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Atti del Quarto Congresso Europeo di Behavior-Based Safety (B-BS)

Behavior-Based Safety: coniugare produttività e sicurezza comportamentale

Venezia, Scuola Grande San Giovanni Evangelista 14-16 aprile 2010

A cura di Elena Algarotti e Guido Tosolin
AARBA (Association for Advancement of Radical Behavior Analysis)

www.aarba.it; www.aarba.org

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Behavior-Based Safety Editoriale

A cura di Fabio Tosolin
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Premessa metodologica

La sicurezza sul lavoro è oggetto di dibattiti, studi e ricerche continue. Solo recentemente tuttavia si è cominciato a comprendere appieno come la messa a punto di strutture fisiche e di dispositivi di protezione sia condizione necessaria, ma non sufficiente a ottenere un vero salto di qualità nella riduzione del fenomeno infortunistico, delle malattie professionali e dei disastri ambientali.

I cinquant'anni trascorsi dalle prime scoperte di Heinrich, che quantificavano nella misura dell'80% le cause comportamentali degli infortuni, non sono infatti bastati a rendere consapevoli tutti gli attori della sicurezza di quanto fosse imprescindibile un approccio alla sicurezza basato sulle leggi scientifiche del comportamento, piuttosto che sulla messa a punto di strumenti fisico-tecnici. Si è così operato molto sul versante tecnico della sicurezza, affinando progressivamente attrezzature e macchinari al fine di renderli intrinsecamente più sicuri o erigendo barriere sempre più impenetrabili e atte a impedire il cosiddetto *errore umano*.

Esigenza di un approccio scientifico alla sicurezza

Già nell'infelice definizione di "errore umano" si percepisce il vizio a-scientifico di fondo di un approccio *naïve* al problema della sicurezza; in nessuna scienza naturale si definirebbe mai un evento osservato. Il concetto di errore presuppone infatti una forma di volontarietà delle azioni umane e dunque di finalismo, che può ben appartenere al linguaggio comune o a quello filosofico-religioso, ma che non trova spazio nel linguaggio rigoroso di alcuna disciplina scientifica. Per medici e biologi l'infezione batterica non è uno sbaglio della natura, come per un geologo la frana non è una pecca, o un malinteso della montagna. Per lo scienziato non esistono atti giusti o sbagliati; esistono soltanto comportamenti, con una probabilità maggiore o minore di occorrenza, che sono più o meno correlati con altri eventi, anch'essi più o meno probabili, come le ferite agli arti o la silicosi.

Nessuno scienziato d'altra parte definirebbe *reato* il rimuovere una protezione di sicurezza, né tentando di individuare l'origine di quell'atto cercherebbe un *colpevole*. Reati e colpe appartengono piuttosto al linguaggio giuridico, che trae origine da convenzioni basate sull'etica, non dalle leggi della natura. Lo scienziato non svolge ispezioni, si limita a effettuare misure; né attribuisce colpe per gli infortuni, ma ne ricerca le cause, intese come eventi misurabili su scala parametrica: *variabili indipendenti*, da cui dipendono eventi successivi, o *variabili dipendenti*.

Behavior-Based Safety Editorial

Fabio Tosolin
President of AARBA

Methodological Introduction

Safety at work is the subject of continuous debates, studies and researches. However, only recently we begun to understand that the development of physical structures and protection barriers is necessary but not sufficient to achieve a real breakthrough in the reduction of injuries, occupational diseases and environmental disasters.

Fifty years have passed since the first discoveries of Heinrich, who quantified that 80% of injuries at Du Pont were caused by unsafe behaviors. However, these discoveries were not enough to make all the safety actors aware of the importance of an approach based on the scientific laws of behavior, rather than on the development of physical and technical tools. So, they focused mainly on the technical side of safety, to make machineries intrinsically more secure to prevent the so-called human errors.

The need for a scientific approach to safety

In the inappropriate definition of "Human Error" we can perceive a defect in the scientific background due to a naïve approach to the problem of safety: no natural science would ever define a natural event such as "wrong". The concept of error presupposes a form of voluntary human actions, with a scope and caused by a future outcome; such a term which may belong to the common language of disciplines such as philosophy or religion, however, it cannot take place in the rigorous language of any scientific discipline. Biologists don't consider bacterial infection as a "mistake" of nature, just like a geologist won't believe that a landslide is a "failure" of the mountain. For the scientist there are no right or wrong actions, but only behaviors characterized by a probability of occurrence.

On the other hand, no scientist could define the removal of a security guard as a crime, and he would never seek a culprit to identify the origin of that action. Terms such as crime and guilt belong to the language of law, that is based on ethical issues, but not on the laws of nature. The scientist does not perform inspections, he just performs measurements; he does not apportion blame for accidents, but he looks for their causes.

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Questo linguaggio dello scienziato può apparire talvolta asettico, o addirittura arido, in base al senso comune. Eppure proprio nell'ostinazione a ricercare cause fisiche di eventi fisici misurabili risiede la ragione del successo del metodo sperimentale, induttivo, caratteristico delle scienze naturali, galileiane, empiriche e sperimentali. La scienza di riferimento per il comportamento è la Behavior Analysis, l'Analisi Comportamentale, che in una sua branca applicativa specialistica prende il nome di Behavior-Based Safety, il protocollo per la misura e la modificazione dei comportamenti di sicurezza.

A differenza di molti metodi e tecniche proposti con alterne fortune in tema di psicologia del lavoro applicata alla sicurezza, la B-BS deve il suo successo e la sua diffusione al fatto di essere *evidence-based*, cioè di essere basata esclusivamente su leggi derivate induttivamente da ricerche sperimentali, pubblicate e replicate da studiosi di tutto il mondo attraverso la prassi protocollare. Come per ogni scienziato, anche all'analista comportamentale non è consentito adottare un suo personale approccio alla metodologia. Chi adotti la B-BS è infatti tenuto ad attenersi alle scoperte verificate della sua disciplina, come il medico è tenuto, anche a norma di legge, ad adottare esclusivamente quei metodi e quei protocolli che siano validati dalla comunità scientifica internazionale.

