Workplace Safety Orientation:

The Construct Validation of a New Measure

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Abstract

This study investigated the ability of a new measure to accurately measure the safety orientation of employees, where safety orientation refers to an appreciation of the importance of safety and knowing how to work in a safe manner. The new measure, designed in the format of a set of ten "spot the difference" puzzles, was created as an objective method of assessing safety orientation in job applicants. Currently safety measures used have the potential for bias. Therefore this study attempts to validate an objective measure to eliminate these biases. To create a hypothetical unsafe environment, subconscious goal setting was used to preserve the safety of the participants while "priming" them for safety. By using this paradigm, the study aimed to determine whether the objective method of assessing safety orientation provided by the safety puzzles is construct valid. The study was conducted in two phases: the first uses an experimental design to allow participants to react to the proposed new measure in a situation which would hypothetically influence their performance, and the second uses a self-report questionnaire to allow for a comparison of the potential new measure to already validated measures. 60 undergraduate students from the University of Canterbury participated in the study, with 58 used for data analysis. The results show that one hypothesis is supported, with participants in the safety-primed environment finding more safety-related differences before neutral differences, in comparison to a control group. This suggests that the measure is not a valid measure as it stands currently, but could be with more research into the variables, sample population, and the actual images themselves. The study provides useful insight into solving a current issue within workplace safety literature. Implications, limitations, and future research are discussed.

Overview

The purpose of this study was to investigate the ability of a new safety orientation measure to accurately measure employees' safety orientation. The new measure, designed in the format of a set of ten "spot the difference" puzzles, was created as an objective method of assessing safety orientation in job applicants. The term "safety orientation" in the current study refers to the degree of awareness of safety at work. More specifically this refers to their understanding of the importance of safety and knowing how to work in a safe manner.

There is currently a lack of measures available which can be used to predict employee safety behaviours. The main measures used are self-report questionnaires, which are renowned for being highly susceptible to unwanted bias effects such as social desirability. This study aimed to fill this gap by creating a measure to predict safety behaviour which would avoid these undesired effects.

By using an objective measure of safety orientation (the puzzles), measurement issues (bias) can be minimised. Job applicants who do not score well and thus are not highly aware of safety in the workplace can be trained to increase their safety orientation, or will not be selected for a job. This will make the workplace a safer environment for all, and hopefully decrease the injury or accident rates.

The introduction discusses the issues around workplace safety, self-report safety measures which can be used to select employees and identify training needs, and known factors that influence the chances of accidents occurring at work. To examine the construct validity of the puzzles, the subconscious goal-setting paradigm, as has been successfully used by Gary Latham (Shantz & Latham, 2009; 2011) to manipulate achievement, was utilised to determine whether the puzzle measure for assessing safety orientation was indeed construct valid. Using this paradigm meant that safety could be manipulated while preserving the safety of the participants. If the puzzles do indeed have construct validity – that is, they do measure safety orientation, the experimental manipulation should be reflected in the puzzle data. Specific hypotheses are outlined at the end of the introduction.

Introduction

Workplace safety is an area of utmost importance in many high-risk industries such as agriculture and construction. In New Zealand, these two industries are most commonly associated with workplace injury and fatality (Ministry of Business, 2013). In these, and similar work environments, compliance in relation to safety can be the determinant between life and death, and decreasing employees' safety risk and the chance of an accident occurring is imperative. An accident can be defined as "any undesired circumstances which give rise to ill health or injury, damage to property, plant, products or the environment, production losses or increased liabilities" (Cooper, 1994, p. 219). During 2011 New Zealand recorded 41 occupational fatalities, and 6087 work-related injuries (Ministry of Business, 2013). Moreover, the World Health Organisation estimated that, in 2000, two million individuals had fatal accidents while working (Halbesleben, 2010). These figures highlight how important it is for best practise methods of managing workplace safety to be known.

It is not only high-risk work environments where safety is important. There are many factors that influence the chances of accidents occurring at the workplace. For example, in a corporate environment the way a person sits, stands, or carries items all pose a risk of injury to the employee. In hospitals, the doctors and nurses are exposed to equipment such as needles on a daily basis. Thus, workplace safety research is necessary for all industries to protect individuals from accident and injury.

New employees to an organisation are known to cause more accidents at work than those with a longer tenure (Salminen, 2004), where a new team member is classified as having worked for the organisation for less than one year (Bentley, Parker, Ashby Moore & Tappin, 2002; Burt, Williams & Wallis, 2012). This can be due to unfamiliarity with the new workplace's rules, regulations, equipment, and procedures, and has been found to occur whether the new employee is familiar with the general nature of the role or not (Burt & Hislop, 2011). While it has been suggested that new team members initially wear a different safety uniform to others employees, and should wear this until they have earned the trust of their co-workers (Burt, Chmiel & Hayes, 2009; Burt & Stevenson, 2009), the creation of a new safety orientation measure could mean that safety behaviour can be more accurately selected for, and this may reduce some of the risk associated with new team members. Many high-risk industries such as construction would therefore greatly benefit from being able to reliably hire new team members who possess a high level of safety behaviour. There are already self-report measures which can be, and are, used to assess and predict how safety-conscious a new or potential employee is, although the validity of these is questionable.

Guldenmund (2007) discusses the issues surrounding many self-reported safety questionnaires, where replication and variance are common factors to attend to when using self-report measures. Moreover, detrimental issues such as desirability biases are frequent for these types of measures (Chmiel, 2008). Clearly, there is a calling for a measure that can successfully predict safety behaviour that is not influenced by bias.

Self-report scales can be used successfully as predictors of workplace accidents (Griffin & Neal, 2000; Neal, Griffin & Hart, 2000; Neal & Griffin, 2006), and accordingly are known as being the most common method of measuring workplace safety. The benefits of being able to predict employees' safety behaviour are vast. Nonetheless, Soane and Chmiel (2005) reported that there is commonly a large discrepancy between what injuries are recorded and how employees report their safety behaviour to be while at work. These findings, in conjunction with the aforementioned bias issues with self-report scales, highlight the need for an objective measure of safety orientation which could be used both for selection and for identifying training needs.

Unsafe Behaviours

Research on workplace safety has clearly highlighted the importance of unsafe behaviours. An unsafe behaviour relates to any behaviour performed by an employee that does not follow the required health and safety guidelines provided to them, and generally arise from people taking shortcuts and failing to follow set procedures (Clarke, 2006b). Research has shown that unsafe behaviours commonly occur when speed and performance is prioritised over safety (Halbesleben, 2010; Mearns, Whitaker & Flin, 2003; Seo, 2005), and are known as being the main precursor to an accident occurring (Chmiel, 2008).

While performing an unsafe behaviour can have a negative outcome, some unsafe behaviours are performed without incident (Clarke, 2006b; DeJoy, 1994). These potential accident-causing behaviours are known as “near miss” incidents. Indeed, the damage of an unsafe action can slowly accumulate over time, where the effects of this may not be instantly recognised (Mullen, 2004). Furthermore, Mullen (2004) describes the common belief of *invincibility*, where people believe that bad things happen to other people, not to themselves, and so they will not be injured at work. These two examples show how important it is for workers to understand and realise the risk they put themselves, and others, under when they choose to perform an unsafe behaviour. Being able to measure and monitor employees’ safety orientation and identify ways to improve their attitudes, behaviour and orientation towards safety at work should decrease the chances of an unsafe behaviour occurring, thus potentially creating a safer working environment.

Safety Climate

Safety climate is one of the most researched aspects of workplace safety, and has received considerable attention throughout the workplace safety literature with regard to decreasing unsafe behaviours (Hoffman & Stetzer, 1996; Neal & Griffin, 2006; Seo, 2005; Turner, Stride, Carter, McCaughey, & Carroll, 2012). Safety climate, along with safety knowledge, employee involvement and participation in the organisation all have been found to positively influence safety behaviour and decrease the chances of unsafe behaviours, and thus workplace accidents occurring (Clarke, 2006b; Neal et al., 2000). Indeed, Christian, Bradley, Wallace and Burke (2009) conducted a meta-analysis using 90 studies on safety climate, and found that increased safety performance (from an increased safety climate) decreases the number of accidents occurring at work.

As safety climate is known as providing the best prediction of unsafe behaviours at work (Seo, 2005), organisations featuring a performance-based climate may find their employees' cutting corners, or taking short-cuts to achieve the desired level of performance requested of them (Hoffman & Stetzer, 1996). For employees adopting this performance-based orientation this could mean that they forgo safety procedures and behaviours. Being able to identify potential employees at selection who display a safety orientation (rather than performance orientation) could protect the future safety of their employees and decrease the chances of accidents occurring.

Personality as a Predictor of Safety

While there are obvious problems with using self-report measures to assess job applicants safety orientation, there is an alternative, the use of a personality test. Broad personality traits such as the Big Five (neuroticism, agreeableness, extraversion, conscientiousness and openness to experiences) have been linked to workplace safety outcomes (Sutherland & Cooper, 1991), and more specifically to the number of accidents occurring at work (Salgado, 2002; Clarke, 2006b, Clarke & Robertson, 2008; Iversen & Rundmo, 2002; Clarke & Robertson, 2005; Cellar, Nelson, Yorke & Bauer, 2001). For example, agreeableness has been found as being predictive of safety behaviour, with more predictive validity than attitudes towards safety (Clarke, 2006a). Other researchers have discovered similar findings, where low agreeableness is significantly related to accidents occurring at work (Cellar et al., 2001; Clarke & Robertson, 2005; 2008). This may be due to employees low on agreeableness having the propensity to not follow instructions.

Iversen and Rundmo (2002) used a self-report questionnaire to find that high sensation-seeking Norwegian drivers are more likely to drive in an unsafe manner than those with a low sensation-seeking score. Thus, extraverted people may drive more dangerously. While Hansen (1989) also found a significant relationship between extraversion and accidents, the results from Clarke and Robertson's (2005) meta-analysis suggest that these are the only studies which report extraversion as predictive of workplace accidents.

Conscientious production workers have been found to perform less unsafe behaviours and be involved in fewer accidents (Wallace & Vodanovich, 2003). Other researchers have reported comparable results, concluding that employees displaying low conscientiousness are more likely to be involved in workplace accidents (Cellar et al., 2001; Clarke & Robertson, 2005). Clarke and Robertson (2005) suggest that this finding is due to low-conscientious individuals being known for occasional lapses in cognition, creating more opportunities for workplace accidents to occur.

While some researchers have found neuroticism to significantly relate to accidents (Christian et al., 2009) for reasons such as individuals high in neuroticism being distracted by their own thoughts and anxieties (Hansen, 1989), others have not replicated this result (Clarke & Robertson, 2005). Also, there is limited research on how openness to experience is related to accidents. These findings still add to the overall picture highlighting how people's personality can have an impact on their safety and that of their co-workers while at work.

Self-Report Safety Measure Options

While there are clearly measurement issues associated with using self-report measures of safety at the time of employee selection, it is important to outline what the nature of the constructs that these measures focus on. Some of these scales were also used in the current study to examine their relationship with the safety puzzle measure data. The Considerate and Responsible Employee (CARE) scale was designed to measure safety behaviour in relation to co-workers (Burt, Gladstone & Grieve, 1998). The scale is based on evidence suggesting that the level of caring shown by an individual towards his or her co-workers is measurable (Burt et al., 1998), and that considerate and responsible employees can induce a safer working environment by caring about the safety and wellbeing of co-workers (Burt et al., 2008). Accordingly, understanding the level of co-worker caring employees show should be positively related to workplace safety. The CARE scale measures worker's individual attitudes, as well as their safety attitude towards their co-workers (Burt et al., 1998; Burt, Sepie & McFadden, 2008). The scale not only focuses on measuring what prior safety measures aimed at assessing, being the extent they feel safe at work and their opinions about safety management, but also how concerned for their co-workers that they perceive themselves to be (Burt et al., 1998; Burt et al., 2008). The CARE scale is one of the scales used in this study.

