; and whether the neck was aligned properly when using the phone. After baseline performance stabilized, participants were exposed to an information only phase that consisted of participants receiving definitions of what constituted safe performance on the 8 targets. After performance stabilized, the second intervention phase began. This phase consisted of participants observing a confederate engaging in the same tasks that the participants themselves were engaging in during their own sessions. In addition, participants were provided with definitions of what constituted safe performance on the 8 targets, as well as a checklist that was used to measure the confederate's safety performance while engaging in the 3 tasks described earlier. Results showed that after observing and evaluating confederate performance, participants themselves performed the target responses more safely than before the information sessions. The researchers concluded that safe posture could be improved dramatically when observing and evaluating another individual engaging in the same tasks.

The results of this study prompted Sasson and Austin (2004/2005) to investigate whether this same effect would occur in an applied setting. In their study, 11 computer terminal operators were divided into two groups and either exposed to an intervention consisting of safety instructions and safety performance feedback, or an intervention that consisted of first observing and evaluating the safety performance of other computer terminal operators before receiving instructions and feedback on their own performance. Results showed that the safety performance increases observed in the instructions, observation and feedback group were greater than those observed in the instructions and feedback alone group. However, safe posture did increase above baseline-levels for both groups.

Best Practice: Combining Behavioral Safety and Ergonomics

At the start of both of the aforementioned studies, the workstations were ergonomically setup according to OSHA guidelines, thus indicating that a joint ergonomic and behavior-based treatment approach might be necessary to maximize safety performance. To test this assumption, Gravina, Lindstrom-Hazel, and Austin (2007) conducted a multiple-baseline design study across five office workers in a university library to increase safe posture while typing. Safe posture was measured for seven target responses: 1) head/neck position, 2) hand/wrist position, 3) shoulder position, 4) back position, 5) arm position, 6) leg position, and 7) mouse use. The first intervention began with a change of the workstation to ergonomically appropriate standards, followed after several sessions by an update of the typical keyboard to a specifically designed ergonomic roller mouse keyboard. After performance stabilized, a behavioral safety process involving peer observations was presented (similar to those in the Sasson & Austin, 2004, study), and in a final intervention phase, graphic feedback was added. Results showed that ergonomic manipulations and the roller mouse keyboard alone increased safety performance across most responses. However, pairing ergonomic changes in workstations with the behavioral interventions of peer observations and graphic feedback increased all safety performance components to substantially higher levels than during baseline, and to higher levels than observed during the previous two intervention phases. Thus, the researchers concluded that a comprehensive ergonomics and behavioral safety approach may be best to maximize postural safety in employees working on computer workstations. These results were recently replicated in an applied study by Culig, Dickinson, Lindstrom-Hazel, and Austin (2008).

Behavioral Safety, Ergonomics and the Computer Workstation User Working Alone

The studies on improving postural safety have shown that behavioral safety approaches can effectively increase safe posture in computer users. However, in all of the studies mentioned so far, the implementation of the behavior-based intervention required several individuals, e.g. the confederate, and the experimenter or supervisor. Many employees who work at computer workstations are lone workers, thus making the interventions described earlier difficult and very costly to implement. A lone worker is defined as any employee who works “out of view or earshot of another person and who doesn’t expect a visit from anyone for an extended period of time” (Security Director’s Report, 2004). To date, the number of studies focusing on lone workers in general, and lone workers working at computer workstations is very limited (see Olson & Austin, 2001). Some researchers have recently conducted studies with lone workers implementing interventions using self-monitoring techniques. Self-monitoring refers to the observation and evaluation of one’s own behavior, which lends itself well to be used with lone workers.

In a study by McCann and Sulzer-Azaroff (1996), self-monitoring was part of a comprehensive intervention aimed at decreasing the risk of developing carpal tunnel syndrome (a type of MSD) and increasing safe overall posture in secretaries. The secretaries’ job was primarily solitary and required them to type on a keyboard regularly. Participants engaged in a simple typing task while their body posture and hand/wrist positions were monitored. After baseline data stabilized, a discrimination training procedure was presented that involved pictorial examples for both safe and at risk posture. Training was followed by a self-monitoring component, during which participants observed their own responses. Finally, feedback, goal-setting and reinforcement were presented for the targets?. Results showed that training and self-monitoring increased safe posture for all postural targets; and the addition of feedback, goal-setting and reinforcement led to further increases in safe posture that was substantially safer than during baseline. However, this study used a multi-component intervention, so that the self-monitoring effects on safe posture could not be separated.

Behavioral Safety and Self-Monitoring

Gravina, Austin, Schoedtder, and Loewy (2008) investigated whether a self-monitoring procedure presented alone would be an effective intervention to increase safe posture. The authors used a self-monitoring intervention to increase safe posture of undergraduate students who engaged in a typing task and an assembly task separately in a simulated office setting. Before the start of the study, the computer workstations were ergonomically adjusted to each individual’s requirements as determined by OSHA standards (2008b). A hidden camera was used to record performance, and a CD player was programmed to prompt self-monitoring by playing a beeping sound at irregular intervals four times throughout each session. Participants engaged in each of the two tasks within each session. Before the first baseline session, participants were provided with definitions for safe posture for each of six target responses: back, shoulder, head, wrist, leg, and arm position. Additionally, participants were asked to demonstrate safe posture and were provided with corrective feedback if unable to demonstrate safe posture initially. During baseline, participants marked a blank box on a sheet of paper whenever the beeping sound occurred. After baseline data stabilized, the self-monitoring intervention was implemented. During the intervention, participants were asked to record on a self-monitoring form presented to them by the experimenter whether their posture was safe or at risk while engaging in the experimental task at the time the beeper sounded. Results showed that self-monitoring increased safe posture for all target responses, although that increase was moderate and in some cases could not be sustained across sessions. The authors argued that additional studies should increase the salience of the self-monitoring process to further increase changes in safe posture.

Increasing the Salience of Self-Monitoring Process: Real-Time Video Feedback

One way to increase the effectiveness of the self-monitoring process is to increase salience by incorporating real-time video feedback components into the intervention. For example, Sigurdsson and Austin (2008) increased safe posture in participants engaging in a transcription task in a simulated office by use of real-time video feed presentations paired with an integrated, computerized self-monitoring procedure. Eight undergraduate students participated in this study. Before the start of the study, each individual's proper workstation setup was determined using OSHA guidelines (2008b), and participants were asked to demonstrate safe posture. Participants were also asked to consent to being videotaped with a clearly visible camera placed in the experimental room. Before each session in the first phase, the information phase, participants were asked to read and initial a safety handout that defined safe posture for each of the five targets. The five targets were: head/neck position, back position, arm position, hand/wrist position, and leg position. After reading the handout, participants engaged in a transcription task for 20 minutes, while the camera recorded their posture.

Before the first intervention session, discrimination training was conducted. Every participant was shown snapshots of his/her own safe and at-risk typing posture (Sigurdsson & Austin, 2008). Each participant was asked to identify the safe and at-risk examples and was given corrective feedback until they were able to correctly discriminate all samples. During the intervention sessions, a computer window containing real-time footage of the participant typing appeared in the right-hand side of the computer monitor. At the same time, a message in a separate window asked the participant to self-report whether he/she was exhibiting safe or at risk behavior for a given postural target the first time he or she looked at the feedback window. After the participant self-monitored, both windows closed and the participant was able to continue typing. The self-monitoring window and the real-time video feedback appeared on the computer monitor approximately every 50s.

Results in the Sigurdsson and Austin (2008) study showed that the treatment package consisting of discrimination training, self-monitoring, and real-time video feedback increased safe posture substantially for all but one postural response across all participants. These increases were greater than those observed in the Gravina, Austin, Schoedtder, and Loewy (2008) study, thus lending support to the idea that a more salient and lucid self-monitoring process with the addition of real-time video feedback may lead to larger increases in safe performance than self-monitoring alone. However, more studies need to be conducted to support this point.

Sigurdsson and Austin (2008) provided their own possible explanations for why this intervention might have been effective. First, the authors argued that participation in the study, specifically the movement of body parts into novel positions, may have allowed participants to experience kinesthetic stimuli they would not have experienced without participating in the study. These proprioceptive stimuli may have been more comfortable, i.e., by reducing pressure symptoms on the different body parts, than previous kinesthetic experiences, and thus the stimuli came to control participants' posture. Specifically, these new bodily sensations may have functioned as reinforcers, thus increasing the future likelihood of occurrence for this particular kinesthetic response. Secondly, the authors make the point that participants may also have developed verbal rules after discrimination training which came to control subsequent safety performance. In other words, participants may have connected the response-produced cues provided by safe behavior with the safety handout definitions provided at the onset of each session, which in turn may have functioned as a cue for expected or normative behavior. Thus, participants may have developed verbal rules such as “If I sit safely, I am doing what is expected of me”. However, the authors point out that increases in safe posture occurred immediately after presentation of the self-monitoring and video-feedback components, which indicates that although rule-governed behavior may have played a role in the effectiveness of the intervention, it probably was effective only as part of the complete intervention package.

Behavioral Functions: Self-Monitoring and Real-Time Video Feedback

Olson and Austin (2001) discussed four potential behavioral functions that have previously been associated with the self-monitoring process. Specifically, Olson and Austin argue that self-monitoring may function as 1) an antecedent that prompts desired behavior by clarifying expectations, may have 2) conditioned consequence function (either reinforcing or punishing), 3) may generate verbal rules for behavior, or 4) may serve a conditioned establishing operation function.

To date, the behavioral functions of real-time video feedback components have not been empirically isolated. Although video feedback is a common component in interventions aimed at increasing teaching or parenting skills in parents or staff working with individuals with disabilities (e.g., Delano, 2007; Phaneuf & McIntyre, 2007), the Sigurdsson and Austin (2008) study represents the first study to incorporate real-time video feedback into a behavioral safety intervention for computer workstation users. Video feedback may potentially serve behavioral functions similar to those ascribed to self-monitoring. If that is indeed the case, it can be assumed that the presentation of real-time video feedback alone may be sufficient to increase postural safety for computer workstation users.

In summary, there is a need for research investigating procedures that will enhance postural safety for lone workers working at computers. Previous research in ergonomics suggests that proper adjustment of individual workstations lays the foundation for safe postures to be exhibited. In addition, behavior- focused safety interventions may provide the additional processes necessary to maximize safety performance. Specifically, the differential effects of self-monitoring processes and video-based feedback on postural safety of computer workstation users should be further examined. The current manuscript describes two experiments conducted to answer the questions: 1) Does real-time freeze-frame feedback alone result in moderate to high increases in safe posture?; 2) Does adding a self-monitoring component lead to further improvements in safety performance?; 3) Does increasing the frequency of freeze-frame feedback result in greater postural safety improvements?

Experiment 1

The goal of the current study was to investigate the effects of a real-time freeze-frame feedback procedure on the postural safety of computer workstation users engaging in a transcription task. Real-time freeze-frame feedback referred to a snapshot taken by the computer from a live? camera recording of the participant's profile. The terms freeze-frame and snapshot will be used interchangeably throughout this manuscript. The study built on the Sigurdsson and Austin (2008) study by presenting individual snapshots of momentary safety performance to the participants, while also eliminating prompted, overt self-monitoring as an intervention component in the first of two intervention phases. The second phase was designed to assess whether freeze-frame feedback paired with self-monitoring could increase safety performance for those postural targets that did not respond to freeze-frame feedback alone in this particular setting.

Method

Participants

Six students from a Northeastern university participated in the present study. Participants were recruited with a flyer (Appendix A) distributed across the university campus. Six additional participants completed the pretest, but didn't meet the requirement for inclusion in the study.

Compensation

Participants received $5 for the initial consent and screening session as well as the discrimination task session. During experimental sessions, participants earned additional money for typing pages from a psychology textbook (Appendix B) into the computer. Participants were able to earn an additional 25 cents for each 100 words that were typed without spelling errors, omissions, and/or additions. The maximum amount a participant was able to earn in each session was \$8. For example, if a participant typed 840 words, and had 60 misspelled words, omissions and/or additions, the payment for this session was based on 780 words (each 100 words typed = \$.25). In this case, the participant received \$1.75 in addition to the \$5 base rate for a total of \$6.75 for this session. The number of accurate words typed was always rounded down if the number couldn't be divided by 100. The main purpose of the compensation scheme was to create a secondary contingency that would increase the external validity of the current study by simulating conflicting contingencies that tend to be in place in a typical office setting.

Session Duration

Participants scheduled up to two sessions a day, five days a week. Each session lasted approximately 30 minutes. Twenty minutes of each session were spent engaging in the transcription task in the experimental room, while ten minutes were allocated to reading the safety handout in the screening room and setting up the participant before the start of every session across all phases. If sessions were scheduled for the same day, the two sessions had to be scheduled at least two hours apart. The maximum number of sessions that could be scheduled in a given week was ten.

Setting, Materials and Software

The setting consisted of three separate rooms in a university research laboratory. One room, the experimental room, was set up to resemble an office. This simulated office was furnished with a chair, desk, and a Dell desktop computer with a 12.5 inch monitor, a standard keyboard and mouse. The computer ran Microsoft Word 2000 Windows Millennium Edition software. A custom program was created in Microsoft

Visual Basic. Itused the Windows Media Player interface was installed on this computer. A Microsoft webcam was mounted on a table to the right wall of the computer workstation. The camera was clearly visible to the participant and was positioned perpendicular to him/her, and was set to record a profile view of the body of each participant.

A second room, the scoring room, was used to record and observe participant safety posture during and after each session and to program the delivery of the video freeze-frame feedback. The room contained a computer workstation, including a Dell desktop computer, a desk and a chair. The computer was connected to the webcam in the experimental room. Additionally, this computer was networked to the participant's computer in the experimental room. The computer ran Microsoft Word 2000 Windows Millennium Edition software. Real-time freeze-frame feedback referred to a freeze-frame taken by the computer from a live camera recording of the participant's profile at regular time intervals. The delay between the snapshot being taken by the webcam, and the presentation of the snapshot on the participant's computer screen was approximately .03s. Freeze-frames were taken throughout the session, and saved on the experimenter-controlled computer. The computer was programmed to send a freeze-frame to the participant's computer at specific time intervals, while simultaneously saving that same photo to the experimenter-controlled computer.

The third room, or screening room, was furnished with a similar computer workstation setup as in the scoring room. This room was used for the typing pretest, the consent process, the discrimination test, and presentation of the safety handout before each session. The main reason for using this third room was to reduce the constraints of having only one experimental room while running back to back sessions throughout the day. The additional room allowed for a smooth transition from one participant to the next in regards to the individual workstation setup necessary before each session.

Pre-Experimental Procedures and Selection Criteria

Consent process. In the first session, participants were asked to read and sign a consent form (Appendix C). The consent form clearly described that participants would be videotaped during their sessions. Participants had to place a check mark next to one of two statements: “I DO authorize the researcher to videotape me during the experimental sessions” or “I DO NOT authorize the researcher to videotape me during the experimental sessions”. If the latter statement was checked, the experimenter read the early exit script (Appendix D) and informed the participant that he/she did not meet the criteria to continue in the study. If the first statement was checked, the participant was asked to perform the typing pretest. All participants consented to being videotaped.

Typing pretest. To participate in the study, potential participants had to type at least 150 words in 5 minutes, without looking at the keyboard while typing (see Appendix E for script used). This criterion was chosen based on our prior research (Tittelbach, Fields, & Alvero, 2007) and similar research conducted in other laboratories (Sigurdsson & Austin, 2008). The experimenter timed the typing pretest using a stop-watch. The participants were told to start as soon as the experimenter said “Go”. The word- count function in Microsoft Word was used to determine the number of words typed, regardless of accuracy. Six participants were excluded from the study, because they did not meet the pretest requirement.