L'oggetto della B-BS

Una disciplina scientifica si caratterizza in base al suo oggetto, osservabile e misurabile su scala parametrica e scopo di ogni scienza è ottenere previsione e controllo dei fenomeni naturali del proprio campo d'applicazione. Per questo parole come psiche, volontà, prudenza o consapevolezza non trovano spazio nel protocollo di B-BS, al contrario del comportamento, che invece è misurabile in termini di frequenza, latenza, durata e intensità. È possibile infatti misurare oggettivamente e anche con strumenti tecnici il tempo che trascorre dalla presentazione di un segnale all'inizio di una manovra correttiva, per quanto tempo vengono indossati i guanti nel trasporto di lamiere taglienti, la frequenza con cui un guidatore passa con il rosso e i decibel di un grido d'aiuto o la pressione su una leva di comando.

A livelli più sofisticati di tecnologia di misurazione è oggi persino possibile calcolare la variazione di conducibilità elettrodermica della mano di un operatore davanti al fuoco di un incendio in un ambiente di realtà virtuale, quando si voglia insegnare il controllo di risposte emotive nell'emergenza. Così come è diventato di uso comune ottenere previsione e controllo dei comportamenti di sicurezza in piloti di velivoli o automezzi, misurando e variando stimoli fisici e comportamenti di guida in un simulatore.

Nella B-BS si distinguono nettamente le misure di comportamento (indossare la mascherina, tenere lo sguardo sulla fresa, allacciare la cintura) da quelle di risultato (infortuni, malattie, incidenti) e si considera che le prime siano precursori delle seconde. Per questa ragione nel protocollo di B-BS si misura l'occorrenza dei risultati principalmente in quanto misura dell'efficacia delle variazioni indotte nei comportamenti e non, come avviene in tante finte applicazioni della metodologia da parte di inesperti, in quanto eventi su cui agire, magari adottando sanzioni.

Contrariamente a quanto avviene comunemente, non si può dunque agire sui risultati, è indispensabile agire sui

According to commonsense, this scientific language could seem aseptic, or even arid. However, the reason for the success of the inductive method lies in the research of the relationship between dependent and independent variables, that is typical of natural, empirical, Galilean sciences.

The science that investigates behavior is the Behavior Analysis, whose specific application in the field of industrial safety is called Behavior-Based Safety, the protocol for measurement and modification of safety behaviors.

Unlike other methods and techniques, the success of Behavior-Based Safety is due to the fact that this method is evidence-based. Those who apply the B-BS have to stick to the discoveries of this discipline, as the medical doctors have to adopt (for legal reasons too) only those methods and protocols that are validated by the international scientific community.

The object of the B-BS

A scientific discipline is characterized by its object, that must be observable and measurable. The purpose of a science is to predict and control natural phenomena under investigation.

This is the reason why words like mind, will, wisdom or information have quite no place in the B-BS protocol, whose object of study is behavior, measureable in terms of frequency, latency, duration and intensity. In fact, it is possible to measure the time occurring between the view of a signal and the beginning of the corrective action, just like it is possible to measure how long a worker wears the protective gloves or the frequency with which a driver keeps accelerating when he sees the traffic light becoming red.

In the B-BS protocol the measurement of outcomes (e.g. injuries) is distinguished from the measurement of behaviors (wearing a mask, keeping eyes on cutter, wearing the seat safety belt). The latter are considered the precursors of the former. For this reason, in the B-BS protocol, the measurement of the occurrence of results aims to evaluate the effectiveness of behavior modification. On the contrary, many false applications of the methodology use such measurements to take decisions, often using sanctions.

Therefore it is not possible to operate on outcomes, but it is necessary to operate on behaviors. However, a strong theoretical background is necessary to correctly implement the B-BS protocol. Sometimes, the protocol is poorly applied only considering results, without measuring and reinforcing the several behaviors that produced those results. Another common mistake is to try to directly modify "not-behaviors" (e.g. "don't smoke in the forbidden areas"). Natural sciences are also called positive sciences because they aim to modify real occurring events rather than not occurring events.

B-BS implies a radical change in the common sense about "human factor" and "human error". Main elements of this are summarized in table I.

comportamenti. Tuttavia, perché il protocollo e i principi su cui si fonda siano rispettati è necessaria una solida preparazione; non è infrequente assistere a finte applicazioni di B-BS in cui si cerca di agire sui risultati, per esempio istituendo premi per avere conseguito un obiettivo, senza curarsi di misurare e rinforzare immediatamente le decine, centinaia di comportamenti che hanno determinato quel risultato. Né è infrequente assistere all'ingenuo tentativo di modificare direttamente dei "non-eventi", come il *non* avere avuto incidenti per tre mesi, oppure dei "non-comportamenti", come il *non* fumare in luoghi a rischio. Le scienze naturali si chiamano anche *positive* (da cui il termine positivismo) proprio perché si occupano di modificare gli eventi che accadono, invece degli eventi che *non* si verificano.

In estrema sintesi, la B-BS implica un cambiamento radicale del comune sentire in fatto di "human factor" e di "human error", come si evince dalla tabella I.