In alignment with the findings suggesting that co-worker caring has a positive impact on reducing accidents, Tucker, Chmiel, Turner, Hershcovis and Stride (2008) carried out research on employees' safety voice – that is, employees' ability and intentions to report on safety issues at work in order to improve a given situation. They created a scale to measure the level of 'speaking up' about safety issues employees are likely to provide, and found this scale to successfully measure the construct, and add valuable insight into the benefits of voicing safety concerns for co-workers (Tucker et al., 2008). Thus, this scale was part of the questionnaire in this study.

Longer standing employees seem to place trust in new team members from the outset, where they show trust in the selection process and the new person performing in a safe manner (Burt & Hislop, 2011; Burt & Stevenson, 2009). Unfortunately, this is often not the case, as has been alluded to in the paragraph discussing new team members. To determine the effect of this, Burt et al. (2009) created a scale to measure current employees' safety reactions towards new team members, and found this scale to show both validity and reliability. This finding certainly adds value to the idea of having a measure which can be used for selection purposes, as new team members pose a risk both from their own behaviour, and to their co-workers. This scale was part of the questionnaire used in the current study.

While the constructs that underlie safety performance have been debated, Neal and Griffin (2006) believe that safety compliance and safety participation are the key determinants (Griffin, 1997; Griffin & Neal, 2000). Neal and Griffin define safety compliance as referring to what tasks an employee needs to perform to uphold workplace safety, and safety participation as those tasks an employee performs by their own accord and that support workplace safety (Griffin, 1997; Griffin & Neal, 2000; Neal & Griffin, 2006). Indeed, these two facets of safety behaviour have been in the research spotlight recently (Turner et al., 2012). Neal and Griffin created a scale to measure each facet, and used these measures to determine the significant association between safety behaviour and reducing the number of workplace accidents. Using this scale, Neal and Griffin (2006) found that an increased level of safety behaviour actually does decrease the number of accidents over time. Furthermore, in alignment with this measure, Soane and Chmiel (2005) created a self-report scale to measure the extent that employees' "bend the rules" – that is, how compliant they are with current rules and regulations at work, which was used in the present study.

The multi-faceted nature of workplace safety is well known, and as such, Cox and Cox (1991) created a scale to encompass some of the major contributing variables that together create the safety concept. They discovered 5 factors underlying employees' attitudes to safety. Of particular interest is the factor for scepticism, in relation to how important individual employees perceive workplace safety to be, or their view of safety. This scale was part of the questionnaire used in the present study.

As safety climate is an important predictor of safety behaviour and performance, Neal et al. (2000) performed a study on this construct and the extent it is mediated by safety knowledge and motivation. In this context, knowledge relates to the information necessary to work in a safe manner, and motivation is the extent that an employee aims to perform safely (Neal et al., 2000). They created a scale for both safety knowledge and motivation, and found them to be useful in predicting safety behaviour as both constructs were found to mediate the relationship between safety climate and performance. Both of these scales were used in the current study.

Other Available Measures

Psychometric testing specialist organisations such as OPRA Consulting Group and SHL Group Limited provide suggestions of a variety of psychometric assessments that are known as being valid and reliable at estimating specific characteristics, such as safety behavior, for work purposes. For example, SHL Group Limited offers the "Workplace Safety Solution" test, which is aimed at measuring potential safety performance for entry-level positions by using a self-report questionnaire (SHL, 2013). Of particular interest is what facets of safety performance are measured, which includes safety judgment (the ability to make decisions which are safety oriented), safety orientation (which takes into account past performance and experiences with workplace safety), and bending the rules (the ability to follow rules) (SHL, 2013). While these measures are advertised as valid, they are still self-reports and suffer from the same bias as measures developed in the research literature.

OPRA Consulting Group offers the "Health and Safety Indicator" test, which is designed to measure people's general disposition towards workplace safety (OPRA Group, 2013). This includes measuring people's ability to follow rules, understand how to work in a safe manner, and specific personality traits which are known as being predictive of safety behaviour (OPRA Group, 2013). While this supports the idea that there are indeed measures that are reliable, once again these scales are self-reported measures and are susceptible to biases such as desirability. Thus the commercial testing environment also seems to lack objective tools to measure job applicants' safety, further highlighting the need for a new measure of workplace safety orientation which does not rely on the applicant filling in information about themselves directly.

The New Objective Measure: Spot the Difference Puzzles

Spot the difference puzzles have been used in the past to research visual perception. Edmonds and Burford (2009) conducted a study whereby a group of children completed a spot the differences task in a test to see whether dehydration has an impact on cognitive ability. This study used a self-report measure to record the participants' level of thirst, and two cartoon images as the spot the difference measure (Edmonds & Burford, 2009). They found this research design to be effective, providing evidence supporting the use of spot the difference measures.

Underwood, Templeman, Lamming and Foulsham (2008) also used spot the difference puzzles, to test participants' visual perception. The study used photographs for the spot the difference images, with one difference per image set over 40 pairs of images

(Underwood et al., 2008). They discovered that items that make sense to be in a particular image will be recognised earlier than items that appear out of place. Furthermore, the general essence of an image is usually picked up on quickly. This study provides further evidence supporting spot the difference puzzles used as a research tool or measure.

In the current study the puzzles contained both safety-related and neutral differences between the two images. The safety-related differences were of an unsafe behaviour in one image, and a more safety-oriented version of this in the alternate image. The neutral differences were more like what Figure 1 shows, with colour changes and items missing or added. These differences were to try to keep the overarching purpose of the puzzles hidden – that is, being related to safety. Figure 1 highlights the general format the puzzles were displayed in, with two almost identical images presented side-by-side. The goal of a spot the difference puzzle is to find all of the differences between the two images.

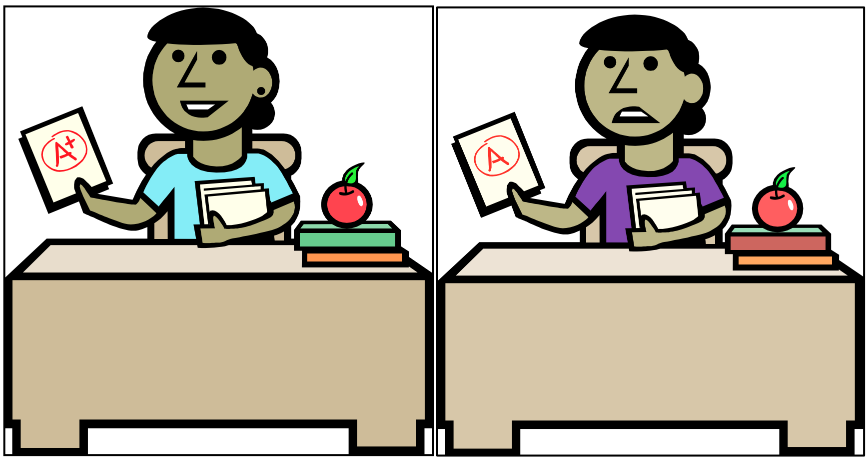

Figure 1: An example of a spot the difference puzzle. There are five differences between the two images.

How to Manipulate Safety in a Safety-Conscious Way?

One of the challenges associated with conducting safety research is the ethical issues associated with manipulating safety. In order to examine the construct validity of the new puzzle measure it was desirable that the influence of a safety manipulation on the puzzle data be examined. The subconscious goal setting paradigm appeared to provide a solution. While John Bargh is known for being one of the first Psychologists to suggest the subconscious goal setting idea in 1990 (Chartrand, Dalton & Cheng, 2008), it is the subconscious goal paradigm as developed by Gary Latham that has proven to be successful at priming for increased performance in a number of organisational-focused studies (Shantz & Latham, 2009; 2011). Indeed, subconsciously set goals have been found to impact performance to the same extent as conscious goal setting (Bargh & Fergusson, 2000). Thus, this subconscious paradigm was used for the current research to preserve the safety of participants while attempting to subconsciously prime their safety orientation. The success of the subconscious paradigm is shown in relation to work task performance and in the sporting arena, and has been hypothesized to be functional in any area where control is exerted over specific outcomes (Locke & Latham, 2006). Thus, this paradigm appears likely to influence employees' safety orientation.

By using this paradigm, the study aimed to determine whether the objective method of assessing safety orientation provided by the safety puzzles is construct valid. It was predicted that those individuals in the subconsciously primed group (primed to be more oriented towards safety) would choose the safety differences before the neutral difference. Each puzzle generated four overall scores (dependent measures), being the total number and number of safety differences found, the time spent finding differences in the puzzles, and the overall order of finding the safety differences. The following hypotheses were examined:

Hypothesis 1: Participants who are subconsciously primed for safety will, in comparison to the control group, show increased performance in the puzzles by:

a) Identifying more differences overall in the puzzles

b) Identifying more safety differences in the puzzles

c) Spending less time finding differences in the puzzles

d) Identifying safety-related differences before neutral differences

Even though the validity of self-report measures is questionable, they can still be valid. Therefore, scales described above were used for the current study (in the phase 2 setting described in the method). There were two general aims: one was to assess whether the puzzle measure data was associated with self-reported safety attitudes as per the hypothesis 2; and to check that the 2 experimental groups were matched on safety attitudes.

Hypothesis 2: Participants who rate themselves higher in the safety attitude scales, will:

a) Identify more differences overall in the puzzles

b) Identify more safety differences in the puzzles

c) Spend less time finding differences in the puzzles

d) Identify safety-related differences before neutral differences

Method

Design

While goal setting theory, as described by Locke and Latham (1990) occurs by conscious planning of activity and performance, subconscious goal setting functions involuntarily (Stajkovic, Locke & Blair, 2006). There is evidence to suggest that subconsciously set goals have a significant impact to performance (Bargh, Gollwitzer, Lee-

Chai, Barndollar, Trotschel (2001), and to the same extent as goals that are created consciously (Bargh & Fergusson, 2000). Locke and Latham (1990) have also proven the improvement to performance that goal setting in general creates. Cooper (1994) related this finding to workplace safety, and found that safety behaviour can be improved and accident rates decreased through goal setting - in the setting of a manufacturing factory. Thus, the validity of using a subconscious paradigm with the hopes of increasing performance is shown in both past workplace research and in the research performed by Shantz and Latham (2009; 2011). Moreover, the subconscious paradigm is of particular interest for studying safety, as it provides an ethical and non-biased method for manipulating individual workplace safety orientation. Therefore it was chosen to facilitate an assessment of participants' safety orientation, and to test the validity of the new puzzle measure.

Phase 1 of the study adopted an experimental format, to provide participants with an opportunity to react to the proposed new measure in a situation which would hypothetically influence their performance. Phase 2 used a self-reported questionnaire to allow for a comparison of the potential new measure to already validated measures.

The study received full ethical approval from the University of Canterbury Human Ethics Committee (HEC 2012/73).