Safe posture demonstration. After participants passed the typing pretest, participants were asked to demonstrate safe posture as defined on the safety handout they read at the beginning of all sessions to ensure that any subsequent performance was not due to the inability to sit in a safe manner. If participants did not display safe posture, the experimenter provided verbal corrective feedback (e.g., “reduce the angle between the middle of your upper arm and your forearm”) until the participant demonstrated safe posture across all six targets. After participants adjusted their posture, the experimenter said “ok” to indicate that the posture was now safe. All participants required corrective feedback for at least one postural target, and two participants required feedback for two postural targets. The body parts exposed to corrective feedback were back, arms, and legs.

Discrimination task. At the start of the first session in each phase the experimenter read instructions (see Appendix F for the script) to prepare the participant for the discrimination task. The participant was asked to read and initial a safety handout (Appendix G) that contained detailed descriptions of safe posture for six different body parts as defined by the OSHA (OSHA, 2008b) guidelines.

The discrimination task itself consisted of a 5-slide PowerPoint presentation shown to the participant before the first baseline session, as well as before the first session in each intervention phase. The purpose of this task was to determine whether each participant discriminated between pictures of unsafe and safe postures at various times within the research study. The 5 slides showed a confederate engaging in a typing task in a simulated office setting identical to the one the participants worked in. Participants were asked to score each of six postural variables as defined in Appendix F as either safe or unsafe in each picture. Each slide depicted all six postural targets and thus allowed for all six target variables to be discriminated as either safe or unsafe (head/neck, back, arms, wrists, legs, and feet). No feedback was given, and participants marked their answer on an answer sheet (Appendix H) presented by the experimenter. The experimenter left the screening room for 10 minutes to allow the participant to complete this task. For each subsequent presentation of this discrimination task, the pictures were randomized without replacement within each block.

For each postural target, there were two slides displaying unsafe posture, and three slides displaying safe posture. All angles were randomly selected, except for one safe example, which was purposely selected to be within 5 degrees of the safe angle definition. For example, according to instructions arms were considered to be safe if the upper arm and lower arm as measured from the elbow and through the mid-line of the upper and lower arm were positioned in a 90-110 degree angle. The safe arm sample was thus selected to be at 95 degrees.

Workstation setup. To ensure that any changes in levels of safety performance in the experimental sessions were due to the intervention and not due to an improper work environment, the workstation was adjusted for each participant as defined by OSHA standards on ergonomically correct workstation setups (OSHA, 2003). The initial adjustment measurements were obtained before the start of the first baseline session. The height of the chair was adjusted to allow the participant to reach the floor with his/her feet, while keeping the upper leg and knee in one straight line. Secondly, the monitor was adjusted so that the top of the screen stood at eye level of the participant, at least 20” and no more than 40” away from the participant’s face. These measurements were recorded for each individual participant and the workstation was set up to these measurements before each session.

Dependent Variables and Measurement

Six target behaviors were defined based on the OSHA guidelines (OSHA, 2003). Angles measurements were taken using an *Iconico Screen Protractor, Version 3.3*:

Head and neck. Head and neck were scored as safe if the head was in line with, or slightly forward of, the upper body. Eyes had to be level with the computer screen.

Back. The back was scored as safe if the lower lumbar region was fully supported by the back rest of the chair. In addition, the angle between the lower back and the upper legs had to be between 90-120 degrees.

Arms. Arms were scored as safe if the angle between the upper arm and lower arm as measured from the elbow and through the mid-line of the upper and lower arm was between 90-110 degrees. Arm position was scored as unsafe if the inside angle between upper and lower arm was smaller than 90 degrees or greater than 110 degrees.

Wrists. Wrists were scored as safe if they were parallel to the floor and in line with the lower arms. Wrist position was scored as unsafe if the back of the hands (or one hand) were bent upward or downward and not parallel to the floor.

Legs. Legs were scored as safe if the upper legs/thighs were parallel to the floor, and the lower legs vertical to the floor. The angle between the upper and lower legs had to be between 90-110 degrees. Leg position was scored as unsafe if the angle between the upper and lower legs was smaller than 90 degrees or larger than 110 degrees.

Feet. Feet were scored as safe if they were flat on the floor. Feet were scored as unsafe if they were not both placed flat on the floor.

Measurement of postural variables. Trained RAs evaluated the postural data based on a 30-second momentary time-sampling procedure (Alvero, Struss, & Rappaport, 2008). A scoring sheet containing the definitions for each of the six variables was used (Appendix If?). Each 30s interval was scored as safe (S), unsafe (U) or Not Applicable (?). Not applicable referred to instances where participants were not engaged in the typing task (e.g., they turned a page of the reading material, stretched, etc.) Percent safe posture were calculated for each target behavior per session by dividing the total number of intervals scored as safe by the total number of intervals scored as safe and unsafe, and multiplying by 100.

Typing productivity. Productivity of typing was measured by counting the number of words typed after each session regardless of accuracy using the Microsoft Word word-count function.

Typing accuracy. Accuracy per minute was measured by subtracting the number of misspelled words, text omissions and additions from the total number of words typed in each session and then dividing by 20 (the session duration in minutes). The auto-spell check function in Word was disabled throughout the study, but participants were still able to manually use spell check.

Independent Variables

The independent variables were freeze-frame video-based feedback delivered every 120s and self-monitoring. A momentary snapshot was taken from each participant's live video feed and was either presented alone, or in combination with self-monitoring to each participant. The freeze-frame of the participant's posture appeared on the participant's computer monitor without any text (i.e., the picture alone). The self-monitoring component required the participant to answer a set of postural questions in a pop-up window appearing next to the live snapshot for all of the six postural variables. Participants were asked “Are/Is your ___________ safe in this picture?” for each postural target. To the left of each question, participants were then asked to check a box with three possible answers (“yes” “no” “uncertain”).

Experimental Design

The design was a nonconcurrent multiple-baseline experimental design across participants (ABA/ABCA). The three main phases were Phase A: baseline, Phase B: freeze-frame feedback, and Phase C: freeze-frame feedback with self-monitoring. Three follow-up sessions were scheduled 7-10 days after completion of the initial experiment. All follow-up sessions were conducted as baseline sessions (Phase A), with the exception that participants were not asked to complete the discrimination task described earlier.

Procedure

Baseline (A). At the beginning of each baseline session, the participant was prompted to read and initial the safety handout described earlier (refer to page 20). After completion of this task, the experimenter read instructions to the participants (see Appendix J for the script) asking them to transcribe pages from a Psychology textbook (Appendix B) into the computer. During baseline, the participant typed for 20 minutes in each session without presentation of any visual feedback.

Stability criteria. Phase changes were scheduled after at least 5, but no more than 14 baseline sessions. The last three data points for each target were not to deviate more than +/- 20 percentage points from the phase average (Kazdin, 1982). Additionally, safety performance data had to be downward trending or showing no upward trend across at least four of the six target responses for a phase change to occur from baseline to the first intervention. For example, a downward trend might consist of successive safety percentage scores of 85%, 60%, 55%, 30%, and 0%. Safety performance percentages that show no trend might consist of scores of 60%, 55% 58%, 60%, and 62%.

Intervention (B): Freeze-frame feedback. Before participants began the intervention phase, they were asked to complete another discrimination test (see subheading "discrimination task" on page 21). After the completion of the discrimination task and at the start of each session thereafter, participants were informed (see Appendix K for the script) that they would receive visual feedback regarding their posture at regular intervals throughout the session. The live snapshot of the participant was presented every 120s. The picture remained on the screen for 15s before automatically closing. The delay between the snapshot being taken by the webcam, and the presentation of the snapshot to the participant was approximately .03s. The participant was not able to type while the freeze-frame feedback window appeared, but was allowed to continue typing once the window closed.

Intervention (C): Freeze-frame feedback with self-monitoring. Procedures were as described above, except that visual feedback was presented in conjunction with self-monitoring (see Appendix L for the script). Self-monitoring involved answering a question ("Are/Is your _______ safe in this picture?") for each of the targets that received an average percent safe score of 80% or below across Phase B. The self-monitoring questions were displayed in a pop-up survey window that appeared next to the freeze-frame feedback window every 120s (see Appendix M for a sample of the window). The participant was told to respond by either clicking "YES", "NO" or

"UNCERTAIN" on the right side of each of the six questions. The participant had to answer all questions before being able to submit the answers by clicking on the "SUBMIT" button on the bottom of the survey window. Once the participant clicked on the submit button, the survey window disappeared. In addition, if the participant did not submit all answers within 15 seconds, the survey screen closed automatically. No feedback was presented for the self-monitoring responses made. The real-time snapshot remained on the screen for 15 seconds before closing automatically. The participant was not be able to type while the freeze-frame feedback and survey windows appeared, but were allowed to continue typing once the two windows closed.

Participants were exposed to this intervention only if (a) they had been assigned to this group and (b) safe posture remained at or below an average safety score of 80 percent for at least one of the targeted responses in the previous phase. Thus, if 4 out of the 6 targeted responses achieved safety scores of around 90%, and the fifth response was scored as showing a safety level of only 40%, Phase C was implemented for the responses that were below the 80% criterion only. However, only 50% of all participants who met criterion to be included in the second intervention phase were actually moved to that phase. This was done to compare the results of prolonged exposure to the first intervention phase to the results of introducing the self-monitoring intervention. Participants were randomly selected to continue with the freeze-frame only intervention or to be exposed to the freeze-frame feedback with self-monitoring intervention.

Follow-up sessions. After completion of the study after either phase B or phase C, participants were scheduled for three more sessions after a break of at least 7, but no more than 10 days. These follow-up sessions were conducted in the same way as baseline sessions. The purpose of the follow-up sessions was to determine if the improvements in safe posture were maintained across time.

Exit questionnaire. At the end of the study, participants were asked to complete an exit questionnaire (Appendix N). This questionnaire was used to assess the social validity of the study, as well as to improve future extensions on the current study. The questionnaire content and format was based on the questionnaire used in the Sigurdsson and Austin (2008) study. After participants completed the questionnaire, the experimenter explained the purpose of the study, and allowed the participant to ask questions. Finally, the participant signed a document that detailed all payments made based on participation in the current study (Appendix O). Participants could choose to be paid after each session, at the end of each week of participation, or at the end of the study.

Inter-observer agreement (IOA). Inter-observer agreement was calculated for at least 30% of the sessions for each participant and phase. IOA was calculated for each individual target response and each participant every 30 seconds on a point-by-point basis. Final IOA percentages were calculated by dividing the number of agreements by the combined number of agreements and disagreements and multiplying by 100.

Data analysis. Effect sizes (Cohen's *d*) were calculated by contrasting performance during baseline sessions with performance during the first intervention phase (Phase B). Phase B mean safety performance scores were subtracted from Phase A mean safety performance scores for each target response. The resulting number was then be divided by the pooled standard deviation across both phases to obtain Cohen's *d* (Cohen, 1969). The same process was used to compare performance in Phase B to Phase C.

Productivity. Average typing productivity per minute was calculated by adding the total number of words typed in each session by the number of minutes per session.

Self-monitoring accuracy. For variables exposed to the self-monitoring phase (Phase C), self- monitoring accuracy was assessed by dividing the number of agreements between the result of the participants' own self-monitoring and the actual safety performance as defined by an independent research assistant by the number of disagreements plus agreements. The resulting number was then multiplied by 100. Research assistants were presented with the snapshot that the participant self-monitored as part of the total number of snapshots scored at the end of the session. The researcher had a time-stamped list of those snapshots that had been self-monitored, and was thus able to directly compare the scores.

Results and Discussion

Results show that real-time snapshot feedback effectively increased safety performance from baseline to intervention for most postural targets. However, the addition of the self-monitoring component led to a slight decrease in mean safety performance across most postural targets. For some participants there was a further decrease in mean safety during follow-up sessions. Safety performance on postural variables not targeted in each individual participant's intervention are not discussed in this section, as safety performance for these postural variables remained at safety levels of 90% or higher throughout all phases of the study.

Freeze-Frame Feedback Alone

Figures 1, 2, and 3 show the results of the freeze-frame feedback intervention on safety performance across each of the three postural targets for participants 207, 210, and

213. Table 1 displays the corresponding descriptive statistics. All three participants were exposed to the baseline phase, followed by a real-time freeze-frame feedback intervention phase, and a return-to-baseline follow-up phase.

For participant 207, the freeze-frame feedback effectively increased average safety performance across all three targets. The most substantial improvement in average safety performance was observed for head and neck. Data were stable and near 0% during baseline, and improved to near perfect safety levels in the intervention phase. The second largest increase was observed for arms for participant 207. In this case, average safety scores showed an initial jump to 100% safe, followed by a decrease to near baseline levels, and a subsequent progressive increase reaching safety levels around 85% safe at the end of the phase. Average safety scores for the third variable, legs, were at zero during baseline, and increased during the intervention, but data were highly variable from session to session. In the follow-up phase, safety performance minimally decreased for head and neck, and remained consistent with average intervention performance for arms and legs.

For participant 210, the freeze-frame feedback intervention increased average safety performance for only one of the three targets. Average safety scores for back increased slightly during the intervention phase, but remained variable. For arms and legs, average safety performance showed an increase in variability during intervention, but average safety performance remained at near zero levels for the majority of the phase. During follow-up sessions, average safety performance decreased to baseline levels for back and legs, while average safety performance increased slightly more for arms, showing an upward trend across sessions.

Participant 213 was exposed to the intervention for only two postural targets, head and neck, and legs. The freeze-frame feedback intervention effectively increased safety performance for both targets. Both targets showed a jump from near zero baseline levels to 100% stable safety levels during intervention. This participant was not exposed to the follow-up sessions.

Freeze-Frame Feedback With and Without Self-Monitoring

Figures 4, 5, and 6 show the results of the freeze-frame feedback intervention with and without self-monitoring on safety performance for each of the three postural targets for participants 216, 208, and 206. Table 1 displays the corresponding descriptive statistics. All three participants were exposed to the baseline phase, followed by a freeze-frame feedback intervention phase, a freeze-frame feedback with self-monitoring phase for some of the postural targets, and a return-to-baseline follow-up phase.

For participant 216, the freeze-frame feedback intervention increased safety performance for two of the three targets. Average safety scores for head and neck increased from baseline to intervention, but safety performance showed an upward trend that started in the last session during baseline. Average safety scores for legs showed an initial jump in safety performance during the first session in the freeze-frame feedback intervention, but safety scores quickly decreased to baseline levels. The third target, feet, increased greatly from baseline to intervention, but data remained highly variable throughout the phase. Only two targets were exposed to the freeze-frame feedback with self-monitoring component, head and neck, and legs. For both targets, the second intervention did not increase average safety performance beyond first intervention levels. Specifically, the introduction of the second intervention led to an initial jump in safety scores, followed by a progressive decrease to near baseline safety levels. Feet were not exposed to the second intervention phase, because data had stabilized near maximum possible safety performance in the first intervention phase. The follow-up sessions did result in further decreases in average safety performance for all three targets.

For participant 208, the freeze-frame feedback intervention increased average safety performance for all three targets from baseline levels. Head and neck, and arms showed the greatest improvements. Both targets showed some variability in average safety scores during the first sessions in the intervention, but performance stabilized at high safety scores at the end of the phase. For legs, average safety performance had been at stable zero levels during baseline, and the introduction of freeze-frame feedback resulted in increased, but highly variable performance during the freeze-frame feedback intervention. The introduction of the self-monitoring component led to a decrease in safety performance for head and neck, and arms, while reducing variability to more stable, high safety performance for legs. Follow-up sessions showed a decrease to baseline levels for all targets.