Tabella I

Imprese senza B-BS	**Imprese con B-BS**
Si cercano i comportamenti insicuri **per punirli** (P+)	Si cercano i comportamenti sicuri **per rinforzarli** (R+)
Si gratificano i lavoratori *solo quando* il loro comportamento **è conforme** allo standard	Si gratificano i lavoratori *non appena* il loro comportamento **è migliore** rispetto al passato
Si gratificano i collaboratori in base al **giudizio di supervisori** (*performance appraisal*)	Si gratificano i collaboratori in base a **conteggi oggettivi** (*performance management*)
Si aspetta che vi siano dei **risultati** (periodi senza infortuni) prima di premiare i lavoratori	Si rinforzano positivamente i **comportamenti** (azioni di sicurezza) a prescindere dai risultati
Si **intensificano** e si **reiterano** gli ordini (*si pongono antecedenti*), per ottenere *"ubbidienza"*	Si **gratificano** i tentativi di esecuzione (*si erogano conseguenze*), per ottenere attività *"volontaria"*

È di tutta evidenza come sia necessario ridefinire molti termini evanescenti del linguaggio comune sulla sicurezza, per renderli suscettibili di analisi scientifica e per poter agire su di essi in quanto variabili dipendenti misurabili. Nel protocollo di B-BS, per esempio, con l'espressione *cultura della sicurezza* si intende l'insieme di contingenze di rinforzo coerenti che insistono sui comportamenti di un gruppo di lavoro, di un'impresa o di un'intera comunità. Analogamente, i *valori* diventano insiemi di affermazioni o regole verbali che prescrivono le modalità di comportamento all'interno di una cultura. Diventa così possibile contare, prevedere e modificare sia i comportamenti di tipo motorio, sia quelli cosiddetti cognitivi ed emotivi. Non a caso la B-BS viene anche definita "*the values based safety process*" (VBSB); in italiano, "il processo di sicurezza basata sui comportamenti e sui valori".

Perché un Congresso Scientifico Europeo di B-BS

La ragione di un Congresso Annuale, Scientifico, di B-BS risiede dunque nell'esigenza di diffondere i principi e le leggi delle scienze comportamentali e le metodologie e le tecniche rigorose che da quelle scienze derivano. È di particolare significato che il congresso sia europeo, perché è l'Europa a essere in particolare ritardo nel-

Table I

Without B-BS	***With B-BS***
Unsafe behaviors are detected to punish them (P+)	*Safe behaviors are detected to punish them (R+)*
Workers are reinforced only when their behavior complies with the standards	*Workers are reinforced as soon as their behavior improves.*
Workers are reinforced depending on the judgment of supervisors (performance appraisal)	*Workers are reinforced depending on objective measures* (performance management)
Workers are rewarding only after they achieve results (e.g. period without injuries)	*Workers are reinforced for their safe behaviors regardless of the results*
Commands are intensified and reiterated to obtain "obedience"	*Reinforcement are delivered to obtain voluntary performance*

It is clear that we need to re-define many of the evanescent terms commonly used in the language of safety. This is the only way to make them suitable for the scientific analysis and to use them as measurable dependent variables. In the B-BS protocol the expression culture of safety defines a framework of coherent reinforcing contingencies that operate on the behaviors of a group: a team, a company or even an entire community. Similarly, values are defined as the whole spectrum of verbal affirmations and rules that prescribe how to behave within a culture. In this way it is possible to count, predict and modify motor behaviors, as well as so-called cognitive and emotional behaviors. This is why B-BS is also known as the "the values based safety process".

Why a Scientific European B-BS Congress?

The rational of an Annual Scientific B-BS Congress, lies in the need to spread laws and principles of the behavioral science. It is of particular significance that the congress is European because Europe is particularly late in the spread and application of the protocol. In fact, despite the B-BS has gradually established itself throughout the world since the 70s, it remained relatively unknown by most European companies, and especially by Italian ones for a long period of time.

One of the causes for this situation is due to the small dimension of most of the Italian companies. These small companies cannot allocate human and economic resources to get knowledge about methodologies that are often spread and shared only in specific congresses, academic courses and safety meetings most of the times abroad.

Since the first edition of Human Factor & Behavior-Based Safety European Congress the scene radically changed. Hundreds of companies could, for the

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la diffusione e applicazione del protocollo. Infatti, nonostante la B-BS si sia progressivamente affermata in tutto il mondo a partire dalle prime applicazioni negli stabilimenti anglosassoni e delle grandi multinazionali negli anni '70, essa è rimasta relativamente poco conosciuta dalla gran parte delle imprese Europee e soprattutto a quelle italiane per un lungo arco di tempo.

Una causa della ritardata diffusione del protocollo risiede probabilmente nella dimensione estremamente ridotta delle nostre micro-imprese. Dimensione che non consente a questa aziende di dedicare risorse umane ed economiche alla ricerca di metodologie e tecniche che sono solitamente condivise solo in convegni specializzati, corsi accademici e riunioni interaziendali dedicate, quasi sempre all'estero.

A partire dalla prima edizione del Congresso Europeo di Human Factor & Behavior-Based Safety del 2006 il panorama è però radicalmente mutato. Centinaia di imprese italiane hanno potuto, per la prima volta nella storia, accedere direttamente a relazioni, prove di efficacia, dibattiti e tavole rotonde sul tema della sicurezza comportamentale, mentre migliaia di aziende italiane ed europee, anche di medie dimensioni, hanno potuto facilmente consultare articoli, documenti e testi in lingua italiana e accedere a formazione qualificata sul tema.

Anche in campo accademico e associativo si sono moltiplicate le occasioni di apprendere i rudimenti delle leggi e dei paradigmi scientifici alla base del protocollo di Behavior-Based Safety. La Behavior Analysis è diventata materia di studio in corsi dedicati e in dottorati di ricerca. E sono ormai decine le tesi di laurea in ingegneria della sicurezza o in psicologia comportamentale. ISPESL, AIAS, CINEAS, Unioni Industriali, grandi Regioni del Nord Italia, ASL e le Istituzioni attive nel campo della sicurezza hanno recepito i criteri del protocollo o hanno stipulato specifici accordi di collaborazione con la società scientifica italiana della B-BS, AARBA, per favorire la diffusione e l'applicazione del processi di B-BS nelle imprese italiane a vantaggio dei lavoratori, come nel caso dell'accordo di collaborazione scientifica in tema di B-BS, siglato tra AARBA e ISPESL del 2 luglio 2008.

In virtù di questo rapido sviluppo diverse decine di migliaia di lavoratori hanno in corso o in via di attivazione processi di sicurezza comportamentale nel nostro Paese, che per questo si colloca una volta tanto all'avanguardia in Europa. Il Congresso Annuale Europeo di B-BS ha infatti sede in Italia fin dalla sua prima edizione del 2006 e richiama ogni anno partecipanti non solo dall'Italia ma anche da altri paesi europei e del Mediterraneo, imponendosi come il più importante del mondo, dopo quello degli Stati Uniti.