Participants

The participants were 60 undergraduate students from The University of Canterbury, Christchurch, New Zealand, who volunteered to be part of the study. The participants were randomly assigned to one of two groups, either the experimental manipulation group or the control group. The random number generator function in Microsoft Excel 2011 was used to perform this task. Each group consisted of 30 participants, with the experimental condition including 21 females and 9 males (age M=21.73, SD=5.46) and the control condition including 20 females and 10 males (age M=20.80, SD=1.92).

Recruitment

Participants were recruited using two processes. Firstly, the Psychology student participant pool was utilised. This participant pool is attributable to first year Psychology students, i.e. students taking the course “Psychology 106: Introduction to Psychology” being required to participate in at least one academic study. To receive course credit and fulfil the requirements to pass the course, they must participate in at least 1 hour of approved research within the university. The present study was granted access to this participant pool from the Psychology Department Research Committee.

An advertisement (see Appendix A) was placed on an online recruiting system (Sonar 6) to recruit first year Psychology students. Secondly, posters were placed throughout the University. Both recruiting methods contained details of how to contact the researcher, what inducement was provided, and who could participate. Undergraduate students were chosen as the sample population because of their easy accessibility for the study. This was important to consider, as the study was conducted over two separate phases approximately two weeks apart. Thus, current students at the University should be easily able to return to the study room to complete the second phase of the study (self-report questionnaires).

To encourage participation, students were given the option of being rewarded by either a $10 voucher (petrol or Westfield mall), or course credit for those Psychology 106 students that requested it. Five participants opted for course credit.

Condition Design (Independent Variable)

A between groups experimental design was used for phase, with the independent variable being the waiting room configuration. Setting up the waiting room with either safety-related or neutral equipment created the two conditions and thus created the subconscious manipulations. The study was performed in 2 phases:

Phase 1: Completion of the "spot the difference" puzzles. The subconscious manipulation occurred in this phase of the study. Participants all completed the puzzles after waiting in the 'conditioned waiting room' for five minutes.

Phase 2: Completion of the workplace safety surveys. This was conducted once all participants had completed the first phase of the study, approximately two weeks after phase 1.

Deception

The success of this study relied on the participants' lack of knowledge about the safety-related nature of the study. Any conscious awareness of the workplace safety nature of the study prior to completion of the puzzles would bias the results. Thus, participants were told the experiment was interested in assessing information processing, and would perform this using a set of "Spot the Difference" puzzles. No reference was made towards the waiting room (the overall purpose and why it was important that they wait), or the general theme of the puzzles. Specific mention and discussion of the workplace safety-related nature of the experiment occurred in the second phase of the experiment. Thus, the importance of waiting to perform phase 2 until after all participants had completed phase 1, was to safeguard the results from any contamination that could have occurred if participants had mentioned the purpose of the experiment to other potential participants.

Pilot Study

A brief pilot study was conducted to determine the effectiveness of the puzzles. That is, to ensure there was no obvious bias contributing to the puzzle results. The pilot study also ensured the two conditions were appropriate. That is, the safety-related condition is in fact suggestive of a positive safety orientation, and the control is completely unrelated to safety.

Ten volunteers completed the puzzles in the pilot, and the results of this (questioning of the pilot participants after completion of the phase 1) showed that the conditions were appropriate, that the puzzles themselves were adequate for the experimental purposes, and the computer programme used to present the puzzles was working to required specifications. The average time period for puzzle completion was also determined from the pilot, which aided in experimental setup.

Phase 1: Materials

The Puzzles

The “Spot the Difference” puzzles were created by a paid artist specifically for the purposes of this study (and another study being undertaken during the same year). The artist was briefed by the research team on what was required, what the puzzles should look like, what each one needed to include, and given examples to use as a guide. Each of ten puzzles was created by two almost identical images, one with a slight adaptation from the other. The dimensions of all images were equal, with all images being made to a width of 1680 pixels and height of 930 pixels. Furthermore, all images were in colour, and were displayed at a resolution of 95 dpi.

Each puzzle contained five safety-related and five neutral differences. An example of a safety-related difference is that in one image a paint can is positioned behind a painter where he could trip on it. The alternate image shows the paint can in front of the painter, in a much safer position. A neutral difference example is changing the colour of an umbrella on the beach, or removing a cellular phone from the pocket of a worker. As specified above, it was necessary to have both types of differences in order to keep the overarching theme of the puzzles hidden.

The puzzles were all created to a particular safety-related theme, which were all aspects of life where an accident could indeed occur. For example, the beach puzzle contains an image of a typical beach scene, with people sunbathing, swimming, making sandcastles, and applying sunscreen. The following settings were used as the general theme of the images: a beach, a family boating, outdoor painting, forest construction work, a kitchen, an office, a street scene and workshop themes. In the beach scene puzzle an example of a safety difference is a little girl swimming in the children's pool in one image, while swimming in the sea in the other. The puzzle images are not able to be displayed in this research as, if the study finds the measure valid, it could be used in organisations. Thus, the security of the images needs to be maintained until further testing and trials have been undertaken.

The Computer Setup

The finalised puzzles were loaded onto the computer software programme E-Prime, with the two images of each puzzle being displayed on the screen horizontally side-by-side. The computer programme was designed to generate and measure the dependent variables, and was set to randomize the puzzle order to reduce order effects. The initial screen of the programme featured instructions on how to complete the puzzles (see Appendix B). The key instructions to note were to click on the right-hand puzzle only, and that each puzzle had a total of ten mouse clicks before moving onto the next puzzle. Participants were informed of the number of clicks they had left, with the total shown on the bottom of the screen. Also, they had the option to "give up", so that, if they could not find any more differences in the current puzzle they could move on to the next puzzle. Once they had clicked the "give up" button they could not then return to the prior puzzle, and a screen giving feedback for the number of differences found in the puzzle was displayed, with the wording "*You found X difference(s). Click when you are ready to proceed"*. Once the participant clicked, the computer programme started the next puzzle.

In order for the programme to know where the differences were in a puzzle, vectors were drawn around each difference. The vectors were simple squares, which were drawn around the difference in the right-hand side puzzle image. The vectors encompassed the whole difference, and thus there were a range of different sizes due to the varying difference sizes. Note the participants could not see the vectors. A click anywhere within the vector would register as a difference being discovered. Clicks outside the vector, even if only just outside the drawn square, were classed as errors. Participants were not guided towards where in the puzzle images the differences were located, although they were shown the difference locations once they had correctly selected a difference. This was specified by the vector used for the computer to identify where the difference was located becoming visible (in green) after being selected. The programme was designed so that when the final puzzle was completed, the programme would shut down to display the computer desktop screen. Participants were told this before commencing the puzzles.

Dependent Variables

The computer programme recorded a number of variables for each puzzle during puzzle completion which forms the basis for testing the hypotheses. These are:

Across all puzzles: Total number of differences found (possible score range 0 to 100), total number of safety differences found (possible score range 0 to 50), overall time spent trying to complete puzzles, overall order of safety differences found.

For each puzzle individually: differences found (possible score range 0 to 10), safety differences found (possible score range 0 to 5), time spent trying to complete the puzzle, order of safety differences found.

Total number of differences found

The total number of differences found is the number of differences, out of ten, that each participant found in each puzzle. This was calculated by summing the number of differences found. To calculate the number of differences found overall, the total differences found scores for all ten puzzles were added together to give a total score out of 100.

Total number of safety differences found

The number of safety differences found was calculated by differentiating between safety-related and control differences (as based on information detailing the nature of each difference vector for each puzzle). The number of safety-related vectors only was summed to provide the safety differences found score, per puzzle (out of five). To calculate the overall number of safety differences found, the total safety differences found per puzzle were added together, to give a total safety difference score out of 50.

Time spent trying to complete the puzzles

Time was recorded sequentially after each mouse click. More specifically, time was recorded at the time each mouse click occurred, totalling ten separate timing results. These were recorded in a running fashion, meaning that the time for click ten (or when the clicked the give up button) was the total time spent on completing the puzzle. This was repeated for all puzzles to record for each puzzle the time spent trying to complete. The total time spent trying to complete puzzles was calculated by adding together each individual puzzle's total time spent trying to complete.

It is important to note that this variable is *time spent trying to complete*, rather than time to complete the puzzle, as it takes into account participants who chose to "give up" before finding all the differences. Giving up, or choosing not to use all of the clicks remaining to try to find differences, and moving on to the next puzzle resulted in these participants having significantly smaller times to complete. Thus the time to complete measure is reflective of *persistence*, rather than *ability*.

Order of safety differences found

The ordering variable provided a way to determine whether participants found safety-related or neutral differences first. This was calculated for each puzzle by determining the order differences were found (e.g., first, second, third clicks), and adding the order scores for only the safety-related differences together. This score was then divided by the number of safety differences found in that particular puzzle. For example, if a participant found safety differences on clicks 1, 2, 4, 5, 8, then their safety difference order score was the sum of these numbers (20), divided by the number of safety differences found (5), giving them a safety order score of four. The smaller the safety difference order score the earlier in the click sequence the participant found the safety differences. The score range for a complete set of puzzles (attempted to find 10 differences) is three to eight. An overall safety difference order score was also calculated by summing the ten individual puzzle order scores and dividing by ten.

Experimental Setup/Manipulation

Three rooms were required to complete the experiment. The first room was required as a meeting space, and involved no specific setup. The other two rooms were adjoining and separated by an internal door. One of these rooms had the computer set up for the puzzles to be completed. The other was arranged as a waiting room. The waiting room was where the manipulation took place, being where the subconscious priming occurred. The different configuration of the waiting room forms the basis of the manipulation (independent variable). Specific items were strategically arranged throughout the waiting room, depending on the condition to facilitate the subconscious priming effect (see Figures 2-8). The placement of the items is crucial for study success by ensuring the subconscious goal-setting paradigm is effective. Indeed, the items should be subconsciously noticed, and not be in full sight or noticeable for this paradigm to be effective as shown in prior research.

Similar types of items were used in both conditions to minimise any potential confounding factors that could limit the meaning of the results. For example, a standard dress hat was used in the neutral condition and was placed in a corner of the room on top of a filing cabinet. For the safety condition the dress hat was replaced by a hard hat, and was placed in exactly the same place (see Figure 2). Furthermore, both conditions were kept as natural and realistic as possible, in keeping with the room being a university student's office, and to enhance the chances of items blending in to the office environment.

Figure 2: An example of the very similar items used for each condition. The top image shows the neutral/control condition items of the container of stationary and the standard dress hat. The bottom image shows the first-aid kit and hard hat.

Throughout both conditions some items remained in the waiting room. These were an umbrella, a newspaper, a bicycle and a large artificial tree. The room also contained a small coffee table and two chairs, plus a desk and office chair.

To provide the subconscious priming effect, the safety condition utilised a hard hat placed on top of a filing cabinet, a high-visibility vest which was draped over a constant item (bicycle), safety glasses set on the corner of a sink with one arm open, ear muffs sitting on the main desk, a chemical bottle sitting by the sink, a safety-related poster pinned up on a wall, drawing pins scattered on a table and on the floor under the table, a first aid kit kept in a clear container, a textbook on workplace safety placed in the left corner of the desk, and a catalogue for safety equipment and two workplace safety related magazines displayed on the small table in the middle of the room. Figures 3 and 4 provide an overview of how this condition looked.