For participant 206, the presentation of the freeze-frame feedback intervention led to a substantial jump in safety performance for two of the three targets, legs and feet. Safety scores for feet stabilized around 95% safe, whereas scores for legs remained high but variable throughout the phase, before decreasing to 0% safety levels in the last two sessions of the phase. Follow-up sessions resulted in a substantial decrease in meansafety performance for both targets. Only the third target, arms, was exposed to the second intervention. However, safety performance for arms was not affected by either the freeze-frame feedback or the freeze-frame feedback with self-monitoring interventions and remained near 0% safety levels throughout all phases.

Effect Size

Table 2 lists the results of the effect size analyses comparing baseline postural safety scores with freeze-frame feedback intervention scores for all participants. Table 3 shows the results of comparing the freeze-frame feedback intervention phase with the freeze-frame feedback intervention paired with self-monitoring phase. Effect sizes were not calculated for the follow-up phase at the end of the study. For the first intervention, effect sizes were large (above .8) for 12 out of 17 targets, moderate (.5 - .8) for 2 out of 17 targets, and low (below .5) for 3 targets. Effect sizes were greatest for head and neck, followed by feet and legs, respectively. The lowest effect sizes were observed for back and arms.

Effect sizes were negative for three out of six targets exposed to the freeze-frame feedback with self-monitoring intervention, while two effect sizes were moderate, and one was low. Both head and neck targets showed negative effect sizes. Effect sizes for arms were negative for one participant, and low but positive for a second. For legs, effect sizes were positive and moderately high.

Summary

As expected, general improvements observed after the presentation of freeze-frame feedback alone for all six participants were similar to those observed after the self-monitoring intervention described by Sigurdsson and Austin (2008), although responses to the exit questionnaire indicate that participants perceived the video snapshot as disruptive to the typing assignment. Participants suggested presenting the video snapshot less often, and/or to making it possible for the participants to continue typing while the snapshot appeared on the screen (Appendix N).

One possible set of explanations for the effectiveness of the real-time freeze-frame feedback is that the feedback may have served the same functions as those of self-monitoring interventions described by Olson and Austin, 2001. For example, the appearance of the snapshot window may have served an antecedent function that prompted participants to change their behavior by clarifying the postural expectations. This interpretation is supported by the fact that safety performance showed a dramatic increase in the very first intervention session for almost all participants.

At the onset of this study, it was expected that adding the self-monitoring component to the real-time snapshot feedback would increase safety performance across participants, as was observed in the Sigurdsson and Austin (2008) study. However, these results failed to replicate. Furthermore, the addition of self-monitoring in the second intervention led to a minor decrease in safety performance for three of the six targets exposed to that intervention. One possible explanation for this outcome may be the role real-time freeze-frame feedback played in this study. That is, if the real-time freeze-frame feedback did indeed prompt covert self-monitoring of postural performance, the self-monitoring component may not have added any extra value or information to the participant, and may actually have functioned as a distraction. In fact, one participant stated that reading the self-monitoring questions made him loose his place in the text he was typing into the computer, which was frustrating, because he wanted to make as much extra money as possible in every session (see Appendix N for this statement).

Follow-Up Phase

A substantial decrease in safety performance from the previous intervention phase to the follow-up phase was observed for 11 of the 15 postural targets exposed to that phase. As described earlier, arms for participant 206 remained at near zero levels throughout the study. For three postural targets, average safety performance actually increased during the follow-up phase. Average safety scores for arms and legs for participant 207and safety scores for arms for participant 210 increased from the first intervention to the follow-up phase. The decrease in safety performance for 73% of all targets during the follow-up phase indicates that changes in safety performance observed throughout the intervention phases are likely the result of the ongoing intervention.

Typing Productivity and Errors

Table 4 shows the typing productivity across participants and sessions as expressed in the average number of typed words per minute and phase. Productivity decreased from baseline to the Phase B intervention phase for all participants, but later increased beyond baseline phase performance during the follow-up phase. Participant 206 had the highest typing productivity, followed by participants 213, 216, and 210, respectively. Participant 208 had the lowest typing productivity. For those participants exposed to Phase C, productivity either remained constant from Phase B (206, 216) or decreased further (208).

Another interesting outcome of this study was that typing errors did actually decrease progressively across all experimental phases for three out of six participants (see Figure 7 and Figure 8). During the final follow-up phase, those participants showed error rates at or near zero. For participant 213, average typing errors increased slightly from baseline to the first intervention. One explanation for the general decrease in errors may be that participants simply got better at typing accuracy with increased practice. Secondly, the monetary contingency in place for typing meant that participants were not only paid for how many words they typed, but for how many of those words were typed correctly. Thus, having more disruptions to the typing task during the intervention sessions , participants may have focused even more on reducing the number of typing errors to still be paid a large amount for each session.

Self-Monitoring Accuracy

Each participant's results of self-monitoring their own posture on the target variables are displayed in Table 5. Participant 206 was only exposed to the second intervention for arms, and participant 216 was only exposed to the second intervention for head and legs. The lowest self-monitoring accuracy was seen for participant 206, followed by participant 216. The highest self-monitoring accuracy was seen for participant 208. The scatter plot in Figure 9 shows the correlation between session-based self-monitoring accuracy and session-based actual safety performance across participants and postural targets. A Pearson correlation coefficient was calculated between self-monitoring accuracy and actual safety performance across all targets. The correlation was significant ($r = 0.88$, $p < 0.05$).

The lack of self-monitoring accuracy may provide another explanation for why safety scores decreased for most targets during the self-monitoring intervention. In other words, if a self-monitoring discrimination training component had been added at the beginning of the second intervention, safety scores may have been higher across participants. This idea is supported by the fact that in both the Sigurdsson and Austin (2008) and in the McCann and Sulzer-Azaroff (1996) studies, the self-monitoring intervention that included a discrimination training component did effectively increase most postural targets. For example, average self-monitoring accuracy in the Sigurdsson and Austin study was 74.33% (*sd* = 23.30). In contrast, in the current study average self-monitoring accuracy was substantially lower at 53.95% (*sd* = 22.56).

Another point to note is that all participants exposed to the self-monitoring intervention did self-monitor at every opportunity to do so, indicating that participants followed the instructions presented to them by the experimenter.

Discrimination Task Accuracy

Discrimination accuracy was assessed by dividing the total number of correct answers within a discrimination task session by the total possible answers. Table 6 shows the calculations across discrimination task sessions and participants. The highest average discrimination accuracy across all participants was observed for feet (92%; *sd* = 14.74), and the lowest for legs (26.67%; *sd* = 20.93). Average discrimination accuracy for wrists was 90.67% (*sd* = 12.8). For head and neck average discrimination accuracy was 81.33% (*sd* = 17.67), for back 72% (*sd* = 14.74), and for arms 74.67% (*sd* = 11.87).

Results indicate that there was no direct relationship between participants' ability to discriminate safe and unsafe posture in the confederate, and each participant's postural safety. This outcome is consistent with previous research on postural safety. For example, Alvero, Rost, and Austin (2008) asked participants to observe and score the safety performance of a confederate in an analog assembly-line workstation. Results showed that there was no correlation between the accuracy of the observations conducted, and the participants' own safety performance while completing an assembly task. However, the Alvero et al. study did find a positive correlation between conducting safety observations on a confederate in general and participants' own safety performance. In other words, the mere act of conducting safety observations on the behavior of another person, regardless of their accuracy, can lead to increases in one's own postural safety. These findings are not supported in the current study. Observations were conducted before each phase, including the baseline phase, but safety performances did not increase consistently after each observation. These differences may have resulted from the fact that in the current study each participant conducted observations on all six postural variables at a time, thus possibly making it more difficult to learn the relationship between safety definitions and one's own behavior. Secondly, in the current study participants were exposed to fewer scoring samples for each postural variable than in Alvero, Rost, and Austin (2008), thus allowing for less practice with and exposure to the observation process.

Exit Interviews

Five of the six participants completed exit questionnaires. The results of those questionnaires can be seen in Appendix N. All participants correctly identified the primary variables of interest to be their posture. Participants also stated that the presence of the video camera was not unpleasant, and half of the participants reported having had experience in their work of being taped or observed. Two participants would have preferred an actual person to provide posture feedback, while two participants would not have wanted feedback by an actual person. The fifth participant stated that feedback by a another person may add another dimension of pressure to perform well. Three participants thought their posture was unsafe before the study, and two participants didn't think that was the case. However, four participants reported that they felt their posture improved as a result of the study. When asked whether participants would want to receive the type of postural feedback presented in this study if they were working at a computer as part of their regular job, three participants stated that they would want this type of feedback. Two participants preferred not to receive this type of feedback.

Inter-Observer Agreement

Table 7 displays IOA data collected for all participants and postural targets. IOA was calculated for 47 out of 143 sessions, or 32.87% of all sessions. The average IOA score for head and neck across participants was the lowest out of all postural targets at 91.36% (range: 77.5% - 100%; *sd* = 9.06). The highest average agreement was obtained for wrists, at 99.24% (range: 87.5% - 100%; *sd* = 2.29). For feet, the average agreement was 98.37% (range: 82.5% - 100%; *sd* = 3.88), and for legs the average agreement was 98.15% (range: 87.5% - 100%; *sd* = 3.99). For back, the average agreement was 96.03% (range: 77.5% - 100%; *sd* = 7.3) and for arms 94.13% (range: 77.5% -100%; *sd* = 8.25).

Implications for Experiment 2

The current study was conducted in extension of the study conducted by Sigurdsson and Austin (2008). However, direct comparisons of effectiveness of real-time video feedback to real-time freeze-frame feedback can’t be conducted, because the frequency of feedback differed across the current study and the study conducted by Sigurdsson and Austin (2008). Thus, Experiment 2 was designed to replicate the frequency of video-based feedback presented in the Sigurdsson and Austin study.

Experiment 2

The purpose of experiment 2 was to investigate whether decreasing the interval between each freeze-frame feedback presentation from every 120 seconds in experiment 1 to every 50 seconds would lead to increases in safety performance beyond those observed in experiment 1. The frequency of feedback presentation was based on the frequency of video feedback used by Sigurdsson and Austin (2008).

Method

Participants

Three students from a northeastern university participated for compensation. Participants were recruited in the same way as described in experiment 1. Five additional participants completed the pretest, but didn’t meet the requirement for inclusion in the study.

General Methods, Independent and Dependent Variable, and Experimental Design

Experiment 2 used the same set-up, pre-experimental procedures, compensation, selection criteria and data analysis procedures as described in experiment 1.The dependent variables were the same five target behaviors defined in experiment 1 (head/neck, back, wrists, arms, legs, feet). The independent variable was the freeze-frame feedback presented in the form of a momentary snapshot taken from each participant’s live video feed presented every 50 seconds on the monitor of the participant. The freeze-frame feedback appeared without any text accompanying it. The design was a nonconcurrent multiple-baseline experimental design across participants (AB). The two phases were Phase A: baseline, Phase B: real-time freeze-frame feedback.

Results and Discussion

Results show that freeze-frame feedback did increase safety performance across the majority of participants and postural targets, but the intervention supported generally smaller effect sizes than those obtained in Experiment 1, and data were highly variable for the majority of participants during intervention. Safety performance on postural variables not targeted in each individual participant's intervention are not discussed in this section, as safety performance for these postural variables remained at safety levels of 90% or higher throughout all phases of the study.

Figures 10, 11 and 12 display the results of the freeze-frame feedback intervention on safety performance on the three postural targets across participants 219, 217, and 220, respectively. Table 8 displays the descriptive statistics for all participants and phases. All three participants were exposed to the baseline phase, followed by a freeze-frame feedback intervention phase.

For participant 219, average safety scores increased from baseline to intervention for both head and neck and back, but performance remained highly variable. For participant 217, average safety performance increased to a stable and high safety performance for feet from baseline to intervention, while increasing to a high but variable safety performance for legs. Average safety scores for participant 220 remained highly variable for both postural targets across baseline and intervention phases, with a slight increase in average safety scores for head and neck across phases.

One explanation for the current results might be the difference in freeze-frame feedback duration across experiments 1 and 2. In experiment 1, participants were exposed to the freeze-frame feedback for 15s at each presentation, while in experiment 2, participants were exposed to the freeze-frame feedback for only 7.5s at each snapshot presentation. This was done to account for the doubled frequency of feedback in experiment 2. It may be the case that 7.5s is too short a duration for participants to conduct the type of covert self-monitoring that might explain the results of experiment 1. Thus, future studies might focus on modifying the duration of freeze-frame feedback to determine the duration at which maximum increases in postural safety can be observed.

Effect Size

Table 9 lists the results of the effect size analyses comparing baseline postural safety scores with freeze-frame feedback intervention scores for all participants. Effect sizes were large (above .8) for five out of six targets, and low (below .5) for one target.

Discrimination Task Accuracy

Discrimination accuracy was assessed by dividing the total number of correct answers within a discrimination task session by the total possible answers. Table 10 shows the calculations across discrimination task sessions and participants. The highest average discrimination accuracy across all participants was observed for feet (96.67%, *sd* = 8.16), wrists (96.67%, *sd* = 8.16), and head and neck (96.67%, *sd* = 8.16). The lowest discrimination accuracy was observed for legs (36.67%; *sd* = 8.16). Average discrimination accuracy for back was 83.33% (*sd* = 14.74), and 73.33% for arms (*sd* = 20.66).

Discrimination task accuracy was generally higher than in Experiment 1. However, participants in the current study also demonstrated the lowest overall scoring accuracy when evaluating legs, indicating that there might be a problem with the way safe legs were defined in both studies. Specifically, participants appeared to have difficulty identifying angles that were smaller than 90 degrees. Thus, future studies of this kind might focus on varying the extent of the description of the definition for legs to determine the effect on discrimination accuracy. It should be noted that the inability to accurately discriminate safe leg performance did not correspond to an inability to demonstrate safe leg posture. In fact, safety performance for legs showed some of the greatest effect sizes across both experiments 1 and 2.

Typing Productivity and Errors

Table 11 shows the typing productivity across participants and sessions as expressed in the average number of typed words per session. The average number of typing errors across sessions and phases is also shown. Participant 220 initially had the highest typing productivity, followed by participants 217. Participant 219 showed the lowest typing productivity. Productivity decreased from baseline to the intervention phase for participants 220 and 217, but remained stable for participant 219. The average number of typing errors across baseline and intervention decreased for participants 219 and 217, while increasing for participant 220

The number of words typed per minute, or typing productivity, did decrease for five out of six participants from baseline to the first intervention. For one participant, participant 210, typing productivity remained constant across the two phases. This general decrease at the onset of intervention was to be expected, given that the appearance of the real-time video feedback intervention blocked a participant from typing. Each snapshot remained on the screen for 15s before automatically closing. Nine presentations occurred during each experimental session. Thus, in a given session during the intervention phases, participants lost 125s of typing time. The addition of the self-monitoring component did not add additional time requirements, which might explain that the introduction of the second intervention did only decrease typing productivity further for one of the three participants exposed to that phase.

Even though the average error rates increased slightly across experimental phases, they remained at or below 1 error in each session. Thus, it appears that the increased frequency of freeze-frame feedback did not lead to greater losses of typing productivity and quality than were observed in experiment 1. This outcome might be related to the fact that the overall exposure to the freeze-frame feedback within each session remained constant in both experiments. Differences in typing productivity and quality in the current experimental setup may thus be primarily impacted by the relationship between freeze-frame feedback exposure time and overall session duration. Future studies may further investigate this point by increasing or decreasing that rate.