Accreditamento, formazione e ruolo delle Società Scientifiche e delle Istituzioni per la sicurezza

La B-BS è un protocollo sviluppato nell'ambito della Behavior Analysis, una disciplina scientifica come la fisica, la chimica o la biologia. Come tutte le scienze naturali, gli scienziati e gli specialisti di questa disciplina trovano un punto di incontro e di scambio d'informazioni in una comunità scientifica. La società scientifica di riferimento a livello mondiale è l'Association for Behavior Analysis - International (ABA-I), che a sua volta si articola in 60 National Chapter, che la rappresentano in tutto il mondo, come AARBA in Italia.

first time, approach to reports, experimental evidences, debates and round tables about behavioral safety. Thousand of Italian and European companies, even middle sized, could easily approach to articles, documents and texts in their native language, and access to qualified training about it.

Even in academic and associative fields, there are more opportunities to learn the laws and scientific paradigms B-BS protocol is based on. The Behavior Analysis has become a subject of study in dedicated courses and in PhDs. There are now tens of degree thesis on safety engineering or on behavioral psychology in our country. ISPESL, AIAS, CINEAS, Industrial unions, the major regions of Northern Italy, ASL, and Institutions active in the security field have concluded cooperation agreements with the Italian Scientific Society for the B-BS, AARBA, to encourage the dissemination and application of B-BS processes within the Italian companies for the on the job safety and wellness of their workers.

Thanks to this rapid development more than 50,000 workers in Italy actually are, or are going, to be under active processes of behavioral security. The annual European Congress of B-BS was established in Italy since 2006 and each year it attracts participants not only from Italy, but also from other European, Mediterranean countries. The Congress became the most important in the world, after the one in the USA.

Accreditation, training and role of scientific societies and institutions for safety

The scientific reference for Behavior Analysis in the world is the Association for Behavior Analysis - International (ABA-I), which has more than 60 National Chapter all over the world, as in Italy (AARBA)

Besides ABA-I, the other reference for the B-BS is CCBS - Cambridge Center for Behavioral Studies, Massachusetts, whose referent for Italy is AARBA. This is an independent scientific institute attended by the pioneers who developed the B-BS and is the only one to accredit the processes of B-BS in businesses.

Like all scientific disciplines, the B-BS requires a solid and specific preparation to be properly applied and even more to be taught. The need for such preparation is evident if one considers the difficulties in predicting and controlling such a complex subject as human behavior. We must also consider that errors or inaccuracies in the application of laws of behavior analysis could cause physical damage and even the death of workers. The implementation of the B-BS protocol whitout an adequate preparation is action reckless and morally deprecable.

The Bachelor's and the Master's degree in Behavior Analysis, with a specific four-year PhD, constitute the curriculum to be able to completely and autonomously apply the method, and to successfully teach it. Although there are many behavioral degree programs nowadays, especially in Anglo-Saxon countries, unfortunately

Oltre all'Associazione degli analisti comportamentali, ABA-I, il riferimento per la B-BS è il CCBS - Cambridge Centre for Behavioral Studies, del Masschusetts. Si tratta dell'Istituto Scientifico indipendente cui partecipano i pionieri che hanno sviluppato la B-BS ed è l'unico ad accreditare i processi di B-BS in atto nelle imprese, con AARBA come referente per l'Italia. L'accreditamento del CCBS è naturalmente basato su misure e risultati e segue procedimenti esclusivamente scientifici, ben diversi e più stringenti rispetto a gran parte dei sistemi formali in uso in ambito di certificazione.

Come tutte le discipline scientifiche e specialistiche, la B-BS richiede una solida preparazione specifica per essere correttamente applicata e ancor più per essere insegnata, o addirittura "certificata". L'esigenza di una tale preparazione risulta evidente se si considera la difficoltà insita nel prevedere e controllare una materia complessa come il comportamento umano. Occorre anche tenere ben presente che errori o imprecisioni nell'applicazione delle leggi della Behavior Analysis ai processi di sicurezza hanno un contraltare in termini di danni fisici e anche di morte dei lavoratori. È di tutta evidenza che attuare un intervento di modificazione dei comportamenti di sicurezza senza una adeguata preparazione rappresenta dunque un'azione sconsiderata e deprecabile sotto il profilo morale.

La Laurea di 1° e 2° livello in Behavior Analysis, unitamente a un PhD quadriennale specifico costituiscono pertanto il percorso formativo di elezione per una completa e indipendente applicazione del metodo e soprattutto per il suo insegnamento. Per quanto siano oggi numerosi i corsi di laurea in Analisi Comportamentale, soprattutto nei paesi anglosassoni, non ve n'è purtroppo alcuno in Italia. Un'eccellente preparazione può tuttavia essere conseguita anche soltanto conseguendo il dottorato di ricerca in OBM. Questo titolo può essere conseguito all'estero, dove il riferimento internazionale è senz'altro la Western Michigan University, ma anche in Italia un titolo analogo potrà essere ottenuto con il costituendo dottorato di ricerca in B-BS (Executive PhD, quadriennale), riservato per ora ai laureati in ingegneria.

Un percorso formativo accademico tanto impegnativo non è tuttavia indispensabile per ogni RSPP o safety manager che applichi in concreto la metodologia, purché a seguito di una buona impostazione iniziale del processo. Allo scopo di favorire la diffusione del protocollo, la Società Scientifica della B-BS in Italia, AARBA, ha pertanto definito i criteri minimi per la formazione in B-BS (Corso di Alta Formazione in B-BS), il Codice Etico e il Repertorio Italiano degli Esperti Qualificati in B-BS, di cui fanno parte attualmente circa 150 esperti di sicurezza e manager. Questi criteri sono accettati e adottati da Istituzioni, Enti e Associazioni di sicurezza in Italia e hanno lo scopo di favorire un'ampia diffusione della metodologia, riducendo i costi di consulenza per le imprese, limitandone la dipendenza da consulenti esterni e mantenendo al tempo stesso delle solide garanzie di applicazione rigorosa.