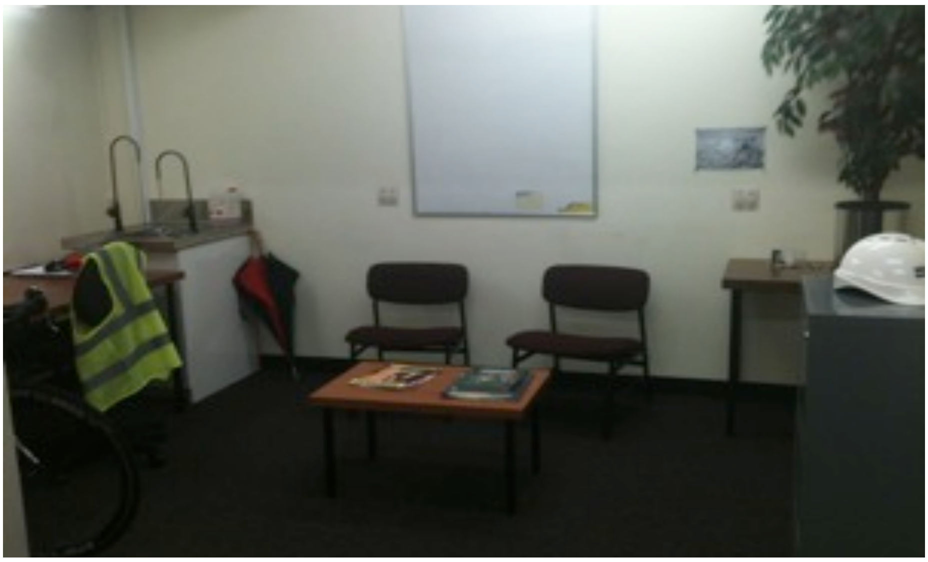

Figure 3: The overall layout of the safety condition, showing the high-visibility vest, safety glasses, chemical bottle, safety-related magazines and catalogue, drawing pins, and the hard hat.

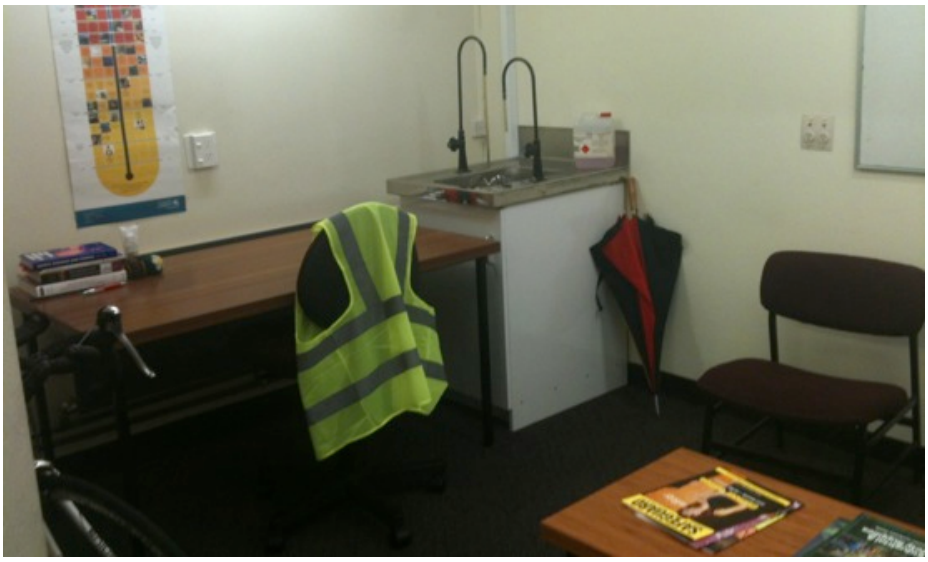

Figure 4: The safety condition from a different angle, showing the safety-related poster, the safety textbook, high-visibility vest, safety glasses, chemical bottle, and magazines and catalogues.

The drawing pins were scattered to depict a hazardous situation. They were only scattered on top of a table, thus minimizing the safety risk to participants. Figure 4 shows the extent of the scattering and thus the minimal safety risk. Furthermore, the control condition utilised paper clips, which were also scattered in the same fashion as the pins.

Figure 5: The paper clips as part of the control condition, and the hazardous situation created with drawing pins scattered for the safety condition.

The control condition featured similar items to the safety condition, and these items were placed in exactly the same place as the safety items. The neutral items were a dress hat, a fleece vest, a pair of sunglasses with one arm opened, a pair of headphones, a drink bottle, a World map poster, paper clips scattered on and under the table, a container of office stationary kept in an identical container to the first aid kit, a textbook for Industrial/Organisational Psychology, and a catalogue for biking equipment and two magazines unrelated to workplace safety but within the context of a university student environment (Figures 6 and 7). Figure 8 shows that the catalogues were of a similar size in both conditions, and the magazines and catalogue were displayed in the same order in both conditions.

Figure 6: The overall layout of the neutral condition, showing the fleece vest, sunglasses, drink bottle, neutral magazines and catalogue, paper clips and dress hat.

Figure 7: The neutral condition from a different angle, showing the World map poster, the textbook, fleece vest, sunglasses, drink bottle, and magazines and catalogues.

Figure 8: A closer look at the coffee table arrangement of magazines and catalogue for both the neutral (top) and safety (bottom) conditions.

Manipulation Check Measures

A manipulation check was conducted on completion of the puzzles to assess whether the participants had any conscious awareness of the safety-related nature of the experiment. This involved asking participants questions in regards to the perceived purpose of the experiment and anything that may have affected their performance (as adapted from Shantz & Latham, 2009). The questions asked were *"what was the overall purpose of the study?"* and "*did you feel your performance was influenced by anything? If so, what?"* This information has been taken into account when discussing the results. Indeed, the key information to take note of is, were any participants answering that any aspect of the waiting room influenced their performance (see Appendix C).

Phase 1: Procedure

The study was undertaken within the Psychology Department of the University of Canterbury. Participants began the experiment in Psychology room 439, where they met the experimenter, were given an information sheet (see Appendix D) and were briefed on the experiment. They also signed a consent form (see Appendix E). Participants were then guided by the experimenter to Psychology room 409. Here the participants were asked to wait while the experimenter finished setting up the computer programme used for the puzzles. The experimenter closed the dividing door between the two rooms, and timed five minutes.

Once five minutes had passed, participants were asked to come through to the next room and sit down at the computer. Participants were instructed to place the mouse where they preferred to suit right or left-handed preferences, but not to touch the buttons until they were ready to begin. After reading the initial instructions displayed on the computer screen, participants could begin when they were ready by clicking a mouse button. The experimenter waited in the adjoining room while the participants were completing the puzzles. There was no time limit, although it took participants on average 16 minutes, 46 seconds to complete all ten puzzles.

On completion of the puzzles, participants were asked to complete the manipulation check questions. They then booked in a time approximately two weeks later to return to complete the second phase of the experiment.

Phase 2: Materials

Self-Report Measures

Phase two comprised a self-reported safety orientation questionnaire, with the purpose of creating a means to compare results from the puzzle measure to validated safety orientation measures. It was crucial that participants had no knowledge of the initial experiment being related to safety. Thus, completing the safety orientation scales after all participants had completed Phase 1 prevented bias and provided the opportunity to appropriately debrief participants and provide a full explanation of the experimental purpose.

The questionnaire consisted of nine validated measures which are described below, plus demographic questions such as gender, age, and number and type of job positions held (see Appendix F). There were eight versions of the questionnaire, each containing the same scales but with a different order of scales. Participants were randomly assigned to one of the questionnaire orders using Microsoft Excel 2011's random number generator. Participants were all given a number when they performed the puzzles, and this was recorded for when they returned to complete the questionnaire (once all participants' data from the puzzles and questionnaire was matched, this recording information was destroyed. Their name was not recorded).

Responses for all scales were obtained on 5-point Likert scales *(1 = strongly disagree and 5 = strongly agree)*. Some scale items were rephrased to allow participants to rate their perceived safety expectations, rather than their perceptions of their current behaviour. This is important for the sample population, being undergraduate students who may not have significant working experience. It was also changed to be more consistent with what an applicant might expect to be asked in a job application process. An average overall score for each scale was calculated for each participant by summing the ratings for the items and dividing the sum by the number of items in the scale, and this figure was used for subsequent analyses. The following scales were used:

Safety participation and safety compliance

Safety participation and safety compliance were measured using an adapted version of Neal and Griffin's (2006) six item scale. Three items from the original scale measuring safety compliance were adapted to become more applicable to a job applicant population. The item *"I use all the necessary safety equipment to do my job"* was adapted to *"I use all the* *necessary safety equipment"*. The item "*I use the correct safety procedures for carrying out my job*" was adapted to "*I use the correct safety procedures*". Also, the item "*I ensure the highest levels of safety when I carry out my job*" was adapted to "*I ensure the highest levels of safety*". The adaptations were undertaken to try to minimise the specific "work" or job theme in the items and be more generalisable and applicable to an applicant population. The remaining 3 items were used to measure safety participation. One item used to measure safety participation is *"I put in extra effort to improve the safety of the workplace"*. Higher scores are indicative of higher safety compliance and participation. The coefficient alpha for the scale in the current study is 0.85. This scale is termed "Orientation" in the current study.

Bending the rules

Bending the rules was measured using the four item scale developed by Soane and Chmiel (2005), which was designed to measure workers' inclination to violate safety rules and procedures. An example item is *"Occasionally I bend the rules when I know it is safe to do so"*. One adaption was made from the original scale, being that "may" was added to the item "*work pressures may mean that I sometimes bend the rules*". This adaptation was made to make the item more generalisable and applicable to an applicant population. A higher score on the scale implies a higher likelihood of the participants breaking safety rules and procedures whilst at work. The coefficient alpha for the scale in the current study is 0.85. To note, this scale was reverse coded, as usually a high score in this scale indicates a higher likelihood of participants to break the rules. Reversing the score made it equivalent with the remaining measures, to enable them to be analysed together.

Considerate and responsible employees

Safety attitudes towards co-workers was measured using the shortened scale version of the Considerate and Responsible Employee (CARE) scale, consisting of 15 items, as developed by Burt et al. (1998). An example item of the shortened scale is *"co-workers* *should be warned when their actions are unsafe"*. Scores for the CARE scale used ranged from 15 to 75, where a higher score is suggestive of a higher level of co-worker caring. Coefficient alpha for this shortened scale is reported as 0.92 (Burt et al., 2009), and the alpha for the current study is 0.86.

Safety scepticism

How participants feel about safety in general, their safety scepticism was measured using a five item scale as adapted from an original safety scepticism scale used by Cox and Cox (1991). An example item is *"safety works well until employees are busy, then other things take priority"*. This item is adapted from the original scale, with "employees" being replaced with "we" in the original scale. Also, the original item "*I believe safety procedures are more for an organisation to meet its legal requirements than for my personal safety*" was adapted to "*I believe safety procedures are more for an organisation to meet its legal requirements than for employee safety"*. These adaptations mean the items are more applicable to job applicants and to students. A higher score on this scale suggests that the individual has a high degree of scepticism of workplace safety. The coefficient alpha for the scale in the current study is 0.72. To note, this scale was reverse coded, as usually a high score in this scale indicates a higher likelihood of participants being skeptical of safety. Reversing the score made it equivalent with the remaining measures, to allow them to be analysed together.