Future Research

One limitation of the current studies relates to the extent to which the postures listed in Experiment 1 and 2 are directly linked to the development of MSDs. For example, a recent review of epidemiological studies focusing on postural variables affecting the development of MSDs and related disorders found that hand and arm positions are most susceptible to MSDs, especially when computer use occurs across several hours (Gerr, Montheil, & Marcus, 2006). Although postural targets such as legs and feet are mentioned in the literature, there seems to be less evidence that unsafe posture relating to these postural targets is linked to the development of MSDs. However, the current evidence is complicated by non-representative sample use, lack of control of extraneous variables, and imprecise measurements of postural variables and outcomes. Thus, further research needs to be conducted to determine what postural variables are directly linked to the development of MSDs and related disorders.

Exit Interviews

All three participants completed exit questionnaires (Appendix N). Two participants correctly identified the purpose of the study to be about postural safety. One participant believed the study was about typing productivity. All participants stated that the presence of the video camera was not unpleasant for them. One participant would have preferred to receive feedback from an actual person, while another participant preferred the video snapshots. The third participant didn't prefer either. In terms of postural safety during baseline, two participants indicated that they thought they were unsafe before the intervention, but they also felt that their posture did not improve much across phases. The third participant thought she demonstrated mainly safe posture during baseline, but also stated that if she saw a snapshot in which she appeared unsafe, she would readjust herself. All three participants stated that the freeze-frame feedback disrupted their typing task, and that the amount paid for engaging in the typing task was appropriate. Participants indicated that they would not want to receive this type of feedback as part of their regular job. Finally, one participant added that she usually works on a laptop computer, and that her posture is generally different when doing so.

Inter-Observer Agreement (IOA)

Table 12 displays IOA data collected for all participants and postural targets. IOA was calculated for 20 out of 51 sessions, or 39.23% of all sessions. The average IOA score for head and neck across participants was the lowest out of all postural targets at 91.75% (range: 82.5% - 100%; *sd*= 8.03). The highest average agreement was obtained for legs, at 100% (range: 100%; *sd* = 0). For wrists, the average agreement was 99.38%

(range: 87.5% - 100%; *sd* = 2.8). For feet, average agreement was 98.75% (range: 80% - 100%; *sd* = 4.48), while average agreement for back was 96.5% (range: 87.5% - 100%; *sd* = 6.2), and for arms 91.88% (range: 77.5% -100%; *sd* = 9.63).

General Discussion

The results of the two experiments demonstrate the effectiveness of freeze-frame feedback as an intervention for increasing postural safety among computer workstation users in a simulated office setting. A visual summary of these results is presented in Figure 13. The graph depicts a direct comparison of mean postural safety performance and standard error from both experiments aggregated across all phases, conditions, and postures.

Safety performance increases were highest for the 120s freeze-frame feedback with self-monitoring group, second highest for the 120s feedback group, and lowest for the 50s feedback group. For the 120s freeze-frame feedback with self-monitoring group, safety performance increased from an average of 9.14% (*sd* = 19.73) during baseline to 46.82% (*sd* = 40.29) during the first intervention. For the 50s freeze-frame feedback group, safety performance increased from an average of 28.23% (*sd* = 34.59) during baseline to 55.36% (*sd* = 38.57) during intervention. For the 120s freeze-frame feedback group, safety performance increased from an average of 28.23% (*sd* = 34.59) during baseline to 58.22% (*sd* = 40.68) during intervention.

The introduction of the self-monitoring intervention led to a minimal increase in mean safety performance from 46.82% (*sd*= 40.29) during the first intervention to 52.02% (*sd* = 41.8). This increase was much lower than originally hypothesized based on the findings of Sigurdsson and Austin (2008) which yielded substantial increases in safety performance from baseline to the self-monitoring intervention for seven out of nine postural targets. In the current study effect sizes for those variables exposed to the self-monitoring intervention ranged from -0.85 to 0.76, whereas in the Sigurdsson and Austin

(2008) study effect sizes ranged from -0.69 to 78.98. Values of 0.8 and above are generally considered large effect sizes (Cohen, 1988). However, effect sizes need to be interpreted with caution, as some of the individual safety performance data show steep slopes, which are not directly captured by the effect size measure.

Perhaps the most interesting finding was the dramatic difference in follow-up safety performance between the 120s freeze-frame feedback with self-monitoring group and the 120s feedback without self-monitoring group. Average safety performance decreased from 52.02% (*sd* = 41.8) to 12.81% (*sd* =18.97) from the intervention to follow-up phases for the self-monitoring group. This decrease was less substantial for the feedback alone group where mean safety performance averaged 58.22% (*sd* = 40.68) during intervention and 48.36% (*sd* = 39.1) during follow-up. There is no obvious explanation for the substantial difference in sustainability of safety performance during follow-up sessions.

However, one reason for this difference may be that participants in the self-monitoring group immediately identified the follow-up sessions as non-posture intervention session, thus focusing primarily on typing productivity instead of postural safety. The self-monitoring intervention disrupted the typing task to a greater extent, as indicated in the exit interviews, than the freeze-frame alone intervention, because participants had to take their eyes off the typing material in order to complete the self-monitoring survey and follow experimental instructions. For these participants, the phase change may thus have been immediately apparent. For the freeze-frame only group, participants reported using some of the time or all of the time that the snapshot feedback was on the screen to continue reading the transcription material to make sure they could continue typing quickly and make more money as soon as the window closed. For those participants, it may have taken longer to realize that a phase change had occurred, thus continuing to focus on their posture while typing. The current data don't directly support this hypothesis. However, two of the three participants made statements in their exit interviews that indicate that they were aware of different conditions in the study. Participant 206 stated that one of the purposes of the study was to measure "effect of changes in condition on typing speed", and participant 208 stated that the purpose of the study was to see "if one could follow instructions, [and] if I am correct, do I get a prize" (Appendix N). Prize in this case meant monetary payment at the end of the study. On the other hand, the three participants in the freeze-frame feedback only condition all stated that the purpose of the study primarily was to measure posture. Finally, the results observed in the self-monitoring group during the follow-up sessions might also be explained by the average baseline safety performance for that group. Average safety performance during baseline sessions was almost identical to the average safety performance observed during the follow-up sessions.

Given the current results, future research should further investigate the effects of removing video-based postural safety self-monitoring interventions. If this type of intervention does indeed reduce safety performance sooner and to a larger extent than other interventions, it may not be the most desirable intervention for this type of setting. In addition, future research should investigate the sustainability of the results of self-monitoring interventions once the intervention is removed by manipulating the type of reinforcement schedule used to establish safe posture during the intervention phase. In the current studies, participants were exposed to freeze-frame feedback based on a fixedtime schedule. Follow-up safety performance may have been different if the intervention had been presented based on a variable-time schedule.

Another factor that may influence the acquisition of safe posture and that should be investigated further has to do with the way in which freeze-frame feedback is presented. In the current study, freeze-frame feedback did not specify what posture a participant was expected to focus on during the intervention. Thus, participants may have focused on all six postural variables at once, which also may have attributed to the lower increases in safety performance observed in the current studies in comparison to those observed in the Sigurdsson and Austin (2008) study. Future studies should investigate the speed of acquisition of postural safety by introducing each postural variable sequentially. This might be done by blurring out the parts of the freeze-frame picture that are not targeted in the intervention.

A notable strength of the present research is its focus on novel, computer-generated ways to address the prevention of MSDs while working at a computer workstation. Specifically, this study is the first study to use real-time freeze-frame video-based feedback with and without a self-monitoring component to improve postural safety. It is also the first study aimed at isolating the effects of a real-time computer-based feedback strategy on postural safety. A limitation of the current study may be that typing productivity decreased moderately at the onset of the intervention. Thus, future studies may examine the effectiveness of freeze-frame feedback that does not block participants from continuing their performance tasks, as well as modifying the feedback presentation interval to maximize freeze-frame feedback effectiveness while minimizing decreases in productivity.

Sigurdsson and Austin (2008) suggested that future studies investigate the effects of computer- and video- based feedback at feedback intervals greater than the 50s interval used in their study. An additional strength of the current study is that it used a feedback interval of 120s, which was more than twice as large as that used in the Sigurdsson and Austin study, while demonstrating similar effects of the intervention on postural safety. Future evaluations of the application of video-based feedback to the area of postural safety should investigate the role of feedback duration, placement, frequency and saliency on safety performance. Another focus of future research should be to investigate what postural variables are directly linked to the development of MSD's in general and computer users in particular. Studies should include computer users in real work settings, and future studies may extend the current application to include laptop users as well.

In summary, the current studies provide a clear example of the effectiveness of real-time freeze-frame feedback in increasing postural safety in a simulated office setting. All participants increased their safety performance from baseline to intervention. Furthermore, the current studies demonstrated that freeze-frame feedback with self-monitoring did not increase safety performance substantially beyond prior levels. Finally, one of the current studies also shows that observed increases in postural safety during the intervention appear to break down more rapidly in return-to-baseline follow-up sessions when participants had just been exposed to the self-monitoring intervention than when they had only been presented with freeze-frame feedback during the prior intervention.

Table 1.

Descriptive statistics of safety performance for participants 207, 210, 213, 216, 208, and 206. The data include the number of sessions in a given phase (N), the mean percent safe posture in a given phase (X), and the standard deviation (SD). The first intervention of freeze-frame feedback is labeled ‘Phase B’. The second intervention, freeze-frame feedback with self-monitoring, is labeled ‘Phase C’. If a participant was not exposed to a given phase, the cell was labeled ‘n/a’.

Participant ID	Target	Baseline			Phase B			Phase C			Follow-up		
		N	X	SD	N	X	SD	N	X	SD	N	X	SD
207	Head/Neck	5	5.01	5.86	17	98.53	5.86	n/a	n/a	n/a	3	85	13.21
	Arms	5	20.1	0	17	66.6	25.12	n/a	n/a	n/a	3	87.5	6.61
	Legs	5	0	0	17	43.89	38.87	n/a	n/a	n/a	3	55.83	51.01
210	Back	10	42.83	34.47	12	71.75	28.28	n/a	n/a	n/a	3	38.71	24.28
	Arms	10	5.75	8.42	12	14.43	26.55	n/a	n/a	n/a	3	22.67	23.82
	Legs	10	0.77	2.43	12	13.78	28.16	n/a	n/a	n/a	3	0	0
213	Head/Neck	13	0.38	1.39	5	78.99	41.4	n/a	n/a	n/a	n/a	n/a	n/a
	Legs	13	17.4	37.18	5	100	0	n/a	n/a	n/a	n/a	n/a	n/a
216	Head/Neck	5	6.5	10.4	12	38.06	16.32	5	34	36	3	0.83	1.44
	Legs	5	5.64	12.61	12	11.55	28.84	5	35	42	3	21.39	13.45
	Feet	5	10.1	10.87	17	55.14	40.14	n/a	n/a	n/a	3	23.14	13.73
208	Head/Neck	8	10.08	4.37	8	66.45	33.19	6	43	20	3	16.54	26.46
	Arms	8	43.93	30.58	8	72.15	44.43	6	84	23	3	25.86	40.46
	Legs	8	0	0	8	31.41	44.24	6	67	52	3	0	0
206	Arms	11	1.14	3.77	6	1.25	3.06	5	0	0	3	0	0
	Legs	11	0.45	1.51	11	63.98	36.95	n/a	n/a	n/a	3	0.83	1.44
	Feet	11	8.87	26.93	11	94.62	6.84	n/a	n/a	n/a	3	26.67	14.43

Table 2.

Effect sizes across baseline and snapshot only intervention sessions (Phase B) for all participants.

Participant	Head/Neck	Back	Arms	Legs	Feet
206	n/a	n/a	0.03	2.43	4.63
207	17.27	n/a	2.63	n/a	1.6
208	2.38	n/a	0.74	1	n/a
210	n/a	0.92	0.41	0.65	n/a
213	2.68	n/a	n/a	3.13	n/a
216	2.31	n/a	n/a	0.27	1.53

Table 3.

Effect sizes across snapshot only intervention (Phase B) and snapshot with self-monitoring intervention sessions (Phase C) for participants 206, 208, and 216.

Participant	Head/Neck	Back	Arms	Legs	Feet
206	n/a	n/a	-0.58	n/a	n/a
208	-0.86	n/a	0.44	0.73	n/a
216	-0.15	n/a	n/a	0.66	n/a

Table 4.

Average number of words typed per minute across participants and phases. Phase B refers to freeze-frame feedback and Phase c refers to freeze-frame feedback with self-monitoring.

Participant	Baseline	Phase B	Phase C	Follow-Up
206	50	45	45	53
207	31	30	n/a	40
208	28	26	24	31
210	29	29	n/a	36
213	41	37	n/a	n/a
216	39	34	34	43

Table 5.

Results of self-monitoring for each participant and respective postural targets across freeze-frame feedback with self-monitoring (Phase C) sessions.

Participant	Postural Target	Total Self-Monitoring Opportunities	Self-Monitoring Accuracy (%)
206	Arms	45	37.78
208	Head/Neck	54	42.59
	Arms	54	94.45
	Legs	54	66.67
216	Head/Neck	45	37.78
	Legs	45	44.44

Table 6.

Discrimination task accuracy in percent across participants and discrimination task sessions.

Participant	Phase	Head/Neck	Back	Arms	Wrists	Legs	Feet
206	Baseline	40	80	80	80	20	100
	Phase B	60	80	60	60	40	100
	Phase C	80	60	80	100	60	100
207	Baseline	80	40	60	80	20	80
	Phase B	100	80	80	80	20	80
208	Baseline	60	60	60	100	0	100
	Phase B	80	80	100	100	20	100
	Phase C	100	80	80	80	0	60
210	Baseline	80	60	80	100	0	100
	Phase B	80	80	80	80	60	60
213	Baseline	80	60	80	100	20	100
	Phase B	80	60	60	100	60	100
216	Baseline	100	100	60	100	20	100
	Phase B	100	80	80	100	20	100
	Phase C	100	80	80	100	40	100
	Average	81.33	72.00	74.67	90.67	26.67	92.00

Table 7.

Average inter-observer agreement across all postural variables for each participant.

	Postural Target					
Participant	Head/Neck	Back	Arms	Wrists	Legs	Feet
206	99.69	100	100	98.13	96.88	99.69
207	93.89	100	86.39	100	97.22	100
208	86.25	91.56	89.38	98.75	99.06	99.69
210	83.61	88.33	96.94	100	100	97.22
213	99.17	99.58	95.42	99.58	96.67	99.58
216	85.36	98.93	98.93	98.93	98.57	93.57

Table 8.

Descriptive statistics of safety performance across participants 220, 217, and 219. The data include the number of sessions in a given phase (N), the mean percent safe in a given phase (X), and the standard deviation (SD). The first intervention of freeze-frame feedback is labeled ‘Phase B’. If a participant was not exposed to a given phase, the cell was labeled ‘n/a’.

Participant		Baseline			Phase B		
ID	Target	N	X	SD	N	X	SD
219	Head/Neck	5	0	0	11	47.24	45.49
	Back	5	0	0	11	30.92	40.18
217	Legs	9	5.31	12.54	8	75.83	24.32
	Feet	9	59.64	39.36	8	88.34	10.56
220	Head/Neck	12	21.8	23.22	6	46.5	26.16
	Arms	12	51.83	33.94	6	52.92	39.57

Table 9.

Effect sizes across baseline and snapshot only intervention sessions (Phase B) for all participants.

Participant	Head/Neck	Back	Arms	Legs	Feet
219	1.47	0.96	n/a	n/a	n/a
217	n/a	n/a	n/a	3.65	1
220	1	n/a	0.03	n/a	n/a

Table 10.

Discrimination task accuracy in percent across participants and discrimination task sessions.