Il IV Congresso

I primi congressi europei di B-BS hanno portato all'attenzione dei manager italiani le potenzialità del processo di sicurezza basato sui comportamenti e le prove di efficacia provenienti da tutto il mondo, soprattutto a opera dei pionieri del metodo e degli scienziati che lo hanno sperimentato. La IV edizione del Congresso vede un'articolazione su

there are no ones in Italy. Excellent preparation could be achieved with a PhD in OBM. This title can be obtained abroad - where the international referent is the Western Michigan University - but also in Italy, where an analogue title may be obtained with the four years Executive PhD in B-BS that is going to be constituted for graduated engineers.

In order to promote the dissemination of the protocol, AARBA identified the minimum criteria for B-BS training (Advanced Training Course in B-BS), defined the Ethic Code, and created the Italian Repertoire of Qualified B-BS Experts, which includes about 200 security experts and managers. These criteria are currently accepted and adopted by institutions, organizations and associations for safety in Italy, and they are designed to increase the dissemination of the methodology, reducing the costs of consultancies for the companies, while maintaining solid guarantees of a strict application.

The 4th Congress

The First European Congress of B-BS brought to the attention of Italian managers the potential of the behavior-based safety process and it presented the evidences of its efficacy, coming from around the world, especially those of the pioneers of the method and of the scientists who have experimented it.

The 4th edition of the congress links productivity and safety, trying to get-trough the commonplace that put these two thing in contradiction. The congress, structured in plenary sessions, workshops and parallel symposia, will offer the right environment to address emerging issues such as the conformance of the B-BS with SGSL, the scientific methods for the assessment of stress, the safety training and the strategies to obtain compliance from top management to trade unions and workers.

For the first time the congress will widen the participation to new categories of speakers: B-BS consultants, representatives of Government Agencies and also persons responsible for security processes within Italian companies that adopt the protocol in very different production conditions.

Hence it will be finally possible to see countless applications the B-BS Protocol in Italy, within many different business sectors such as construction, process industries, power plants, chemical companies, pharmaceutical, medical facilities and food.

These results were impossible to imagine only five years ago. They proves the strength of a methodology that has only one mean for its dissemination: the results it obtained.

The only threat to the growth of B-BS and its positive culture of safety could be represented by the prevail of economic interests on the methodological rigor. As in any activity, the application, teaching, and even certification of the B-BS could become an attractive business for someone willing to barter the principles of

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più giornate, con workshop, simposi paralleli e due grandi plenarie, riservate principalmente ai relatori stranieri sui temi emergenti, come la congruità della B-BS con i SGSL, i metodi scientifici per la valutazione dello stress, per la formazione efficace e per ottenere l'adesione al processo dal vertice aziendale ai rappresentanti sindacali e ai lavoratori. Per la prima volta, infine, si registra l'allargamento della partecipazione a nuove categorie di relatori: consulenti di B-BS, rappresentanti di Enti dello Stato e anche responsabili di processi di sicurezza di imprese italiane che adottano il protocollo nelle più diverse situazioni produttive.

È dunque finalmente possibile vedere, anche nel nostro Paese, realizzazioni del protocollo di B-BS con innumerevoli varianti di applicazione in funzione della tipologia di impresa, a partire da 10-15 addetti fino a molte migliaia di dipendenti e in una varietà di settori come cantieri, industrie di processo, centrali elettriche, aziende chimiche, farmaceutiche, strutture sanitarie e nel campo dell'alimentazione, con problematiche che comprendono anche i lavori isolati, dalla guida di automezzi a quella di elicotteri o convogli ferroviari.

È evidente come siamo di fronte a un risultato impensabile solo 5 anni fa, che testimonia come una metodologia scientifica possa affermarsi forte soltanto dei risultati che consente, a prescindere da normative, obblighi di legge, standard e certificazioni più o meno formali.

L'unica minaccia per la crescita della B-BS e della diffusione della cultura positiva della sicurezza che comporta è rappresentata dall'eventuale prevalere degli interessi economici sul rigore metodologico. Come in ogni attività, applicare, insegnare e perfino "certificare" la B-BS potrebbe diventare un affare, appetibile per qualcuno disposto a barattare i principi della scienza e dell'etica con quelli di un business disinvolto. Un merito del Congresso Annuale di B-BS è anche quello di contribuire a rendere le imprese consapevoli di cosa debbano aspettarsi e pretendere da un intervento di B-BS, a cominciare da risultati misurabili, in tempi definiti e certi.

Diverse relazioni congressuali mostrano come la B-BS sia congruente con i sistemi di gestione e con il modello di Deming. Molte testimoniano o dimostrano la superiore efficacia che il metodo consente. Altre ancora mettono in chiaro come il protocollo corrisponda e anzi ecceda spesso largamente quanto richiede la normativa vigente: la vigilanza, la partecipazione attiva e il coinvolgimento dei lavoratori sono presidiati con la B-BS come con nessun altro metodo.

Il IV Congresso Scientifico Europeo di B-BS di Venezia ha infine anche il merito di smascherare un diffuso pregiudizio, che vuole l'impresa sempre sorda alle esigenze di sicurezza, in nome del profitto. La B-BS si afferma tra gli imprenditori italiani per la medesima ragione per cui si è affermata ovunque nel mondo: semplicemente, consente di ridurre gli infortuni. con il solo supporto attivo di tutti i lavoratori e dei loro rappresentanti sindacali e senza bisogno di incentivi economici, stanziamenti e fondi comunitari. Gli imprenditori e i manager che l'hanno adottata non hanno aspettato di esservi obbligati da leggi o decreti, né da minacce di sanzioni. Hanno adottato il metodo a prescindere da aree geografiche o da sistemi normativi, senza attendere che il protocollo diventasse un sistema esimente, senza sconti sui premi assicurativi e senza neppure aspettare la fine di crisi e recessione. E lo hanno fatto realizzando nelle loro imprese un processo basato su comportamenti e valori, senza ricorrere a ispezioni né a tanti provvedimenti disciplinari anzi, sostituendo quasi sempre la sanzione con il suo contrario.

science and ethics with those of business. The Annual Congress of B-BS helps to make companies aware of what should be expected from an intervention of B-BS, starting from measurable results with definite and certain timing.