Safety reactions to new team members

To assess how participants might react to a new team member or recruit, the six item scale developed by Burt et al. (2009) was used, with some minor adaptations. For example, the item *"everyone pays more attention to safety when a new member joins the crew"* was adapted to *"everyone pays more attention to safety when a New Team Member joins a workplace"*. Furthermore, in all items the phrase "new crew member" was replaced with "new recruit". Lastly, "crew" was deleted from the second item, making it "*immediately determining the safety attitudes of a new recruit is important for safety"*. The adaptations were undertaken to increase the applicability of the scale to an applicant population. Higher scores on this scale are suggestive of a higher understanding of safety in relation to new recruits. That is, understanding that new recruits should not be trusted with safety procedures and extra precaution should be taken with regard to safety when new recruits are present. The coefficient alpha for the scale as used currently, and as used by Burt et al. (2009), is 0.70. This scale is termed "New Team Members" in the current study.

Safety knowledge

Safety knowledge was measured using four items, as developed by Neal et al. (2000). An example item is "*I know how to perform my job in a safe manner"*. One change was made from the original scale, being that the phrase "I ensure" was added to the start of the scale as a precursor to all items. A higher score on this scale indicates a higher level of knowledge for workplace safety procedures. The coefficient alpha from the original scale is 0.90, and in the current study is 0.83.

Safety motivation

Safety motivation was measured using four items as developed by Neal et al. (2000). An example item is *"I believe that workplace health and safety is an important issue"*. A higher score on this scale is indicative of having a higher level of motivation to work safely. Neal et al. (2000) report the coefficient alpha for the scale as 0.93, and in the current study is 0.91.

Employee's safety voice

Safety voice was measured using five items developed by Tucker et al. (2008). The scale was adapted to be better suited to an applicant population. For example, the precursory statement to all scale items of *"in my job"* was changed to *"typically I would"*. Furthermore, all sentences in the original scale begin with *"I"*. This was removed in the current scale. These adaptations make the items more generalisable to an applicant population. An example item is *"typically I would make suggestions about how safety could be improved"*. A higher score on the scale indicates a higher likelihood of the participant raising safety concerns (speaking up). Coefficient alpha for the original scale is reported by Tucker et al. (2008) as 0.78, and in the current study is 0.81.

Safety incidents

Participants were asked to record the number of work-related injuries or incidents they had been involved in to provide more detail on their past experience with workplace safety. An example item is **"***how many times have you had a near hit, minor injury or lost time injury"* or "*how many times have you had a very minor injury not requiring medical attention"*. There were five items that created this summary.

Phase 2: Procedure

All participants returned to complete the self-report questionnaire within two weeks of the initial phase of the study. The participants returned to Psychology room 409 at their allocated time to complete the four page questionnaire. This took on average 12 minutes. On completion, participants were all rewarded with their reward of choice.

Debriefing

At the completion of the survey performed in phase two of the experiment, participants were appropriately debriefed. The researcher presented each participant with a debriefing information sheet, explaining the overall purpose of the study (see Appendix G). The researcher also verbally explained the purpose of the study to each participant. Part of the debriefing included explaining why it was important to deceive them, and what the deception involved.

Results

Data Preparation

E-Prime recorded data for each participant in their own individual data files. On completion of all 60 participants, this raw data was merged into one E data file, and subsequently transformed into a more easily analysable format (Microsoft Excel 2011). This resulted in the data for each participant being displayed in rows, with each variable shown in columns.

The data from the safety surveys (phase 2) was combined with the information from the puzzles in the SPSS Statistics 20 dataset. This scale data was matched via participant numbers to the puzzle data. The average for each scale was calculated by summing the item ratings within a scale and dividing the sum by the number of items in the scale (all scale thus had a possible score range of 1 to 5). Data inspection found all cases to be correct, with no missing values.

Manipulation Check

The manipulation check questionnaire information was summarised, with all the answers given for each question outlined and the number of participants that chose each answer (Table 1). The aim in performing the manipulation check was to identify participants who noticed the manipulation: that is, those participants who felt their performance in completing the puzzles was influenced by the waiting room setup.

Table 1: A summary of the manipulation check answers to the question "*What was the overall purpose of the study*"?

What was the overall purpose of the study?	Number of participants	Number in Safety condition
To study information processing using spot the difference puzzles	18	5
To spot the differences in two almost identical puzzles	16	8
To test observation of safety factors in the workplace	3	1
To spot the differences with regards to safety	2	1
To see what people notice first and if they can pick out dangers in environments such as the workplace	2	2
To see whether people are more likely to identify hazards or random changes between the two pictures	2	2
To see if people would click on incorrect differences if they were told there were more differences	2	1
To see how participants tried to "spot the differences" and if they gave up	2	2
To identify the order when people are trying to spot the differences	2	1
Studying attention to detail or attention span	2	1
No idea	2	1
To see how people analyse things such as hazards	1	1
To assess attention to detail particularly regarding health and safety	1	0
To compare problem solving skills to demographics	1	0
To study observational ability	1	1
To see how males and females differ in finding differences	1	1
How background noise disturbs people's attention and accuracy	1	1
To evaluate the time it takes to notice differences	1	1

Table 1 shows that some participants make note of the safety-related nature of the study. For example, two participants believed the overall purpose of the study to be *"to spot the differences with regards to safety"*. In total, 11 participants believe the study is somehow related to safety or hazards. Of these, four were in the neutral condition, ergo are of no consequence due to the fact that safety-related features could not have influenced their performance. Furthermore, Table 2 shows that a total of three participants answered that their performance was influenced by *"safety equipment in the waiting room"*. To determine if these participants should be removed from the sample, the group mean and standard deviation was calculated for the four overall dependent variables (total differences found, total safety differences found, time spent finding differences, order of differences found). Next the standard deviation was multiplied by three, and this result subtracted from and added to the mean. The results of the participants in question were then compared to the overall variable ranges created by the latter procedure. All concerning participants (7 as indicated from Table 1; 3 as indicated from Table 2) had results which were within the calculated range, indicating that they were not outliers. Thus, these participants remained in the study.

Finally, as an overall test for outlying participants, participants individual results were considered against the four overall variable ranges generated by the procedure described above. Inspection of the distance results showed two participants to be significant outliers, one from each condition. These participants were removed from the dataset.

Table 2: A summary of the manipulation check answers to the question *"Did you feel your performance was influenced by anything? If so, what?"*

Did you feel your performance was influenced by anything? If so, what?	Number of participants	Number in Safety condition
No	25	11
Clicking a difference, but it wasn't registered by the computer programme	7	4
Noticing safety equipment or hazards in the puzzles made me look for those differences more	5	3
Background noise	4	1
Safety equipment in waiting room	3	3
Became easier to spot the differences with time	2	1
Time pressure	2	1
Lack of patience which led to "giving up"	1	0
Being a research participant - made me nervous	1	0
Being a research participant - made me try harder	1	0
Placing a personal time limit to achieve for each puzzle	1	0
Recognising the overall theme of the puzzle images	1	0
By being told there were 10 differences, when I could only find 9	1	1
Accidentally clicking on the left-hand image	1	1
Screen went blank during experiment	1	1
The puzzles - translation of objects was obvious	1	1
Being told how many clicks were left	1	1
Becoming frustrated that couldn't find the differences as easy as I thought I should be able to	1	0
Personal experiences with working in hazardous environments	1	1

Safety Attitudes

Table 3 shows the results of the phase 2 scale analysis. A two-tailed Independent samples t-test was used to compare the groups for each scale and no significant differences were found. These results suggest that the groups were matched on safety attitudes, and thus pre-existing safety attitudes were unlikely to have bias the between group comparison of the puzzle results.

Table 3: Descriptive statistics and t-test results for the safety behaviour questionnaire for each group (control and safety).

Variable	Control Condition Mean (SD) N = 29	Safety Condition Mean (SD) N = 29	t-test t (1, 56) =
Orientation Scale	3.67 (.65)	3.56 (.66)	0.63
Knowledge Scale	4.20 (.45)	4.06 (.50)	1.13
Motivation Scale	4.53 (.44)	4.30 (.69)	1.46
New Team Members Scale	3.60 (.56)	3.50 (.54)	0.72
CARE Scale	4.20 (.43)	4.08 (.42)	1.02
Safety Voice Scale	3.54 (.66)	3.37 (.69)	0.93
Bending the Rules Scale (R)	2.75 (.86)	2.53 (.83)	0.97
Safety Scepticism Scale (R)	3.56 (.64)	3.30 (.73)	1.42
Near Hit Incident	6.21 (20.30)	6.31 (18.44)	-0.02
Minor Injury	2.76 (3.53)	3.79 (5.43)	-0.86
Minor Injury requiring Medical Attention	0.24 (0.58)	0.59 (0.98)	-1.63
Lost Time Injury	0.07 (0.37)	0.21 (0.49)	-1.21
Unsafe Behaviour	2.07 (9.25)	4.59 (18.53)	-0.65

Some participants chose to “give up” on the puzzle, and move on to the next one. Table 4 shows the percentage of participants who completed the puzzle – that is, used all the available clicks or attempts to find the differences, for each puzzle. Inspection of Table 4 shows that for some puzzles, more participants chose to “give up” than in other puzzles, indicating that some puzzles were more difficult than others.

Table 4: Percentage of participants in each condition that completed each puzzle (i.e. did not choose “give up”).

Puzzle	Control Condition (%) N = 29	Safety Condition (%) N = 29
Beach	82.76	62.07
Boat	93.1	86.21
Falls	89.66	72.41
Forest	75.86	75.86
House	96.55	96.55
Office	75.86	62.07
Office Behaviour	96.55	89.66
Street	93.1	72.41
Workshop	86.21	89.66
Workshop Gear	79.31	75.86
Total	48.28	27.59

Main Analysis: Hypothesis Testing

A one-tailed independent samples t-test was conducted for each of the overall variables: the number of differences found over all puzzles (maximum value of 100), total number of safety differences found over all puzzles (maximum value of 50), time taken to complete puzzles (minutes), and the order in which safety differences were found. The results are shown in Table 5, along with means and standard deviations according to condition (safety or control). The hypotheses stated that those in the safety condition will perform better than those in the control condition in terms of finding more differences overall, finding more safety differences, spending less time finding differences, and discovering the safety differences earlier in the click sequence (having a lower safety order score). The test was performed one-way to encompass the directionality of the hypotheses.

Table 5: Means, standard deviations and Independent samples t-test values for the overall variable totals and for safety scale data according to participant condition (either safety or control).

Variable	Control Condition Mean (SD) N = 29	Safety Condition Mean (SD) N = 29	t-test t (1, 56) =
Number of differences found	91.55 (4.65)	88.52 (5.93)	2.17*
Total safety differences found	43.24 (1.33)	41.38 (2.83)	3.21**
Time spent finding differences	17.13 (4.16)	16.40 (4.27)	0.66
Average Safety Order	5.14 (0.39)	4.94 (0.42)	1.88*

* *p < .05, one-tailed*
** *p < .01, one-tailed*

Inspection of the t-test results displayed in Table 5 shows a significant difference between the safety and control conditions for the total number of differences found in all puzzle. It is evident from inspection of the means that more differences were found by participants in the control condition, thus not supporting hypothesis 1a. Table 5 also shows that participants in the control condition found significantly more safety-related differences than those primed in the safety condition. Thus hypothesis 1b is not supported. The order of safety differences found over all puzzle shows a significant difference between conditions, where safety-primed participants identify safety-related differences earlier in the click sequence compared to participants in the control group. This result is in support of hypothesis

1d. The lack of a significant difference between conditions for the total time spent finding differences does not support hypotheses 1c. An examination was conducted of each puzzle individually to determine whether some puzzles might be better predictors of safety orientation (as measured in this study) than others. The t-test results from each puzzle individually can be seen in Table 6.