Participant	Phase	Head/Neck	Back	Arms	Wrists	Legs	Feet
219	Baseline	100	80	40	80	20	80
	Phase B	100	60	60	100	40	100
217	Baseline	100	80	80	100	40	100
	Phase B	100	100	80	100	40	100
220	Baseline	100	80	80	100	40	100
	Phase B	80	100	100	100	40	100

Table 11.

Average number of words typed per minute across participants and phases. Phase B refers to freeze-frame feedback and Phase c refers to freeze-frame feedback with self-monitoring.

	Participant	Baseline	Phase B
Words/Minute	219	23.94	23.98
	217	35.07	32.24
	220	36.55	29.35
Errors/Session	219	0.6	0.73
	217	10.56	8.88
	220	0.58	1

Table 12.

Average inter-observer agreement across all postural variables for each participant.

	Postural Target					
Participant	Head/Neck	Back	Arms	Wrists	Legs	Feet
219	93.33	97.08	95.42	100	100	100
217	91.79	96.79	92.86	100	100	96.43
220	90.36	95.71	87.86	98.21	100	100

Figure 1. Average safety scores across head/neck, arms, and legs for participant 207.

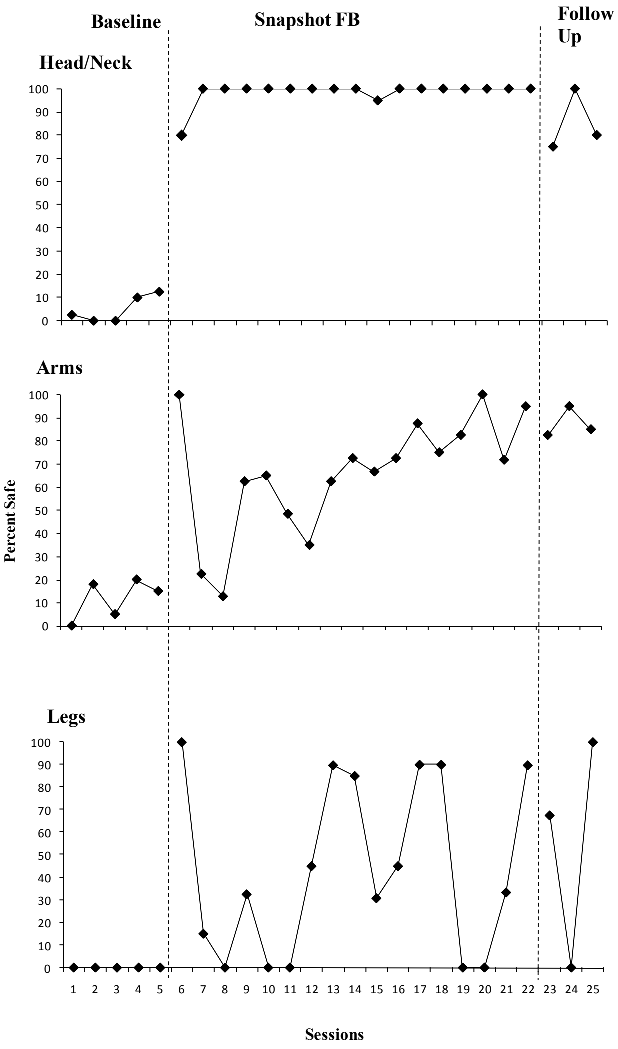


Figure 2. Average safety scores across back, arms, and legs for participant 210.

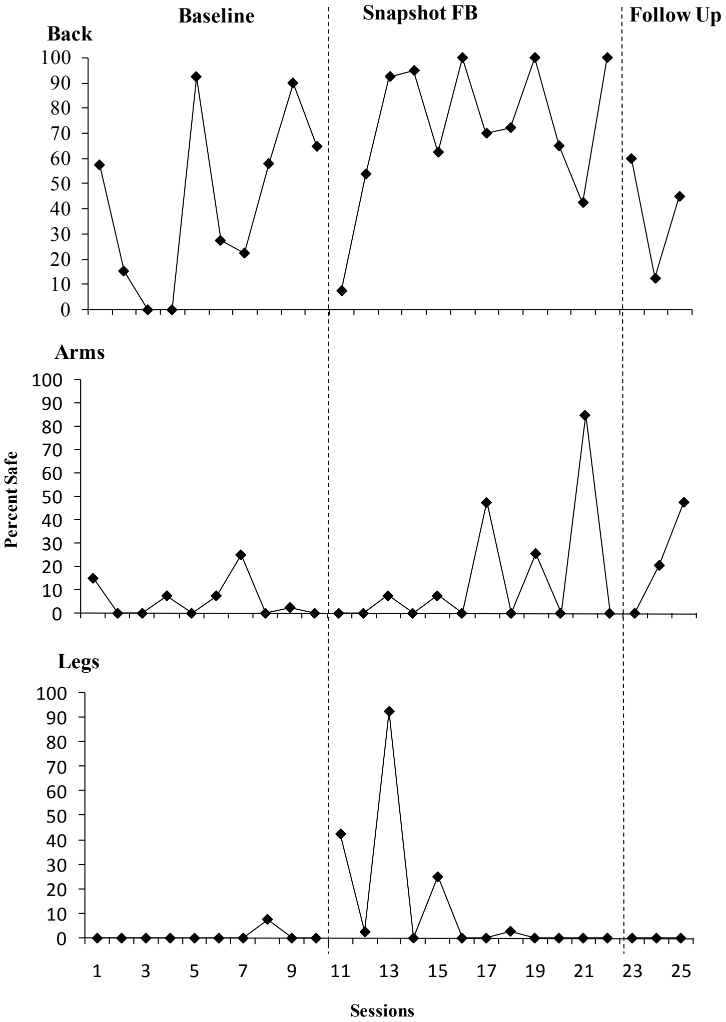


Figure 3. Average safety scores across head/neck and legs for participant 213

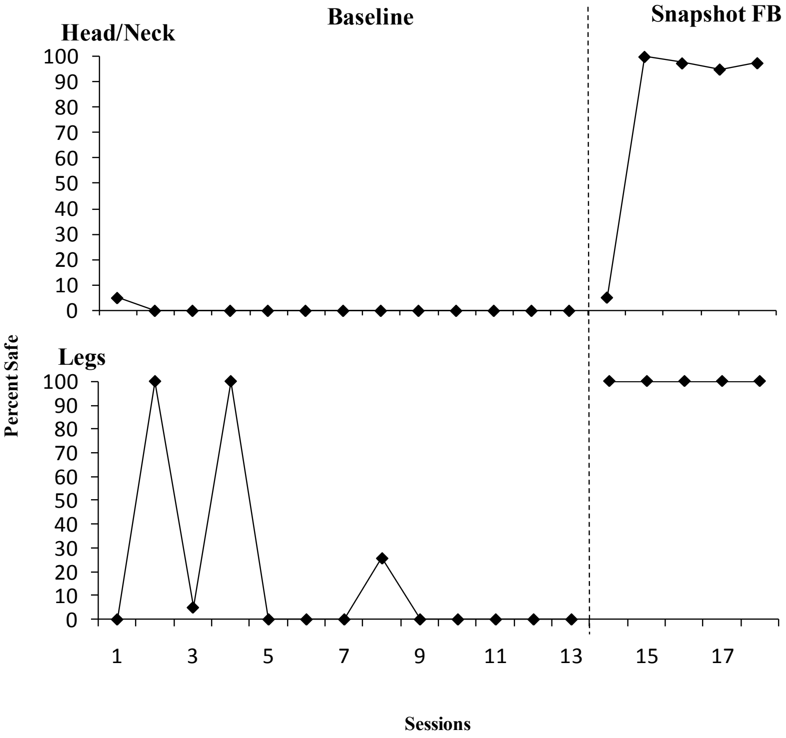


Figure 4. Average safety scores across head/neck, legs, and feet for participant 216.

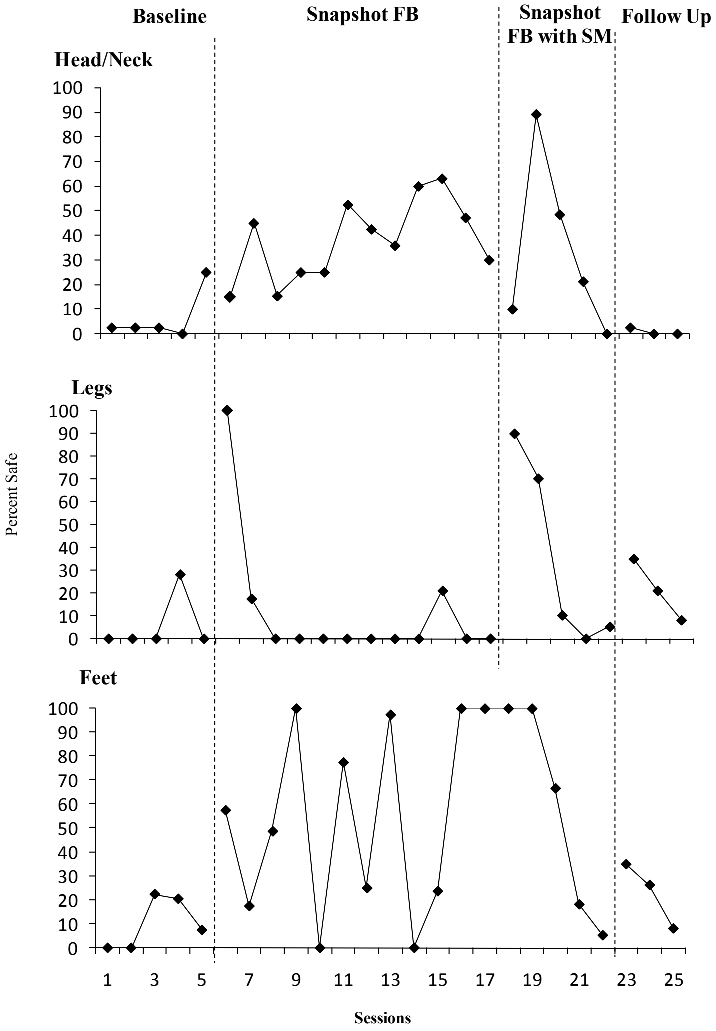


Figure 5. Average safety scores across head/neck, arms, and legs for participant 208.

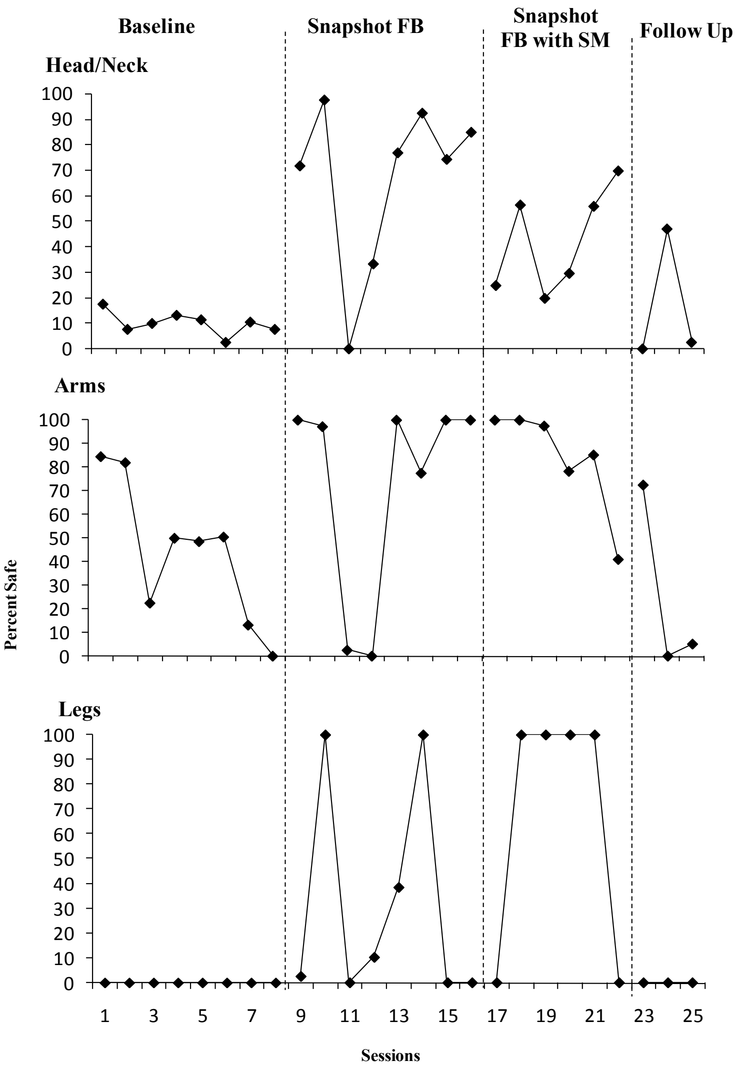


Figure 6. Average safety scores across head/neck, legs, and feet for participant 206.

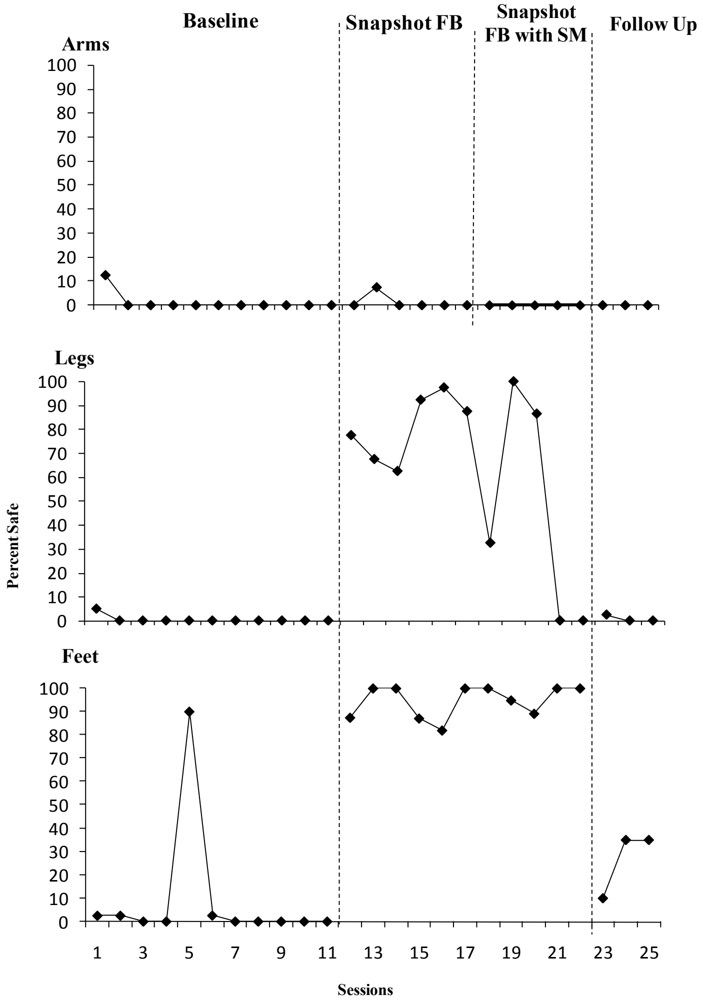


Figure 7. Number of typing errors made across sessions and phases for participants 207, 210 and 213.