Several reports presented in the congress show that the B-BS is congruent with performance management and with the model of Deming. Many demonstrate the superior effectiveness of the method; others clarify how the protocol matches and even exceeds what the existing legislation requires. Vigilance, active participation and involvement of employees are better manned with B -BS than with any other method.

The 4th Scientific European Congress of B-BS in Venice aims to uncover the widespread prejudice about the deafness of the contractor to the needs of safety. The B-BS is growing in Italy for the same reason that spread it throughout the world: simply, it helps to reduce injuries. Without the need of economic incentives, appropriations and funds. Contractors who implemented it have not waited to be bound by laws or decrees, or by threats of sanctions. This happened even in times of crisis, with the active support of all employees and their representatives. Without inspections nor disciplinary action, mostly replacing the sanction with its opposite.

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D. Cooper

The return on investment of the B-BS process

Il ritorno sull'investimento del processo di B-BS

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ABSTRACT. Over the past 30 years or so, Behavioral Safety has become a well-established method for changing safety behavior and reducing incident rates. In 2009 Cooper meta-analytically reviewed 17 published Behavioral Safety field studies containing 24 data sets to identify the most effective design components across a wide range of settings.
The study showed designs incorporating a workgroup approach, in static settings, utilizing daily observations, multiple (3-4) feedback channels and participative goals were associated with greater incident rate reductions.
However, the review did not calculate the Return on Investment of the design components in various combinations. Addressing this gap, the results of the current paper show some designs offer high returns while others are associated with significant deficits.

Key words: *return on investment, behavioral safety.*

RIASSUNTO. Nel corso degli ultimi 30 anni, la sicurezza comportamentale è diventata un metodo consolidato per cambiare i comportamenti di sicurezza e ridurre i tassi di incidente. Nel 2009 Cooper (1) ha riesaminato 17 studi sul campo pubblicati riguardo la sicurezza comportamentale, contenenti 24 set di dati per identificare gli elementi più efficaci in un ampio spettro di scenari.
Lo studio ha dimostrato che i progetti che incorporano un approccio con gruppi di lavoro, in siti statici, utilizzando osservazioni giornaliere, con molteplici canali (3-4) per il feedback e con obiettivi condivisi, sono associati alle maggiori riduzioni del tasso di incidenti.
La rassegna non ha però calcolato il ritorno sull'investimento per progetti in cui vi sono diverse combinazioni delle componenti del processo B-BS, lacuna che questo articolo si propone di colmare mostrando come alcuni progetti siano associati ad alti ROI mentre altri a perdite significative.

Parole chiave: *ritorno sull'investimento, ROI, sicurezza comportamentale.*

Introduction

Organisations are often required to work with limited and fewer resources, while also meeting business objectives. Not exempt from this discipline, HSE professionals need to show that the cost and effort expended on a safety initiative has yielded a return.

A major question remaining about behavioral safety is whether it's cost-effective, and if so what is the expected Return on Investment (ROI). Many claims have been made about the ROI of Behavioral Safety processes (1). Some indicate the process has paid for itself (2), while others suggest a ROI of 281% (3) resulting from reductions in incidents, insurance premiums and workers compensation. Others have obtained substantial reductions in operating costs (4), further increasing the cost-benefit. Knowledge of the average ROI for various structural designs would be useful for those considering Behavioral Safety as a means to control incidents, to help in the decision-making process. Alternatively, they could provide a comparative point for those already using Behavioral Safety to determine if their average ROI is above or below expectations.

Calculating the cost of incidents

There are two types of incident costs: direct and indirect. Direct costs typically reflect those that are directly associated with an incident. Typically, these include [a] Investigation costs (i.e. how many people involved multiplied by the number of man hours multiplied by the average hourly salary); [b] Production downtime (e.g. time spent by first-aider with injured person, time spent by co-workers in attendance to injured person, and actual downtime of all the production processes); and, [c] Medical expenses, damage to equipment or product, sick pay, repairs, legal costs, court fines etc. The indirect costs typically includes costs that are indirectly linked to the accident, e.g. employers and public liability claims, business interruption, product liability, training of replacement staff, loss of goodwill, loss of corporate image, etc.

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Method

A wide-ranging literature search located 106 professional and academic behavioral safety articles. These were examined and kept for review purposes only if they (1) focused solely on occupational safety; (2) quantified behavioral change and incident reductions; (3) stated observation contact rates; and (4) were written in English. Seventeen studies met these criteria. Of these, 5 reported the results of 2 or more separate studies within the article. In total, this provided 24 useable data sets (See Appendix 1).

Common study characteristics were identified and coded. This included (i) Type of setting (static or dynamic), (ii) observation focus (individuals, workgroups or outcomes), (iii) observation frequency, and, (iv) the number of feedback channels used (posted, verbal, written, weekly briefings). Study outcomes were the degree of (a) injury reduction and (b) behavioral improvement.