Inspection of Table 6 shows a significant difference between the two conditions for the number of safety differences found in each of the beach, boat, street, and workshop gear puzzles. An examination of Table 6 shows that the average number of safety differences found in each of these puzzles is higher in the safety condition than the neutral condition. Thus, there is no support for hypothesis 1b. There is a significant difference between conditions in the street puzzle for the total time taken to complete the puzzle. An inspection of the mean times suggests that the safety-primed participants spent significantly more time trying to complete the puzzles than the neutral condition, which is not in support of hypothesis 1c. An inspection of the street puzzle shows that safety-primed participants found significantly more safety-related differences before neutral differences than the control condition. Thus, there is support for hypothesis 1d for this individual puzzle alone.

Table 6: Independent samples t-test values and descriptive statistics for the overall variable totals, according to condition (safety or control).

Puzzle	Variable	Control Condition Mean (SD) N = 29	Safety Condition Mean (SD) N = 29	t-test t (1, 56) =
Beach	Number of differences found	8.52 (1.22)	8.24 (1.60)	0.74
	Total safety differences found	4.90 (0.41)	4.59 (0.82)	1.81*
	Time spent finding differences	2.08 (1.09)	2.00 (0.90)	0.29
	Average Safety order	4.66 (0.82)	4.51 (0.72)	0.72
Boat	Number of differences found	9.21 (1.37)	8.66 (1.54)	1.44
	Total safety differences found	4.79 (0.41)	4.41 (0.82)	2.22*
	Time spent finding differences	1.47 (0.75)	1.41 (0.80)	0.28
	Average Safety Order	5.61 (1.01)	5.21 (1.03)	1.50
Falls	Number of differences found	8.86 (0.99)	8.52 (0.95)	1.35
	Total safety differences found	4.45 (0.57)	4.24 (0.58)	1.37
	Time spent finding differences	2.09 (1.16)	1.84 (0.71)	0.98
	Average Safety Order	5.02 (1.26)	4.82 (1.15)	0.62
Forest	Number of differences found	9.24 (0.91)	9.00 (1.10)	0.91
	Total safety differences found	4.79 (0.56)	4.55 (0.83)	1.30
	Time spent finding differences	1.95 (0.72)	1.76 (0.75)	1.03
	Average Safety Order	5.24 (1.01)	4.91 (1.07)	1.21
House	Number of differences found	9.34 (0.72)	9.28 (0.59)	0.40
	Total safety differences found	4.52 (0.51)	4.55 (0.57)	-0.24
	Time spent finding differences	0.95 (0.41)	0.99 (0.51)	-0.38
	Average Safety Order	5.40 (0.84)	5.33 (1.21)	0.24
Office	Number of differences found	9.03 (0.73)	8.72 (0.99)	1.35
	Total safety differences found	4.69 (0.47)	4.48 (0.63)	1.41
	Time spent finding differences	2.50 (1.44)	2.13 (1.05)	1.11
	Average Safety Order	5.44 (1.12)	5.27 (1.05)	0.60
Office Behaviour	Number of differences found	9.14 (0.88)	8.09 (0.86)	1.06
	Total safety differences found	4.79 (0.49)	4.72 (0.45)	0.55
	Time spent finding differences	1.26 (0.63)	1.08 (0.40)	1.27
	Average Safety Order	5.20 (0.92)	4.86 (0.85)	1.49
Street	Number of differences found	8.97 (0.82)	8.59 (1.05)	1.53
	Total safety differences found	4.86 (0.35)	4.55 (0.63)	2.31**
	Time spent finding differences	1.29 (0.53)	1.67 (0.91)	-1.96*
	Average Safety Order	4.77 (0.94)	4.33 (0.78)	1.95*
Workshop	Number of differences found	9.59 (0.68)	9.45 (0.91)	0.65
	Total safety differences found	4.97 (0.19)	4.90 (0.41)	0.63
	Time spent finding differences	1.61 (0.73)	1.51 (0.66)	0.58
	Average Safety Order	5.06 (1.10)	5.12 (1.16)	-0.23
Workshop Gear	Number of differences found	9.38 (0.78)	9.03 (1.09)	1.39
	Total safety differences found	4.97 (0.19)	4.62 (0.62)	2.86**
	Time spent finding differences	1.93 (0.79)	2.00 (1.23)	-0.25
	Average Safety Order	5.03 (0.95)	5.06 (0.88)	-0.08

Given that Table 3 shows the safety attitude survey data collected in phase 2 of the study to be independent of the experimental manipulation, the data from both conditions was collapsed, and correlational analysis was performed using the overall puzzle scores. Table 7 shows the correlations between the overall puzzle scores and each safety attitude scale used in phase 2.

Inspection of Table 7 shows that there are no significant correlations between any of the overall puzzle variables and the safety attitude scales. Thus, hypothesis 2 is not supported.

Table 7: Correlation coefficients of overall puzzle scores and safety attitude scales

	Orientation	Knowledge	Motivation	New Team Member	CARE	Safety Voice	Bending the Rules	Safety Scepticism
Number of differences found	0.05	0.18	0.00	-0.10	0.01	0.02	0.08	0.08
Total safety differences found	-0.02	0.06	-0.05	-0.06	0.02	-0.01	-0.01	0.04
Time spent finding differences	-0.10	-0.05	-0.11	0.06	0.08	-0.06	-0.17	-0.09
Average Safety Order	0.01	0.12	0.17	-0.07	0.14	0.02	0.07	0.10

* < .05, one-tailed

To further explore the whether the individual puzzle data were associated with already existing safety attitudes, Pearson's correlational analysis was performed for each puzzle individually (see Table 8).

Table 8: Correlation coefficients of safety attitude scale scores for each puzzle.

Variable	Orientation	Knowledge	Motivation	New Team Member	CARE	Safety Voice	Bending the Rules	Safety Scepticism
Beach								
Total number of differences found	-0.06	0.04	-0.05	-0.11	-0.10	-0.17	-0.03	-0.26*
Total safety differences found	-0.03	0.05	0.03	-0.10	-0.05	-0.08	0.05	-0.10
Time spent finding differences	0.11	0.09	-0.08	0.03	0.14	0.13	0.02	0.01
Order of safety differences found	0.18	0.08	0.12	0.09	0.03	0.09	-0.12	-0.03
Boat								
Total number of differences found	0.03	0.12	-0.08	0.02	0.07	-0.02	0.16	0.06
Total safety differences found	0.08	-0.07	-0.03	-0.01	-0.08	0.02	0.23*	0.14
Time spent finding differences	-0.19	-0.05	-0.32**	-0.02	-0.08	-0.18	-0.12	-0.22*
Order of safety differences found	0.04	0.01	0.16	0.06	0.05	0.10	0.20	0.09
Falls								
Total number of differences found	0.32**	0.13	0.12	0.15	0.06	0.30*	0.19	0.20
Total safety differences found	0.14	0.19	0.04	0.02	-0.10	0.06	0.22*	0.06
Time spent finding differences	-0.03	-0.01	-0.12	0.03	0.00	0.02	0.10	-0.06
Order of safety differences found	0.07	0.09	0.08	-0.03	-0.05	-0.01	0.11	0.09
Forest								
Total number of differences found	-0.02	0.17	-0.11	-0.11	-0.14	-0.04	-0.03	-0.19
Total safety differences found	0.04	0.02	-0.01	0.03	-0.05	0.08	-0.14	-0.14
Time spent finding differences	-0.02	0.06	-0.15	0.27*	0.13	0.09	-0.19	-0.08
Order of safety differences found	-0.10	-0.20	0.11	-0.12	0.02	-0.17	0.16	0.06
House								
Total number of differences found	-0.06	0.08	0.03	-0.21	0.15	0.10	0.01	0.09
Total safety differences found	-0.07	0.05	-0.17	-0.30*	-0.04	-0.05	-0.13	0.04
Time spent finding differences	-0.41**	-0.23*	-0.21	-0.06	0.00	-0.32**	-0.38**	-0.34**
Order of safety differences found	-0.09	0.13	0.04	-0.02	0.17	-0.05	-0.11	0.20

Office								
Total number of differences found	-0.12	0.02	-0.28*	-0.13	-0.06	-0.01	-0.13	0.06
Total safety differences found	-0.05	0.11	-0.29*	0.04	0.01	-0.04	-0.02	0.04
Time spent finding differences	0.02	-0.02	0.04	-0.11	0.02	0.05	-0.04	0.05
Order of safety differences found	0.00	0.14	0.01	-0.02	0.27*	0.06	-0.03	-0.01
Office Behaviour								
Total number of differences found	-0.06	0.13	0.17	-0.14	-0.01	-0.22*	0.24*	0.29*
Total safety differences found	-0.10	0.03	0.16	-0.10	0.11	-0.11	0.07	0.19
Time spent finding differences	-0.03	-0.22*	0.02	-0.05	-0.01	0.02	-0.11	-0.04
Order of safety differences found	0.09	0.30*	0.26*	0.21	0.26*	0.07	0.02	0.05
Street								
Total number of differences found	-0.17	0.17	-0.07	-0.16	-0.03	-0.13	-0.16	0.00
Total safety differences found	-0.08	0.07	-0.01	-0.10	0.02	0.00	-0.10	-0.08
Time spent finding differences	-0.02	0.10	0.01	0.25*	0.19	-0.07	-0.05	0.15
Order of safety differences found	0.01	0.11	0.01	-0.12	0.00	0.13	0.06	0.13
Workshop								
Total number of differences found	0.33**	0.12	0.13	0.07	0.16	0.23*	0.12	0.26*
Total safety differences found	0.12	-0.12	0.05	0.26*	0.14	0.14	0.00	0.09
Time spent finding differences	-0.18	-0.01	0.00	-0.07	-0.03	-0.16	-0.10	-0.09
Order of safety differences found	-0.09	-0.09	0.05	-0.19	-0.18	-0.09	-0.09	-0.13
Workshop Gear								
Total number of differences found	0.15	0.12	0.08	-0.04	0.10	0.17	0.00	0.07
Total safety differences found	0.02	0.11	0.04	0.05	0.12	0.01	-0.03	0.07
Time spent finding differences	-0.04	-0.10	0.12	0.04	0.02	-0.11	-0.21	-0.04
Order of safety differences found	-0.02	-0.01	-0.14	-0.08	0.04	0.00	0.09	-0.04

Table 8 shows that some puzzle data appear more strongly related to safety attitudes than others. There are a number of significant correlations highlighted in Table 8. As per the stated hypotheses, the variables total differences and total safety differences found are hypothesized to increase as safety attitude scale scores increase, while time and order variables are predicted to decrease with increasing safety attitude scores. Hence, the correlations discussed will be only those pertaining to these respective hypotheses.

Total number of differences found

In regards to the total number of differences found, there was a small, positive correlation between the beach puzzle and safety scepticism scale scores. This suggests that people who scored higher on the safety scepticism scale and thus hold workplace safety in high regard found more differences in the beach puzzle. Furthermore, this result was also found for the safety scepticism scale and both the workshop and office behaviour puzzles. A small, significantly positive correlation was also found between the office behaviour puzzle and the bending the rules scale for the total number of differences found. This suggests that people who score themselves as being more likely to follow rules found more differences in the office behaviour puzzle. The workshop puzzle shows a small significant relationship with the safety voice scale, highlighting that participants who believe themselves as being more likely to speak up about safety-related issues found more differences in the workshop puzzle. The orientation scale also shows a medium relationship with the number of differences found for both the falls and workshop puzzles. This means that participants who scored themselves higher in participating and complying with safety found more differences in the falls puzzle. Lastly, a medium relationship was discovered between scores for the falls puzzle and the scale measuring safety voice, indicating that more differences were found by participants who rated themselves as being likely to speak up about safety-related issues. These results provide support for Hypothesis 2a. Thus, higher safety attitude scale ratings are significantly related to a higher number of differences found in some specific puzzles.