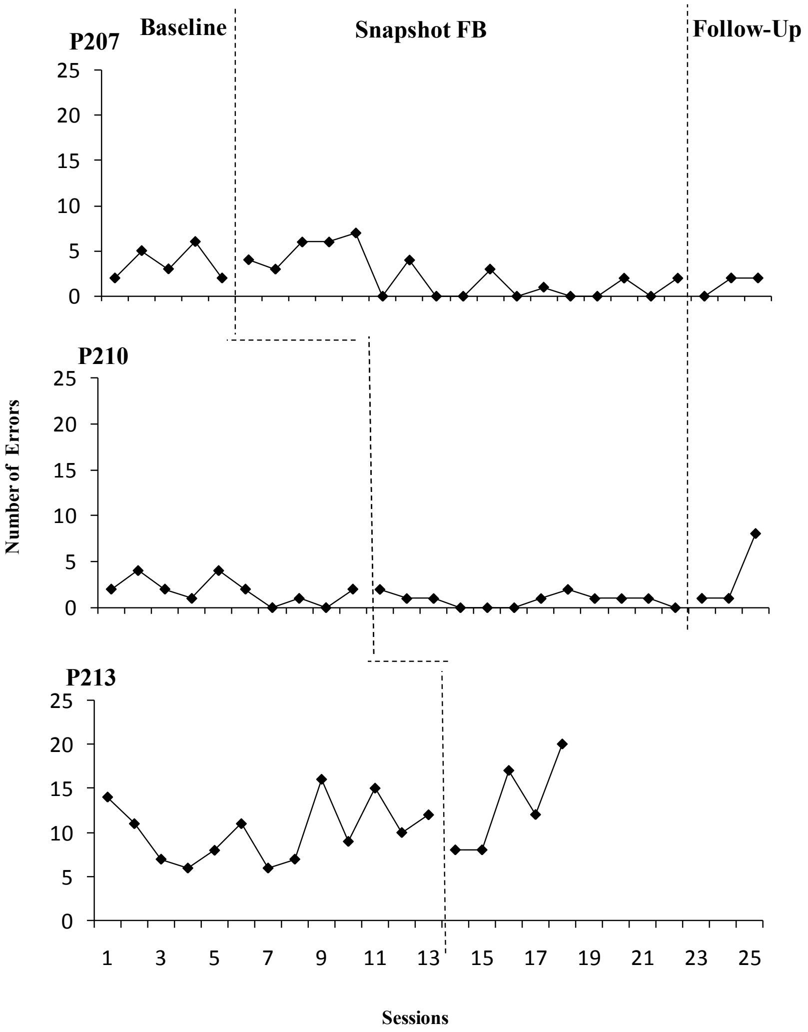


Figure 8. Number of typing errors made across sessions and phases for participants 216, 208 and 206.

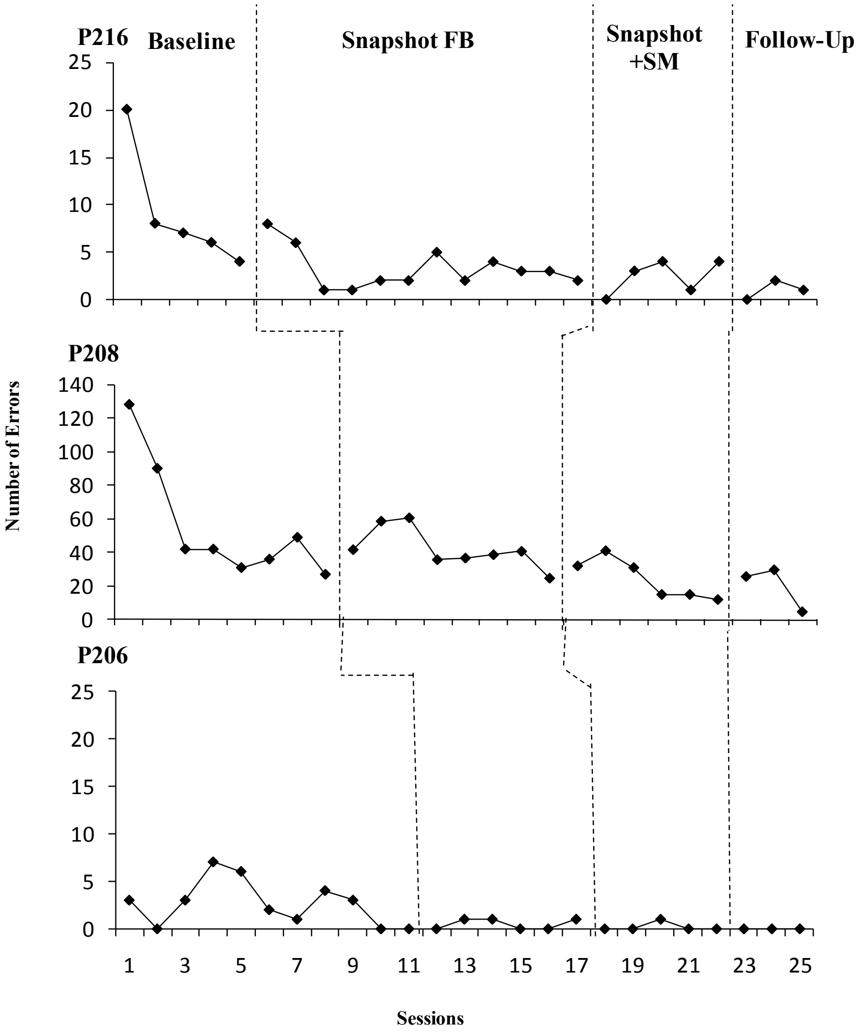


Figure 9. Correlation between session-wide self-monitoring accuracy and session-wide actual safety performance across all postural targets.

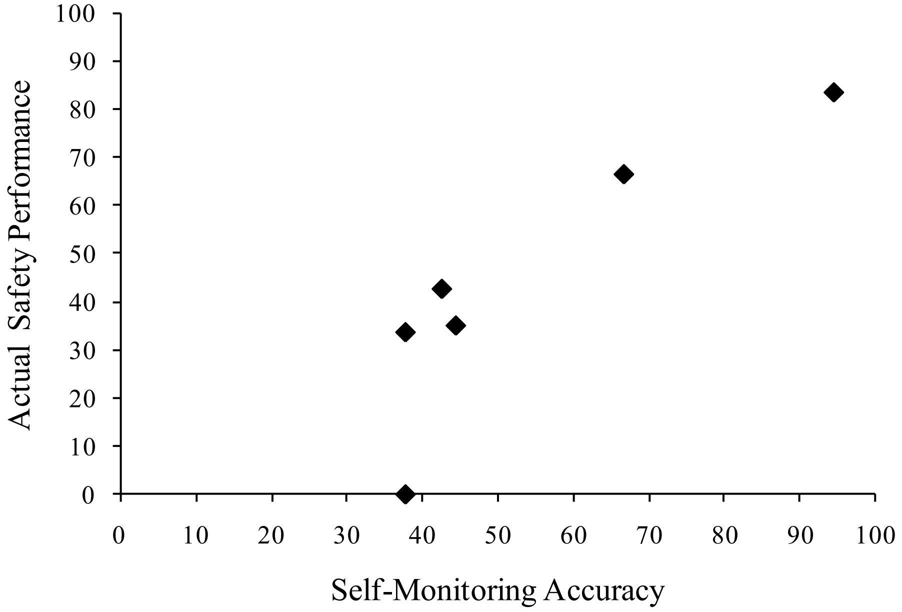


Figure 10. Average safety scores across head/neck and back for participant 219.

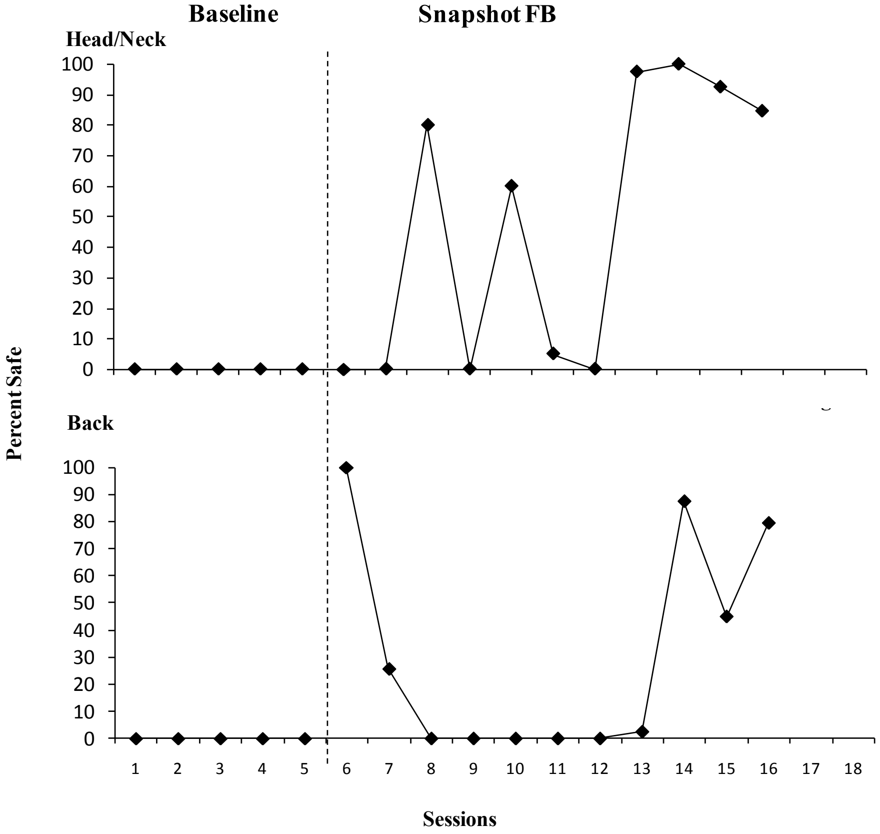


Figure 11. Average safety scores across legs and feet for participant 217.

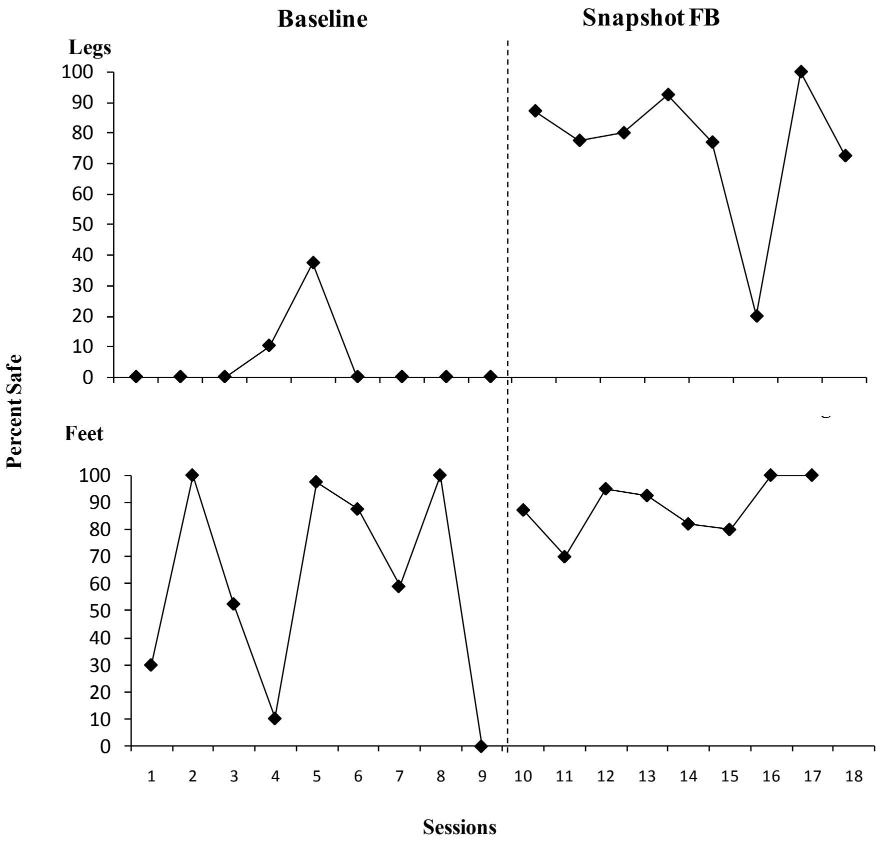


Figure 12. Average safety scores across head/neck and arms for participant 220.

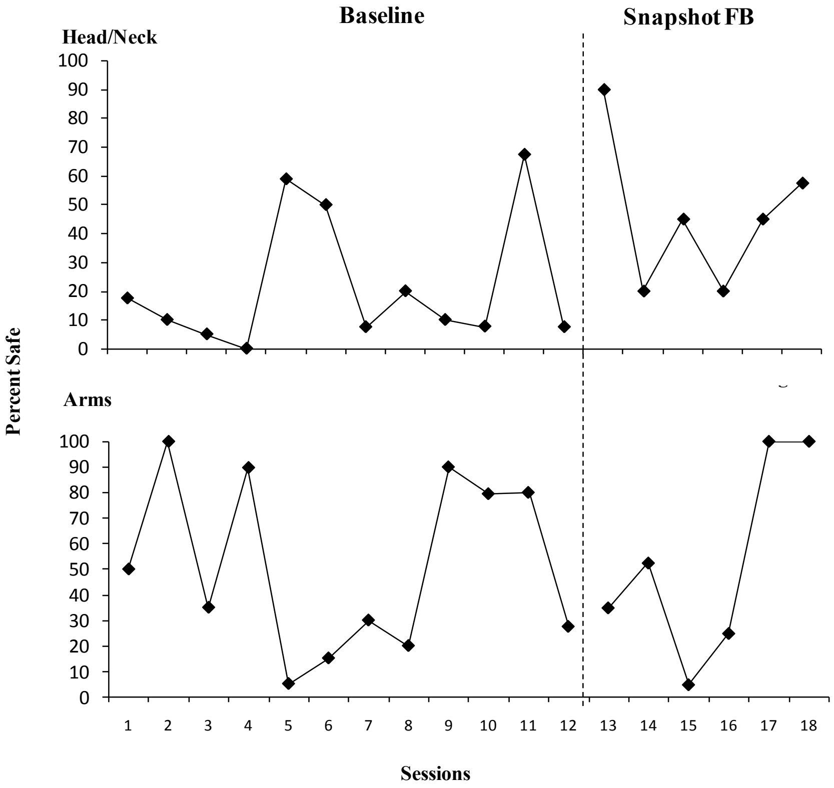
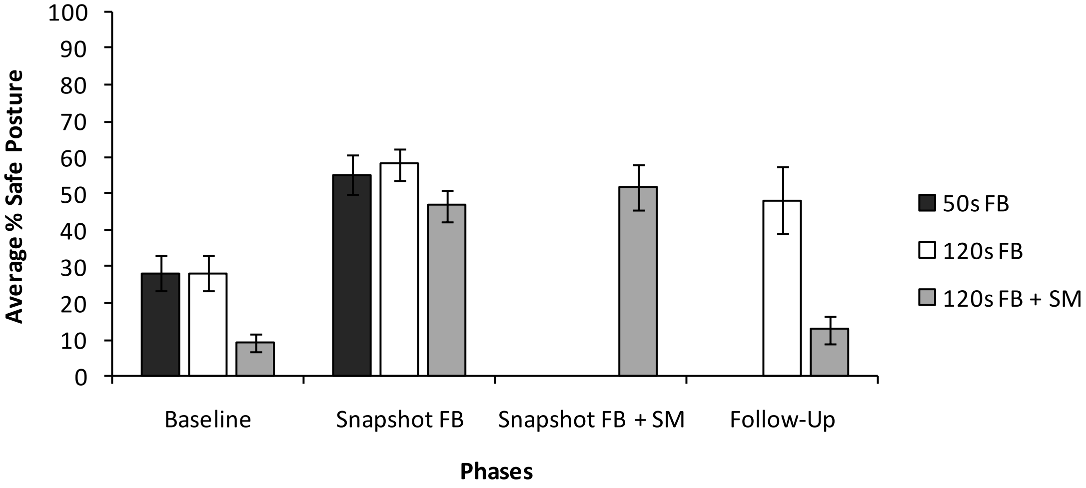


Figure 13. Average safety performance scores averaged across all postures (head/neck, back, arms, legs, and feet) and participants for each phase. 50s FB refers to 50s freeze-frame feedback. 120s FB refers to 120s freeze-frame feedback. 120s FB + SM refers to 120s freeze-frame feedback with self-monitoring. Standard error bars included.