Data Transformation

Many of the studies reported success in different ways. To ensure 'like for like' comparisons a number of data transformations were required:

1. *Behavioral Change*: The degree of behavioral improvement was obtained directly from the reported statistics or by subtracting the reported baseline score from the final intervention score when the specific degree of improvement was not reported.
2. *Incident reduction*: A similar procedure was adopted to ascertain the degree of injury reduction. In three instances (5), baseline injury figures encompassed a number of previous years, rather than the corresponding period in the previous 12 months. This practice could have inflated the claimed degree of injury reduction (i.e. most companies experience annual reductions in incidents due to other safety management practices). In these instances, the reported 'injury baseline' was divided by the appropriate number of months to obtain an average monthly injury rate. The product was multiplied by 12 to obtain an estimate of the prior annual injury rate. Percentage changes were computed for injury reduction and behavioral improvement from each study.
3. *Incident Rates*: The calculation of reported injury rates also differed across the studies. Some were based on 100,000 or 200,000 hours worked and some on a million hours. All injury rates were recalculated to reflect the rate of 200,000 hours worked. This did not affect the magnitude of change reported in the studies; it merely facilitated a like-for-like comparison.
4. *Incident Costs*: To ensure 100% correspondence, the direct costs of injuries were initially determined at 1978 rates of $13,520 (6), which was the year of earliest publication. These figures exclude indirect costs that are thought to range between 8-32 times the direct costs (HSE, 1991). Average start and end of study costs were calculated by multiplying each study's incident rates by $13,520, minus the man-hour training costs of those involved. The figures were then updated to reflect more recent cost estimates of $29K per disabling injury (7), by multiplying the product of all previous calculations by 2.15 (i.e. $29K/$14K=2.15),
5. *Study combinations*: To calculate the ROI of various B-BS design features in combination, the studies were divided into sub-groups. The variables of interest were [a] type of setting; [b] Observation focus; [c] Contact Rate; and [d], the number of feedback channels used.

Results

The results are illuminating (see Table I), although not definitive due to the relatively small number of studies within each sub-set.

The combination of design features providing the greatest savings ($1.7 million) per 200,00 hours worked were studies conducted in static settings, where observations of an entire workgroups safety behavior are conducted daily, and information about the workgroups safety performance is delivered using multiple feedback channels. The combination with the most significant losses ($2 million plus) are those using 1 on 1, peer-to-peer observations with a minimal contact rate of once per week, and using only 1 or two feedback channels. According to results of a survey of 1440 companies, round 50% of all B-BS processes use this loss producing combination (8).

Table I. ***ROI of B-BS design feature combinations***

No	Setting	Focus	Contact Rate	No. Of Feedback Channels	$ RoI
4	Static	Work Group	Daily	3-4	1.695,394
2	Static	Work Group	Daily	1-2	62,371
1	Static	Work Group	2-3 p.w.	3-4	33,598
1	Static	1 on 1	2-3 p.w.	3-4	232,996
4	Static	1 on 1	2-3 p.w.	1-2	142,050
2	Static	1 on 1	1 x p.w	1-2	(2,034,133)
2	Dynamic	Work Group	Daily	1-2	125,772
2	Dynamic	Work Group	1 x p.w	1-2	(2,317)
4	Dynamic	Outcomes	Daily	1-2	49,935
1	Dynamic	Outcomes	2-3 p.w.	1-2	340
1	Dynamic	1 on 1	Daily	3-4	(10,453)

Across the entire range of studies, most combinations (n=8) produced some return, although the magnitude differed. Three combinations produced losses, with no clear common distinct design feature pointing to one particular reason why. Previous research (9), however, does suggest managerial commitment to the process may account for some of the variation.

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Appendix 1. Studies Reviewed

Study	# of Data sets	Length of Study (Weeks)	Industrial Setting	Contact Rate	Observation Focus	# of Feedback Mechanisms
Cooper et al 1994	1	20	Cellophane factory	Daily	Workgroups	4
Cooper (2006a)	2	93	Metal refinery	Daily	Workgroups	4
Cooper (2006b)	1	70	Paper Mill	Daily	Workgroups	4
Zhu et al (2000)	2	52	Oil Rigs	Daily	Workgroups	1
Haynes et al 1982	1	36	Transit Operations	Daily	Outcomes	3
Larson et al (1980)	3	104	Police	Daily	Outcomes	1
Cooper & Newbold (1994)	1	11	Light bulb Manufacturer	Intermittent	Workgroups	4
Komaki et al (1978)	1	25	Food Manufacturer	Intermittent	Workgroups	2
Komaki et al (1980)	1	45	Vehicle Maintenance	Intermittent	Workgroups	2
Nasenan & Saari (1987)	1	60	Shipbuilding Yard	Intermittent	Outcomes	2
Reber & Wallin (1994)	1	88	Offshore Diving	Intermittent	One-on-One	3
Winn et al (1999)	1	60	US Postal service	Intermittent	One-on-One	3
Reber & Wallin 1984	1	56	Sugar Cane Machinery	Intermittent	One-on-One	1
Reber et al 1990	3	55	Farm Machinery	Intermittent	One-on-One	1
Mattilla & Hyodynmaa (1988)	2	20	Construction	Once P.W.	Workgroups	2
Fellner & Sulzer-Azaroff (1984)	1	60	Paper Mill	Once P.W.	One-on-One	1
Hodson & Gordon (2000)	1	104	Automotive parts	Once P.W.	One-on-One	1

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D. Cooper

Safety leadership: application in construction site

Leadership nella sicurezza: esempi di applicazione nella cantieristica

B-Safe Management Solutions Inc.

ABSTRACT. The extant safety literature suggests that managerial Safety Leadership is vital to the success and maintenance of a behavioral safety process. The current paper explores the role of Managerial Safety Leadership behaviors in the success of a behavioral safety intervention in the Middle-East with 47,000 workers from multiple nationalities employed by fourteen sub-contractors and one main contractor. A quasi-experimental repeating ABABAB, within groups design was used. Measurement focused on managerial Safety Leadership and employee safety behaviors as well as Corrective Actions. Data was collected over 104 weeks. During this time, results show safety behavior improved by 30 percentage points from an average of 65% during baseline to an average of 95%. The site achieved 121 million man-hours free of lost-time injuries on the longest run.

Stepwise multiple regression analyses indicated 86% of the variation in employee safety behavior was associated with senior, middle and front-line manager's Safety Leadership behaviors and the Corrective Action Rate. Approximately 38% of the variation in the Total Recordable Incident Rate (TRIR) was associated with the Observation rate, Corrective Action Rate and Observers Records of managerial safety leaders (Visible Ongoing Support).