Total safety differences found

The workshop puzzle shows a small, positive relationship with the new team members scale, indicating that a higher understanding of the risks posed by new team members was associated to a higher number of safety differences found in the workshop puzzle. The bending the rules scale also shows small, positive relationships with the number of safety differences found in both the falls and the boat puzzles, indicating that participants who believe they will follow safety rules found more safety-related differences in the falls and boat puzzles. These findings are in support for Hypothesis 2b for the specific puzzles and scales only.

Time spent trying to complete the puzzles

A small, negative correlation was found between time spent finding differences in the puzzles and the knowledge scale for both the house and the office behaviour puzzles. Participants who scored themselves as being more knowledgeable about safety spent less time trying to complete both the house and office behaviour puzzles. The safety voice scale shows a medium negative relationship with time spent finding differences in the house puzzle. Thus, participants scoring themselves higher in the ability to communicate with co-workers about safety aspects spent less time trying to complete these puzzles than those who scored themselves lower. Both the motivation scale and safety scepticism scale show significantly negative relationships for the time spent finding differences in the boat puzzle. This suggests that participants who scored themselves as being either highly motivated to work safety, or believe they have a positive view of safety spent less time trying to complete the boat puzzle, compared to participants who did not score themselves as highly. Lastly, Medium negative correlations were reported between the house puzzle and the scales orientation, bending the rules and safety scepticism. This shows that participants spent less time trying to complete the house puzzle when they self-rated themselves as being more compliant with safety rules, and more willing to perform these, or are more likely to follow safety-related rules in a positive light. These findings are in support of Hypothesis 2c, for these puzzles and scales specifically.

Order of safety differences found

Small but significantly negative correlations were found for the order of safety differences found in the office behaviour puzzle, with the scales knowledge, motivation and CARE. Thus, participants who rate themselves as having a higher level of co-worker caring, have a higher understanding of safety practises, or have a higher level of co-worker caring found safety differences earlier in the click sequence. This result provides partial support for Hypothesis 2d.

Discussion

The overarching purpose of this study was to use the subconscious goal-setting paradigm as developed by Shantz and Latham (2009; 2011) to manipulate (prime) safety to test the construct validity of a new safety measure. The new measure is a collection of “spot the difference” puzzles, created specifically for the purposes of this study. Literature on workplace safety has highlighted the need for a more objective and non-biased measure that could be used for selecting employees, in high-risk industries especially. This research aimed to provide an introduction to this, and to create a new measure appropriate for the requirements.

Summary of Results

Overall, little evidence was found in support of the hypotheses. The first aim of the experiment was to show that the puzzles can be used to accurately measure participants' potential safety orientation. No significant difference was found between conditions for the time spent trying to complete the puzzles overall. The number of differences and safety differences found was significant, although supporting control condition participants finding more differences in each category, thus against hypothesis 1a and b. Hypothesis 1d was supported, with safety-conditioned participants identifying safety-related differences before neutral differences significantly more than participants in the control condition. Thus, the puzzles proved successful in differentiating which differences participants found first, depending on which condition they were in.

Hypothesis 2 stated that participants rated higher in the safety attitude scales used in this study will, in comparison to those who scored lower, find more differences overall and more safety differences, spend less time trying to complete the puzzles, and identify safety-related differences before neutral differences. It was expected that highly safety-orientated participants would identify more safety-related differences, and thus more differences overall. This hypothesis was overwhelmingly not supported. Some individual puzzles did indeed support the hypothesis, although these results were scattered over different scales and puzzles, and thus results do not paint a clear picture. Nonetheless, participants who scored themselves higher on the motivation, knowledge, orientation, and employee safety voice scales, and those that believe they are less sceptical of safety and are more compliant with rules took significantly less time to complete the puzzles than those who scored themselves lower on these scales.

Practical and Theoretical Implications

There is a need for a new measure to accurately capture the safety orientation of new employees especially. This need is even more evident when considering the statistics of accidents that occur due to negligence to follow the correct safety procedures in high-risk industries. The results from this study suggest that the proposed measure is not fit for the purposes required from a measure of safety orientation, as it stands currently. However, there is some support for the puzzles measure in line with the expectations outlined in the hypotheses, which is promising and suggests that it is capable of being a valid measure of safety orientation. The general premise of the puzzle measure does appear appropriate to use as a safety orientation measure, and to overcome the current challenges experienced with ways to measure safety-related attitudes currently.

Limitations

The results presented in this study should be interpreted with caution, as an inspection of the average scores displayed in Tables 5 and 6 suggest that range restriction is apparent. Thus, the results may not be a reliable representation of the population for individuals who are applying for a position which involves safety-related aspects. This could be due to the participants being undergraduate students from one university. A majority of the participants will have limited work experience, especially with regard to performing tasks where they must consider their safety and perform the task in a specific way for safety purposes. This is likely quite different from the actual population the measure would be used for, being applicants for high-risk positions. Taking into account different work types and exposure to safety-related positions could explain the non-significant results found in this study.

Another explanation for the range restriction is that the differences in the puzzles may have been relatively easy to find. Indeed, the average number of differences found per image was over eight (out of ten) in every puzzle, which is suggestive of the difficulty level being low (Table 6). Further analysis is required to determine the effect of the differences, as in the size of the differences (vector sizes), and the amount that changed (such as a whole person moved, or simply a colour change). This was not controlled for in the current study, and is likely be influential to the final outcome.

The average age of the participants is 21.73 in the safety condition and 20.80 in the control condition. Thus, the results may be specific to this population only. Also, this age of participants could mislead the results, as university students of this age are likely to not be interested in workplace safety or see the importance of abiding by safety rules and regulations. Further research using a different sample population would be beneficial to determine the generalisability of the results, therefore whether the unsupportive results found in this study are due to the measure itself, administration of the measure, or simply because of the population chosen to test the measure on.

As per the rationale for this study, self-report measures are undoubtedly renowned for being biased. By using self-report measures of safety behaviour as a validation tool for the puzzles measure as occurred in this study, bias could be a factor influencing the results found. To be sure of the validity of the puzzle it could be best measured against actual accident data. That is, to see whether individuals with a poor performance on the puzzles have a history of more workplace accidents. This still has its limitations, such as the availability of such data. Testing the puzzle measure and self-report questionnaire with employees from high-risk occupations would be beneficial to test the validity further, and to potentially be able to compare the findings against past accident data.

The manipulation of the waiting room, which created the two conditions, may not have been adequate. First, the manipulation was meant to be subconscious, which would result in all safety-primed participants being oblivious to the safety-related features of the waiting room. The manipulation check information shows that some safety-primed participants did indeed notice safety equipment in the waiting room. There were 11 items changed between the two conditions. Prior research on subconscious priming for performance has only used one "prime". Thus, the current study is not in alignment with prior studies that this was based on. However, even conscious priming of safety prior to taking the puzzle test might be expected to be reflected in the puzzle data if it is indeed a valid measure. The order of finding safety differences supports the scales validity based on the priming, whereas the overall number of safety differences found does not.

Also with regard to the manipulation setup, the current study used a model whereby the prime was directly related to the performance task. Custers and Aarts (2010) note that many studies use a priming situation that is completely unrelated to the performance task – termed the "unrelated studies setup". The studies performed by Shantz and Latham, and Bargh et al. (2001) use this phenomenon also. An example of how this has been successfully performed is shown through Shantz and Latham (2009) priming call centre operators for performance by showing them a photo of a well-known runner winning a running race. A repeat of the current study while using an unrelated priming model could return different results.

The variable "time spent trying to complete puzzles" is questionable, as this does not differentiate between participants who used all possible attempts to find the differences and those that chose to "give up". This variable may be contaminated by the shorter times taken by participants to finish the puzzle that did indeed decide to "give up" and move on to the next puzzle. This difference could be due to the difficulty level of the puzzle, or due more to a personality variable such as persistence influencing how much time they were prepared to spend looking for more differences. Another explanation for giving up could be time pressures. Indeed, the manipulation check answers shown in Table 2 show that some participants were under time constraints, which were due to appointments or lectures they had scheduled in the next hour. These participants are likely to have rushed to complete the experiment, and thus given up on more puzzles than they normally would have.

Future Research

Performing this experiment again while accounting for the limitations discussed above would be useful to attempt to validate the new measure. Furthermore, as specified, repeating the experiment on different sample populations, such as a group of employees from a high-risk occupation would be useful.

There is a lack of longitudinal research on workplace safety (Chmiel, 2008; Neal & Griffin, 2006). There are few safety-related studies to date that do repeat measurement over time, and Neal and Griffin (2006) is one which does. Once, or if, the puzzle test has been validated, it would be useful to conduct some longitudinal assessments to examine test-retest reliability and predictive validity. Collecting accident data is something which can only occur when the chance presents itself for ethical reasons. Thus, performing the study over time, taking into account accidents data would add significant value to the new measure in terms of validity and reliability.

Conclusion

The present study aimed to find evidence supporting the new safety orientation measure being a valid measure for assessing potential employees' safety. The results suggest that the measure, as it currently stands, is not appropriate for assessing safety orientation overall. Nonetheless, one hypothesis was supported, showing that participants who are in a safety-primed environment found more safety-related differences before control differences, compared to those who were in a neutral environment. Thus, the measure may be capable of differentiating between participants who vary in safety orientation. This result provides impetus to further improve the puzzles in order to develop a valid and objective measure of safety orientation. The study adds to the current literature on safety measures, and provides one of the first studies to investigate alternative ways to successfully measure safety attitudes. The results, although not conclusive, provide a great introduction for research on methods for predicting safety orientation without the risk of bias such as desirability which are associated with self-report measures.

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Appendix A

SPOT THE DIFFERENCES
and Earn $10

This study is investigating how people process information in puzzles, based on a set of "Spot the Difference" puzzles.

Open to all undergraduate students!

(Except STAR students)

All you have to do is complete 10 Spot the Difference puzzles and complete a survey 2 weeks after.

The puzzles take approx 30mins,
and the survey will take 10min.

You choose from either a **$10 voucher**
(Westfield or Petrol) or ***PSYC 106 course credit***.

Contact **aeh37@uclive.ac.nz** to sign up or for more info!

Appendix B

You will see two almost identical images side-by-side. Your task is to find the differences between the two displayed images. There are a total of 10 DIFFERENCES in each puzzle. At the beginning of each puzzle, the mouse cursor (+) will be in the bottom centre of the screen. The Task - You have a total of 10 ATTEMPTS (mouse clicks) to find the differences. Please move the computer mouse cursor over the difference on the RIGHT-HAND puzzle, and click on the difference with the left-hand mouse button. If the difference is correct a green indicator box will be displayed. If an error occurs, the selected area will not be highlighted, and you will be able to try again. It is important to place the middle of the mouse cursor (+) directly over the difference. Once your 10 attempts to find the differences are completed you will be moved on to the next puzzle. If you are stuck and cannot find more differences, please choose “Give Up” to move onto the next puzzle. Once you have moved on to the next puzzle, you won’t be able to return to previous puzzles. Please repeat this process until all 10 PUZZLES have been completed.