Appendix A:

Recruitment Flier

Earn $10-$16/hour on campus!

- Make <u>easy money</u> while still on campus.
- Just simple typing skills needed.
- We'll work around your schedule.

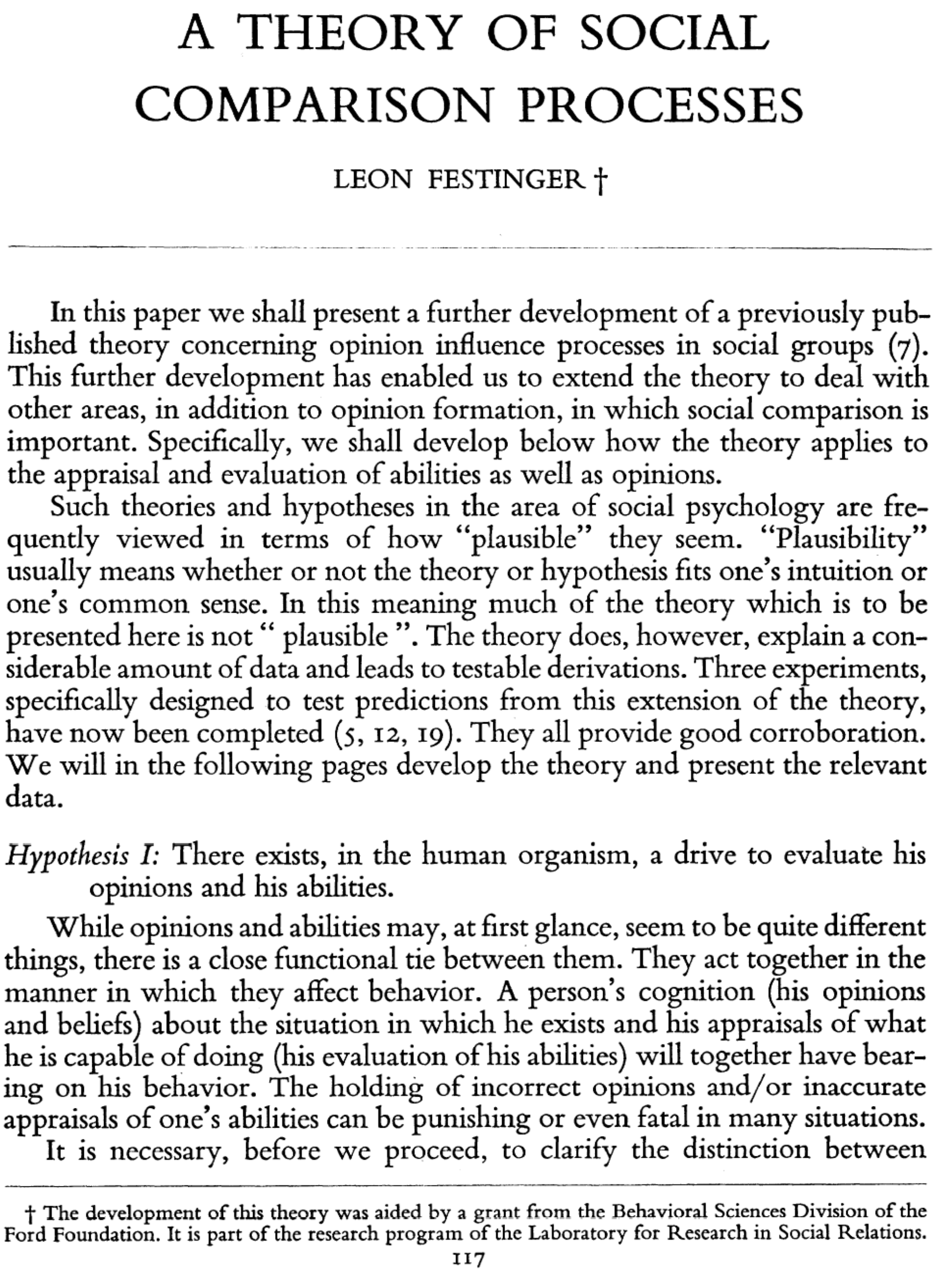
You are being recruited for a research study.
Only individuals who can touch type at 30 words per minute are eligible!

Interested? Then contact Danielle Tittelbach at
Danielle.Tittelbach@qc.cuny.edu or
Call 917-518-7720

!PLEASE NOTE YOU MUST BE AT LEAST 18-YEARS-OLD TO PARTICIPATE!

Appendix B:

Typing Task Material (Sample)



A THEORY OF SOCIAL COMPARISON PROCESSES

LEON FESTINGER [†]

In this paper we shall present a further development of a previously published theory concerning opinion influence processes in social groups (7). This further development has enabled us to extend the theory to deal with other areas, in addition to opinion formation, in which social comparison is important. Specifically, we shall develop below how the theory applies to the appraisal and evaluation of abilities as well as opinions.

Such theories and hypotheses in the area of social psychology are frequently viewed in terms of how "plausible" they seem. "Plausibility" usually means whether or not the theory or hypothesis fits one's intuition or one's common sense. In this meaning much of the theory which is to be presented here is not " plausible ". The theory does, however, explain a considerable amount of data and leads to testable derivations. Three experiments, specifically designed to test predictions from this extension of the theory, have now been completed (5, 12, 19). They all provide good corroboration. We will in the following pages develop the theory and present the relevant data.

Hypothesis I: There exists, in the human organism, a drive to evaluate his opinions and his abilities.

While opinions and abilities may, at first glance, seem to be quite different things, there is a close functional tie between them. They act together in the manner in which they affect behavior. A person's cognition (his opinions and beliefs) about the situation in which he exists and his appraisals of what he is capable of doing (his evaluation of his abilities) will together have bearing on his behavior. The holding of incorrect opinions and/or inaccurate appraisals of one's abilities can be punishing or even fatal in many situations.

It is necessary, before we proceed, to clarify the distinction between

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[†] The development of this theory was aided by a grant from the Behavioral Sciences Division of the Ford Foundation. It is part of the research program of the Laboratory for Research in Social Relations.

Appendix C

Consent Form

Queens College/CUNY
65-30 Kissena Blvd.
Flushing, NY 11367

CONSENT TO SERVE AS A PARTICIPANT IN A RESEARCH PROJECT

Project Title:
Effects of Feedback on Safety Responses
Project Main Investigator:
Danielle Tittelbach, Doctoral Student, Department of Psychology
Research Faculty Advisor:
Alicia M. Alvero, Department of Psychology

General Information:

You are being asked to participate in a research project conducted through Queens College, CUNY. Queens College requires that you give your signed authorization to participate in this research project. A basic explanation of the research project is presented below. Please read all information on this form. If you decide to participate in the research project, please sign the bottom of the last page of this form.

Purpose of the Project:

The purpose of this study is to examine the effects of feedback on safe posture while sitting in front of a computer and typing.

Experimental Procedures:

Pretest

At the beginning of the study, you will be asked to complete a pretest that determines whether you are eligible to participate in the study. During this test you will copy material from a psychology textbook onto the computer using the keyboard. To be included in the study, you will have to be able to type at least 30 words per minute across 5 minutes. If you don't meet this criterion, you will be asked to leave and will not continue with the main part of the study.

Duration

This study is expected to last a total of approximately 20 hours. The entire experiment will require 40 sessions of participation. Each session is 30 minutes long. You will be able to complete a maximum of two sessions per day and a maximum of five days per week. Thus, the minimum number of weeks needed to complete this study is 4. If you participate in only 5 sessions per week, it will take 8 weeks to complete the study.

Task

You will be asked to sit at a computer and type. A camera will be pointed at you during each session (see detailed description below). Throughout the experiment, you will be provided with information regarding the safety of your overall posture while typing and sitting in an office chair.

Use of Camera:

Throughout the experiment, a camera will be pointed at you. This camera will be active, and each session will be videotaped.

Please check one of the following:

☐ I agree that the researcher may videotape me during the experimental sessions.

☐ I do not agree that the researcher may videotape me during the experimental sessions.

Potential Risks

There are no inherent risks in participating in this experiment.

Benefits

The primary benefit of this study is that you will receive information that may help you improve your posture while working on the computer.

Reimbursement:

You will be compensated for participation. You will receive a basic rate of $5 per session ($10 per hour). In addition, in each session you can earn $ 0.25 for every 100 words you type without a spelling error. The maximum amount of money you can earn for each set of 100 words is $3 in each session. You have the following payment options: 1) payment after each session, 2) weekly payment, or 3) payment in one lump sum at the end of the study.

Termination of Participation:

You must be able to touch type without looking down at the keyboard. If you are not able to do this on a regular basis, you may be asked to leave the study.

Withdrawal from the Project:
Your participation is completely voluntary. You may decide to terminate your participation in this research at any time without penalty. However, if your participation is terminated, you will be paid only for the sessions you completed up to that point.

Confidentiality:
Your data will remain confidential and you will only be identified by a code number instead of your name. All data will be stored in a location that is only accessible by the principle investigator of this study and the faculty research advisor.

Who to call if you have any Questions:
The approval stamp on this consent form indicates that this project has been reviewed and approved for the period indicated by the Queens College, CUNY, Institutional Review Board for the Protection of Human Subjects in Research and Research Related Activities.

If you have any questions about your rights as a research participant, or to report a research related injury, you may call the Office of Research and Sponsored Programs, Queens College (CUNY) at 1-718-997-3561.

If you have any questions about this research project you may contact:

Alicia M. Alvero (Faculty Advisor)
Professor, Department of Psychology
Queens College, CUNY
Flushing, NY 11367
Telephone: 1-718-997-3212

What it means to sign this form:
By signing this consent form you agree to participate in this research project. The purpose of the research, the procedures, and the potential risks and benefits of your participation have been explained to you in detail. You can decide to withdraw from this project at any time without penalty. Withdrawal or refusal to participate will have no effect on any services you may otherwise be entitled to from Queens College, CUNY.

Name of Participant (please print):____

Signature of Participant:____

Today's Date:________________________________

Institutional Review Board Approval Stamp:

Appendix D

EARLY EXIT SCRIPT

Thank you for your willingness to participate in this study. This study has certain criteria for participation. You are not meeting these criteria at this point and thus won't be able to continue the study from here on.

Do you have any questions?

Answer all remaining questions

Thank you very much and have a good day.

Appendix E

PRETEST, SCREENING, AND INITIAL INSTRUCTIONS SCRIPT

[1] Welcome to the OBM Lab. Have you ever participated in any study in this lab?

If participant says "Yes" to this question, read script No. 5. If the participant answers "No", hand the participant the consent form and read the following:

[2] Please read this consent form carefully. When you have read the whole document, please sign the last page of the consent form if you agree with all statements made in the document. You will receive a copy of the consent form for your own records as well. Let me know if you have any questions or concerns.

After participant finishes reading the consent form, ask the participant the following:
[3] Do you agree with having your sessions recorded with a video camera?

If participant says "Yes" to this question, go to script No. 4. If the participant answers "No", go to script No. 5

[4] Do you suffer from chronic pain, have musculoskeletal disorders, or any other condition that may result in pain when sitting at a computer workstation?

If participant says "Yes" to this question, go to script No. 6 in this script. If the participant answers "No", go to script No. 5

[5] Before you begin participation in this study, I need you to demonstrate that you can touch- type without looking at the keyboard. In order for you to participate in this research study you need to be able to type at least 150 words in 5 minutes, or 30 words in 1 minute, without looking at the keyboard.

Walk participant to workstation, and ask him/her to begin the touch-typing pretest. If the participant does not meet the inclusion criteria, read the following to him/her:

[6]Thank you for your willingness to participate in this study. This study has certain inclusion criteria that are both for research purposes and for your own protection. You have not met these criteria and thus won't be able to participate. Thank you for your time.

If the participant does meet the inclusion criteria, read the following:
[7] You are now ready to begin scheduling your sessions for this research study. Your sessions will be 30 minutes long, and you can schedule 2 sessions a day. For each completed session, you will be paid $5, or $10 for each completed hour. In addition, you can earn $.25 for each 100 correctly spelled words you type in any given session. You can choose if you would like to get paid after every session, at the end of every week, or at the end of the study. Do you have any questions?
Continue with scheduling the first sessions

Appendix F

DISCRIMINATION TASK INSTRUCTIONS SCRIPT

Welcome back. Please read the following safety handout. After reading the handout, please place today's date on top of the handout, and your initials on the bottom. I will be right outside this room and will return in 5 minutes.

Leave the room and wait for five minutes to pass. Return to the room and say:

Can you please demonstrate to me what safe posture looks like?

Wait for participant to demonstrate safe posture. If the participant is unable to demonstrate safe posture, provide verbal feedback until participant shows safe posture. Afterwards, say the following:

Now please take a look at the Power Point presentation on the screen in front of you. There are five pictures of a person sitting in front of the computer and typing. Your task is to go through each of the five pictures by pressing the down arrow on the keyboard in front of you.

Physically demonstrate where the keys are.

While you look at the picture, you should answer six questions about what the person does in each picture. The questions are stated on the sheet on the table in front of you. You can use the handout you just read to help you answer the questions. All instructions are also on the sheet.

Place the score sheet in front of the participant and point at the questions.

Please put today's date and your initials on top of this sheet. Begin with the picture you see on the screen now and continue until you get to Picture 5, as indicated in the title on top of the pictures. Once you get to picture 5, leave that picture on the screen until I came back. I will be right outside this room and will return in 15 minutes.

Do you have any questions?

Appendix G

Pre- Session Safety Handout

Date: ___________________________________

Head/Neck:

The head should be upright and in line with the upper body.
The eyes should be level with the computer.
The head should not be tilted forward or backward.

Back:

The back should be supported by the back rest of the chair.
The angle between the back and upper legs should be between 90-120 degrees.

Arms:

The upper arms should be hanging comfortably at the side of the body.
The forearms should be straight and parallel to floor,
and the forearms should be in a 90-110 degree angle with upper arms.
The elbows should not be extended outward.

Wrists:

The wrists should be straight and parallel to the floor and hands should not be raised upwards or bent down.

Legs:

The thighs should be parallel to the floor, and lower legs perpendicular to the floor.
The angle between the thighs and legs should be between 90-110 degrees.

Feet:

The feet should be placed flat on the floor.

Please Initial Here:________________________

Appendix H

Discrimination Task Score Sheet

Please take a look at the picture in front of you on the computer screen. On top of the picture you should see the title “Picture 1”. Please answer to following question for all six body parts as listed in the table below and defined in your handout:

“Are/Is the _______________ (fill in name of body part) safe or unsafe in this picture?”

You should answer by placing an **X** in either the “Safe” or “Unsafe” column below.

To move to the next Picture, press the down arrow (↓) on the right hand side of your keyboard.

If you have any questions, please let the experimenter know.

You have 15 minutes to mark all fields.

	Safe	Unsafe
Picture 1		
Head/Neck		
Back		
Arms		
Wrists		
Legs		
Feet		
Picture 2		
Head/Neck		
Back		
Arms		
Wrists		
Legs		
Feet		
Picture 3		
Head/Neck		
Back		
Arms		
Wrists		
Legs		
Feet		

	Safe	Unsafe
Picture 4		
Head/Neck		
Back		
Arms		
Wrists		
Legs		
Feet		
Picture 5		
Head/Neck		
Back		
Arms		
Wrists		
Legs		
Feet		

Appendix I:
Score Sheet

Participant: ____________________ **Scorer ID:** ____________________ **IOA? Y / N**

Date: ____________________ **Session:** ____________________

Head/Neck:

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?