Appendix C

Department of Psychology

"Spot the Difference" Puzzle Information Processing Study

Post Study Questionnaire

Thank you for your participation in part 1 of 2 of this study. I hope you enjoyed completing the puzzles.

Please answer the following questions in a few sentences, in relation to the study you just completed:

1) What was the overall purpose of the study?

____

____

2) Did you feel your performance was influenced by anything? If so, what?

____

____

____

Appendix D

Department of Psychology

"Spot the Difference" Puzzle Information Processing Study

INFORMATION SHEET

You are invited to participate as a subject in the research project "Spot the Difference" Puzzle Information Processing Study.

The purpose of this project is to investigate how people process information in puzzles.

Your involvement in this project will be to complete a series of "spot the difference" puzzles on a computer-based programme. You will use the computer mouse to select the different area on one of the two puzzles. There are 10 puzzles, with 10 differences each.

It is estimated to take 30 minutes to complete the puzzles.

As a follow-up to this investigation, you will be asked to complete a self-report measure, which will be used to relate the information collected from the puzzle information processing task to your work experiences. This will take approximately 10 minutes to complete. This will be performed after all participants have completed part one (in approximately 2 weeks). You will be contacted by email with further information.

The results of the project may be published, but you may be assured of the complete confidentiality of data gathered in this investigation: the identity of participants will not be made public. No identifying information will be recorded or kept. Any identifying information will be discarded. All data and participant information collected from the study will be held under direct responsibility of the primary supervisor.

Please keep all aspects of the study to yourself, until after Part 2 of the study is completed.

The project is being carried out as a requirement for completion of a Masters of Science in Applied Psychology by Anna Hill under the supervision of Dr. Chris Burt, who can be contacted via email at Christopher.burt@canterbury.ac.nz.

The project has been reviewed ***and approved*** by the University of Canterbury Human Ethics Committee.

Appendix E

Anna Hill

Department of Psychology

CONSENT FORM

"Spot the Difference" Puzzle Information Processing Study

I have read and understood the description of the above-named project. On this basis, I agree to participate as a subject in the project, and I consent to publication of the results of the project with the understanding that anonymity will be preserved.

I understand also that I may at any time withdraw from the project, including withdrawal of any information I have provided, without penalty.

I note that the project has been reviewed ***and approved*** by the University of Canterbury Human Ethics Committee.

NAME (please print): ………………………………………………………….

Signature:

Date:

Appendix F

Puzzle Information Processing Study

Part 2 – Safety Questionnaire (A)

Thank you for continuing to participate in this research. The second part of the study concerns workplace safety.

- Please read each question carefully, and answer giving your first reaction.
- Please answer all of the questions honestly. The research relies on your full and honest answers.

If you have any questions about this research, please contact Anna Hill (researcher) aeh37@uclive.ac.nz or Associate Professor Chris Burt, christopher.burt@canterbury.ac.nz

Section 1: General Questions

1. Age: _________
2. Gender: Male ☐ Female ☐
3. Are you studying: Part-time ☐ Full-time ☐
4. How many paid jobs have you held? ________
5. How many jobs have you held which you feel had an associated safety risk? ____
6. These descriptions relate to **work-related injuries or incidents** that you have been involved in. Next to each description please write ***how many times you*** have had………

	Number of times
A near hit incident, which had it turned out differently, could have resulted in injury	
A very minor injury not requiring medical attention	
A minor injury requiring medical attention (e.g. first aid treatment or a visit to a doctor), though no time off work	
A Lost Time Injury (LTI) that required you to take time off work	
An increase in safety risk which was the result of your behaviour	

Complete the questions below in relation to how you behave in a work situation.

These statements relate to your ***safety orientation at work.*** Please circle a number to indicate how much you agree or disagree with each of the statements listed below**.**

	Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
I use all the necessary safety equipment	**1**	**2**	**3**	**4**	**5**
I use the correct safety procedures	**1**	**2**	**3**	**4**	**5**
I ensure the highest levels of safety	**1**	**2**	**3**	**4**	**5**
I promote the safety program within the organisation	**1**	**2**	**3**	**4**	**5**
I put in extra effort to improve the safety of the workplace	**1**	**2**	**3**	**4**	**5**
I voluntarily carry out tasks or activities that help to improve workplace health and safety	**1**	**2**	**3**	**4**	**5**

These statements refer to your ***compliance with rules***. Please indicate how much you agree or disagree with each of the statements.

	Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
I sometimes cut corners if it makes the task easier	**1**	**2**	**3**	**4**	**5**
Work pressures may mean that I sometimes bend the rules	**1**	**2**	**3**	**4**	**5**
Occasionally I bend the rules when I know it is safe to do so	**1**	**2**	**3**	**4**	**5**
When my boss is not around I can be more flexible with which procedures I follow	**1**	**2**	**3**	**4**	**5**

These statements relate to your ***safety knowledge at work.*** Please indicate how much you agree or disagree with each of the statements.

I ensure …	Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
I know how to perform my job in a safe manner	**1**	**2**	**3**	**4**	**5**
I know how to use safety equipment and standard work procedures	**1**	**2**	**3**	**4**	**5**
I know how to maintain or improve workplace health and safety	**1**	**2**	**3**	**4**	**5**
I know how to reduce the risk of accidents and incidents in the workplace	**1**	**2**	**3**	**4**	**5**

Complete the questions below in relation to how you behave in a work situation.

These statements relate to how you ***view safety*** in the workplace. Please indicate how much you agree or disagree with each of the statements.

	Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
Safety works well until employees are busy, then other things can take priority	**1**	**2**	**3**	**4**	**5**
I believe safety procedures are more for an organization to meet its legal requirements than for employee safety	**1**	**2**	**3**	**4**	**5**
I only pay lip service to safety	**1**	**2**	**3**	**4**	**5**
If I worried about safety all the time I would not get the job done	**1**	**2**	**3**	**4**	**5**
There is little point in reporting potential safety hazards	**1**	**2**	**3**	**4**	**5**

These statements refer to ***motivation to work safely.*** Please indicate how much you agree or disagree with each of the statements.

	Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
I believe that workplace health and safety is an important issue	**1**	**2**	**3**	**4**	**5**
I feel that it is worthwhile to put in effort to maintain or improve my personal safety	**1**	**2**	**3**	**4**	**5**
I feel that it is important to maintain safety at all times	**1**	**2**	**3**	**4**	**5**
I believe that it is important to reduce the risk of accidents and incidents in the workplace	**1**	**2**	**3**	**4**	**5**

Complete the questions below in relation to how you behave in a work situation.

These statements refer to ***safety communication***. Please indicate how much you agree or disagree with each of the statements.

Typically I would …	Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
Make suggestions about how safety could be improved	**1**	**2**	**3**	**4**	**5**
Tell colleagues who were doing something unsafe to stop	**1**	**2**	**3**	**4**	**5**
Discuss new ways to improve safety with my colleagues or boss	**1**	**2**	**3**	**4**	**5**
Inform the boss when I noticed a potential hazard	**1**	**2**	**3**	**4**	**5**
Report to my boss if my colleagues broke any safety rules	**1**	**2**	**3**	**4**	**5**

These statements relate to how you feel about ***new recruits.*** Please indicate how much you agree or disagree with each of the statements.

	Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
It is important for safety for me to find out the safety history of a new recruit	**1**	**2**	**3**	**4**	**5**
Immediately determining the safety attitudes of a new recruit is important for safety	**1**	**2**	**3**	**4**	**5**
It is important for safety for me to encourage a new recruit to ask about safety procedures	**1**	**2**	**3**	**4**	**5**
Everyone pays more attention to safety when a new recruit joins a workplace	**1**	**2**	**3**	**4**	**5**
It is particularly important to watch out for the safety of a new recruit	**1**	**2**	**3**	**4**	**5**
It is safer to assume initially that a new recruit will not follow safety procedures	**1**	**2**	**3**	**4**	**5**

Complete the questions below in relation to how you behave in a work situation.

These statements relate to your ***safety attitudes towards co-workers***. Please indicate how much you agree or disagree with each of the statements.

	Strongly Disagree	Disagree	Neither Agree/ Disagree	Agree	Strongly Agree
Workers should point out hazards to co-workers	**1**	**2**	**3**	**4**	**5**
Workers should immediately remove hazards if possible	**1**	**2**	**3**	**4**	**5**
Safety depends on everyone following safety procedures	**1**	**2**	**3**	**4**	**5**
Co-workers should be warned when their actions are unsafe	**1**	**2**	**3**	**4**	**5**
Workers should assist each other with tasks to ensure safety	**1**	**2**	**3**	**4**	**5**
Co-workers should discuss changes that could improve safety	**1**	**2**	**3**	**4**	**5**
Crew leaders should be notified of hazards	**1**	**2**	**3**	**4**	**5**
Safety comes from worker cooperation	**1**	**2**	**3**	**4**	**5**
Co-workers' limitations should be recognized	**1**	**2**	**3**	**4**	**5**
Co-workers should give each other informal safety instruction	**1**	**2**	**3**	**4**	**5**
Supporting co-workers ensures everyone's safety	**1**	**2**	**3**	**4**	**5**
A worker should never be too busy to help a co-worker	**1**	**2**	**3**	**4**	**5**
Co-workers should discuss near-hits	**1**	**2**	**3**	**4**	**5**
Co-workers should discuss past accidents	**1**	**2**	**3**	**4**	**5**
Near-hits should be reported to management	**1**	**2**	**3**	**4**	**5**

Please check that all questions are completed. Thank you for your time and participation in this research.

Appendix G

Department of Psychology

"Spot the Difference" Puzzle Information Processing Study

Debriefing Information

Thank you for your participation in this study.

This study was concerned with investigating whether it is possible to subconsciously manipulate safety orientations. Specifically, subconscious goal setting was used to investigate safety orientation as measured by a spot-the-difference safety orientation measure.

The hypothesis proposes that participants who are primed in the safety-oriented waiting room will select safety-related differences before neutral differences. They will also find more safety-related differences in comparison to the control group by being subconsciously aware of safety, and thus noticing the different safety-related features. Because of the safety-related nature of the measure, it is proposed that the safety-primed participants take less time than the control group to find safety differences.

Using the subconscious paradigm for this research will preserve the safety of participants while measuring their workplace safety orientation. The objectives of the study are to determine whether subconscious goal setting can be transferred to workplace safety orientation, and if the specified covert method of assessing safety orientation is effective.

You completed two parts to this experiment – the first was the spot the differences puzzles, where the subconscious manipulation occurred, and the subsequent part of completing the safety-related scales. The results of both parts will be used together to determine the accuracy of the new safety scale at measuring individual safety orientation.

The results of the project may be published, but you may be assured of the complete confidentiality of data gathered in this investigation: your identity will not be made public. Please remember, you may withdraw from the study at any stage without penalty.

The project is being carried out as a requirement for completion of a Master of Science in Applied Psychology by Anna Hill under the supervision of Dr. Chris Burt, who can be contacted via email at Christopher.burt@canterbury.ac.nz. He will be pleased to discuss any concerns you may have about participation in the project. Alternatively, you may contact the researcher at aeh37@uclive.ac.nz.

The project has been reviewed *and approved* by the University of Canterbury Human Ethics Committee.

If you wish to receive an email with the results of this study, please let the researcher know.

Thank you again for your participation.