Back:

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?

Arms:

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?

Wrists:

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?

Legs:

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?

Feet:

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?	s u ?

Appendix J

FIRST TYPING SESSION INSTRUCTIONS SCRIPT

Welcome to your first typing task session. Before you begin your session, I need you to read this safety handout. After reading the handout, please place today's date on top of the handout, and your initials on the bottom. I will be right outside this room and will return in 5 minutes.

Leave the room and wait for five minutes to pass. Return to the room and say:

Let's begin your first typing session. Please follow me into the next room and take your handout with you.

Walk the participant to the experimental room. Adjust the equipment to the appropriate measures, and say to the participant:

Please have a seat in the chair before you. Your task will be to copy the pages from a psychology textbook mounted on the right of the computer screen into the computer. Start at the top of the page and continue typing until I come back into the room 20 minutes from now, when the session will be over. Whenever you reach the bottom of a page, simply turn the page over and continue with the top of the next page.

Please do not open any other programs on the computer, or close any open windows that you can see on your screen!

Once I enter the room when the session is over, please stop typing, but do not close the Microsoft Word program.

Do you have any questions?

Appendix K

FIRST INTERVENTION SESSION PHASE B (REAL-TIME FEEDBACK)

Welcome back. Before you begin your session, I need you to read this safety handout. After reading the handout, please place today's date on top of the handout, and your initials on the bottom. I will be right outside this room and will return in 5 minutes.

Leave the room and wait for five minutes to pass. Return to the room and say:

Let's begin your typing session. Please follow me into the next room and take your handout with you**.**

Walk the participant to the experimental room and say:

Your task is to type the material you see on the right into the computer. Please start … (point to line in text).

During this session, you will see a window appear on your computer desktop at regular time intervals. The window will contain a real-time snapshot of you typing at this workstation. The snapshot will remain on the screen for 15 seconds before automatically closing. After the window closes, you can continue typing. Please do not manually close the pop-up window.

Please do not open any other programs on the computer, or close any open windows that you can see on your screen!

Once I enter the room when the session is over, please stop typing, but do not close the Microsoft Word program.

Do you have any questions?

Appendix L

PHASE C: FEEDBACK WITH SELF- MONITORING

INSTRUCTIONS SCRIPT

Welcome back. Before you begin your session, I need you to read this safety handout. After reading the handout, please place today's date on top of the handout, and your initials on the bottom. I will be right outside this room and will return in 5 minutes.

Leave the room and wait for five minutes to pass. Return to the room and say:

Your task is to type the material you see on the right into the computer.
During this session, you will see a window appear on your computer desktop at regular time intervals. The window will contain a real-time snapshot of you typing at this workstation.

At the same time the picture of you appears on the screen, a second window will appear to the left of the picture. A message will prompt you to answer a question about the picture you see. To answer, use the mouse to click on either the 'YES', 'NO', or "Not Sure" button on the right hand side of the question. To submit your answers, click on the 'submit' button on the bottom of the window.

The picture will remain on the screen for 15 seconds before automatically closing. After the window closes, you can continue typing.

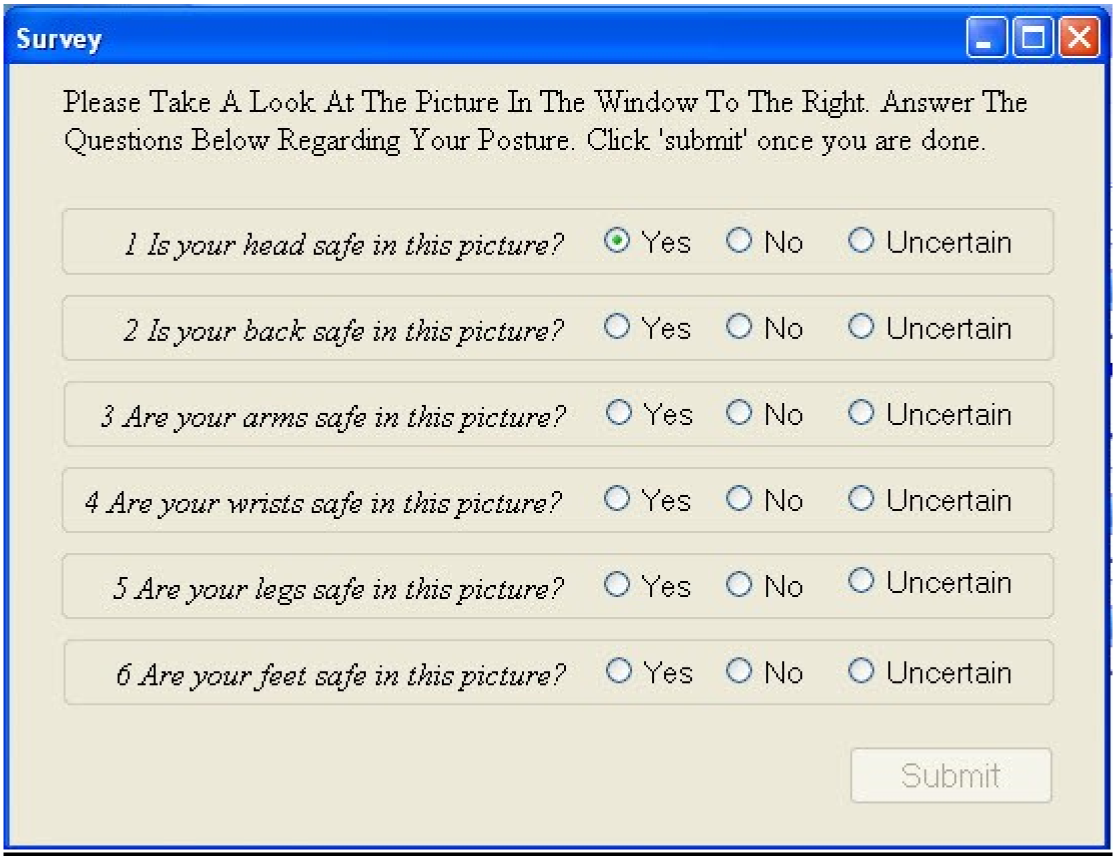
Please do not open any other programs on the computer, or close any open windows that you can see on your screen!

Once I enter the room when the session is over, please stop typing, but do not close the Microsoft Word program.

Do you have any questions?

Appendix M

Sample Self-Monitoring Window



Please Take A Look At The Picture In The Window To The Right. Answer The Questions Below Regarding Your Posture. Click 'submit' once you are done.

1 Is your head safe in this picture? ● Yes ○ No ○ Uncertain

2 Is your back safe in this picture? ○ Yes ○ No ○ Uncertain

3 Are your arms safe in this picture? ○ Yes ○ No ○ Uncertain

4 Are your wrists safe in this picture? ○ Yes ○ No ○ Uncertain

5 Are your legs safe in this picture? ○ Yes ○ No ○ Uncertain

6 Are your feet safe in this picture? ○ Yes ○ No ○ Uncertain

Appendix N

Results from the Exit Questionnaire

1. What do you think was the purpose of the study?

P206: 1) Effect of feedback on posture while typing 2) Effect of posture feedback on typing speed 3) Effect of changes in condition on typing speed
P207: If better posture leads to typing faster.
P208: If one could follow instructions, if I am correct, do I get a prize.
P210: Improving the posture of an individual.
P216: Monitor posture of typing.
P217: Posture, and if I would be effected by seeing good and bad then my own while typing.
P219: I believe the purpose of the study was to observe posture and how it affects typing.
P220: To see how productive a person is while typing (including interruptions).

2. What do you think was being measured or observed?

P206: Posture, changes in posture, typing speed over different conditions.
P207: Posture and amount of words typed.
P208: If you follow the instructions to pattern your behavior on the safety protocol or not; does perception = reality?
P210: The head, back, feet, wrists, and arms.
P216: Consistency or change of my typing posture.
P217: My posture why typing.
P219: I believe my posture was being observed.
P220: Productivity

3. Was the presence of the video camera unpleasant for you?

P206: No.
P207: No.
P208: No- did not notice it.
P210: Not at all.
P216: Not at all.
P217: Nope.
P219: At first I thought I would feel uncomfortable but once we got started it felt ok.
P220: No.

4. Do you have any experience with your work being taped or observed?

P206: Not that I can remember.
P207: No.
P208: Sometimes I tape therapy sessions.
P210: Yes.
P216: Yes.
P217: Typing became more accurate (minus the time of the pop ups when was distractive)
P219: It was easier to see through video snapshots if I was in correct posture.
P220: No.

5. Would you rather have received feedback provided by a real person in the room rather than receiving feedback through video snapshots of yourself displayed on the computer?

P206: A real person, if they could tell whether adjustments I made in posture brought me closer to ‘safe’ posture.
P207: There might have been more pressure with a real person there (Also, I have a tendency to talk to people).
P208: yes.
P210: No.
P216: No.
P217: A person- the video snapshots were distracting.
P219: It was easier to see through video snapshots if I was in correct posture.
P220: Doesn’t matter.

6. Do you think your posture was unsafe before you started getting the video feedback?

P206: Yes; I locked my arms straight because otherwise typing quickly caused pain in my elbows and I didn’t’ keep my feet on the floor.
P207: Yes, it was unsafe. I feel like I extend my neck forward and slump my back. Also, my feet are usually never flat on the ground.
P208: No difference.
P210: Yes, before my posture wasn’t perfect.
P216: No.
P217: Not entirely- when witting at a desk. However, I am usually sitting on my bed with my laptop.
P219: For the most part I felt I had a safe posture, and kept it the same throughout all sessions.
P220: Yes, I didn’t change much bit tried to be comfortable with my feet in the correct ‘safe position’

7. (If answer to #6 was yes) How unsafe do you think your posture was before you started getting the video feedback (circle the response that best describes your posture):

1) very much at-risk
2) somewhat at-risk **P210; P207**
3) not very much at-risk **P217; P206; P220**

8. Do you think your posture improved as a result of receiving video feedback?

P206: Yes; I kept my feet on the floor more often and tried to keep my forearms at a 90-110 degree angle to my upper arms.
P207: Yes, I think I still slump my back, but my feet and neck have improved.
P208: No.
P210: I sit up more straight and my head is leveled correctly to the computer.
P216: I think it stayed basically the same. I was just more aware if the was something wrong.
P217: No I think I stayed pretty much the same.
P219: Yes because if I thought I was doing something wrong I would readjust myself.
P220: No.

9. (If answer to #8 was yes) How much did your posture improve?

1) a lot **P210**
2) somewhat **P219; P216; P206; P207**
3) a little bit **P220**

10. Did the video feedback interrupt your typing assignment?

P206: Yes.
P207: Yes, somewhat, sometimes you get into a groove when typing and the picture popping up slowed me down sometimes.
P208: Yes, it was a pain.
P210: Yes.
P216: Yes, it completely ruins your rhythm.
P217: Yes.
P219: A little bit, I would be focused on typing and it kept popping up.
P220: Yes.

11. Did the possibility of receiving an additional $.25 for each 100 words typed accurately and without omissions make you work harder/type more words than you would have without that extra offer?

P206: Yes.
P207: Not really. But it gave some initiative.
P208: No.
P210: Somewhat
P216: No.
P217: Yes.
P219: Yes.
P220: Yes/no. What made me push harder was trying to get done with the page and read more. The extra money was a bonus.

12. If you could change the extra amount that is offered for each 100 words typed accurately, what amount would you change the offer to (if at all) to make it fair for the type of work required?

P206: The work was not difficult, and although I wouldn't say no to more money, I felt it was fair.
P207: $.25 is fair. The work was not difficult.
P208: $10 per hundred words.
P210: 10 cents for each word.
P216: I would leave it the same.
P217: It seemed fair, but more is certainly welcomed.
P219: I believe $.25 is a good amount.
P220: None.

13. How did you feel about receiving video feedback?

P206: It made me more aware of my posture.
P207: Other than the reasons given from question 10 it was good, and helpful.
P208: I thought it was ineffective although I would like human feedback.
P216: Was interesting to see what type of posture I actually had- from a different type of view.
P217: It didn't bother me.
P219: It felt ok, I didn't really understand the concept of it.
P220: Annoyed me.

14. If you were working at a computer workstation on a regular basis as a part of your job, would you want to get video feedback on your posture like was done in this study?

P206: If unsafe posture would have negative health effects, then yes.
P207: Yes. Again, I have poor posture in general so I think it would be beneficial.
P208: No, it was irrelevant.
P210: Yes of course!
P216: No.
P217: No, since it would get distracting or I would ignore it.
P219: No I would not because while working I wouldn't' want to get interrupted and I believe my posture is safe.
P220: No.

15. What would you change about the video feedback to make it work better for you?

-Frequency: Make it appear more or less often.
P219/P217/P210: Less often**;**
P220/ P208: Not at all

-Presence: Have feedback on the screen all the time.
P219/P220: No;
P206: Yes;
P208: That would be better than it was

-Self-monitoring: Remove or modify self-scoring component.
P219: Yes

-Other comments?
P206: Have a score on postures and have score for each snapshot to indicate improved or worsened performance.
P207: When it appears, you are still able to type.
P208: A person sitting in back in an unobtrusive manner and at the end of every 5 sessions giving positive feedback and a $10 reward for putting up with observer.
P216: Maybe an image constantly on the screen so it doesn't interrupt the typing.
P217: Be able to type while the video was on screen.

16. What did you say to yourself, if anything, during the session and when you saw the video feedback?

P207: Wow you have a nice side profile! Actually, I tried to pay attention to my posture and sometimes how dirty my shoes were
P208: At one time I said “damn” when I rushed past the text. I laughed at some sexist or anti-Semitic content. Ignorance and stupidity is sometimes humorous, e.g. Anna O case in point.
P210: How long will it (the picture) appear for?
P216: Of course my posture is ok. Maybe I was wrong.
P217: Oh no, I lost my place! Darn!
P219: If I was in correct posture and why it appeared so many times.
P220: Wow, I look fat.

Additional Comments:

P206: **“**I thought to myself that I would sit further back on the chair and adjust my arms.”
P207: “It was frustrating to have to answer the questions in the window that popped up on the screen, because it made me lose my place in the text. I wanted to type as fast as I could so that I could make the most money each session, and answering those questions made that difficult.”
P210: Participant reported not having looked at video feedback much, because she wasn’t really interested in it.
P216: **“**I saw that what I was doing was sometimes wrong, but I didn’t change it- I am comfortable that way” (He knew that the same 2 targets were always being targeted- pointed out legs as one he knew was unsafe)
P219: **“**I wasn’t sure whether this was about typing skills or posture. I don’t sit like that at home. I use a laptop.”

206, 207, 208, 217, 219 reported that they found the typing material incredibly interesting, and 206 and 217 offered to continue the study just to finish reading the book chapters.

Appendix O

Payment Form

Participant ID	**Date**	**Time**	**Session Number**	**Amount Paid**	**Participant Initials**
			Session 1		
			Session 2		
			Session 3		
			Session 4		
			Session 5		
			Session 6		
			Session 7		
			Session 8		
			Session 9		
			Session 10		
			Session 11		
			Session 12		
			Session 13		
			Session 14		
			Session 15		
			Session 16		
			Session 17		
			Session 18		
			Session 19		
			Session 20		
			Session 21		
			Session 22		
			Session 23		
			Session 24		
			Session 25		
			Session 26		
			Session 27		
			Session 28		
Debriefing Session:				**Total Amount Paid Out:**	**Participant Initials:**

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