The results strongly suggest manager's Safety Leadership influences the success of Behavioral Safety processes.

Key words: *behavioral safety, Safety Leadership, Corrective Actions, TRIR, multiple regression.*

RIASSUNTO. L'attuale letteratura sulla sicurezza suggerisce il ruolo centrale che la Leadership riveste per il successo ed il mantenimento nel tempo di un processo di sicurezza comportamentale. Il presente articolo esplora il ruolo dei comportamenti di Safety Leadership illustrando il successo ottenuto da un progetto di B-BS realizzato in Medio-Oriente, con 47000 lavoratori di diverse nazionalità legati all'azienda da rapporti di lavoro diretti o in subappalto.

È stato utilizzato un disegno quasi sperimentale con misure ripetute (ABABAB) entro i gruppi. La misurazione dei comportamenti si è focalizzata sulla Safety Leadership dei manager, sui comportamenti dei lavoratori e sulle Azioni Correttive. I dati sono stati raccolti nel corso di 104 settimane. In questo lasso di tempo, i risultati mostrano che i comportamenti di sicurezza sono aumentati di 30 punti percentuali passando da una media del 65% (baseline) ad una media del 95%. Come miglior risultato, il sito industriale ha raggiunto un totale di 121 milioni di ore-uomo consecutive senza infortuni determinanti la perdita di ore lavorative.

L'analisi della regressione multipla secondo il modello Stepwise ha indicato che l'86% della variazione nel comportamento dei lavoratori è associata sia ai comportamenti di Safety Leadership dei senior, middle manager e dei capiturno, sia alle Azioni Correttive. Approssimativamente, il 38% della variazione nel Tasso di Incidenti Registrabili Totali (TRIR) è associato al tasso di osservazioni, al tasso di Azioni Correttive ed alle registrazioni degli osservatori in presenza dei safety leaders (Visible Ongoing Support).

In conclusione, i risultati ottenuti suggeriscono in maniera decisa che la Safety Leadership dei manager influenza il successo dei processi di sicurezza comportamentale.

Parole chiave: sicurezza comportamentale, Safety Leadership, Azioni Correttive, TRIR, regressione multipla.

Introduction

Top performing companies express high commitment to safety by developing a process in which the workforce can participate, and which can be implemented and monitored so both management and the workforce can receive feedback (1). A systematic Behavioral Safety process fulfils these conditions. The intention is to focus worker's attention and action on their safety behavior to avoid injury. Interventions are aimed entirely upon the observable interactions between safety behavior and the working environment.

Behavioral Safety attempts to identify those unsafe behaviors implicated in the majority of injuries. These behaviors and/or their proxies (e.g., hoses left lying across walkways) are developed into specific behavioral checklists. Trained observers use these to monitor and record people's work behavior on a regular basis (e.g., daily). Derived from the observation results, 'Percent safe' scores provide feedback so people can track their progress against self-set, assigned or participative improvement goals (2). Feedback mechanisms include verbal feedback at the point of observation, graphical charts and/or written performance summaries so corrective actions can be taken (3, 4). Results indicate significant reductions in injury rates are possible within a relatively short time (5) with the impact lasting for many years (6).

Those companies implementing Behavioral Safety possess a high degree of organizational commitment to safety (1). However, the commitment of individual man-

ager to the organization's safety goals and the Behavioral Safety process is a significant factor (7). Managers need to provide the necessary resources and actively support the process. In many instances this does not occur.

1.1 Management's Commitment

Managerial commitment is defined as "engaging in and maintaining behaviors that help others achieve a goal" (8). Broadly speaking, measurement can be undertaken in two ways: Direct questions are asked of managers (9) or their commitment behaviors are monitored (10). Not many managers admit they are uncommitted to safety when asked, whereas behavior provides the ultimate proof of commitment (10, p.4). An extensive search of the psychological, managerial and safety literatures reveal the existing managerial commitment evidence is almost entirely based on the findings of numerous safety climate perception surveys (e.g. 11) with very little empirical work assessed the actual impact of managerial commitment behaviors on safety performance (e.g. 12, 13). Perceptual data obtained in the UK construction industry suggested the impact of managerial commitment to safety could exert an impact of approximately 51% on a Behavioral safety process (14).

1.2 Management Levels

Although unclear, the available evidence suggests different management levels exert different effects on employee behavior. For example, in a Dutch questionnaire study of 207 workers on 15 construction sites, Andriessen (15) found that senior managers exert a greater influence on employee motivation to behave safely than supervisors do. Conversely, Simard and Marchand's (16, 17) Quebec questionnaire survey with 23,615 production workers, suggests supervisors exert a greater influence on employee behavior than senior plant managers do. These two examples suggest the effects of management's commitment are likely to be moderated by situational aspects such as the prevailing safety culture (18), type of setting (19) and type of organizational structure (20). In a Behavioral Safety study in a British Nickel Refinery, Cooper (8) found that different management levels exerted independent and cumulative effects on employee safety behavior. Senior management commitment played a primary role in shaping employee behaviors and a secondary role by shaping lower management behavior that in turn influenced employee behavior.

Study Aims

The purpose of the current study was to investigate the impact of managerial Safety Leadership support on employee safety behavior and incident rates in a Middle-East construction setting.

Method

Participants and Setting

47,000 Third-Party Nationals from India, Indonesia, Malaysia, Nepal, Philippines, Sri Lanka, Turkey and the UAE were involved in the construction of 2 X LNG Super Trains, an Employee Camp for 50,000 workers, LNG Storage Tanks & Jetty.

The workforce were employed by Fourteen Sub-contractors from India, Ireland, Italy, Nepal, the UAE, and USA working for a Japanese / French Joint venture. In other words, the project involved multiple contractors and multiple nationalities in a dynamic setting (19). The size of the project was equivalent to 100 US football fields combined, with the wiring for 1 X Train alone stretching in excess of 3000 miles (i.e. longer than the distance between New York and Los Angeles!).

Quasi-Experimental Design

While data were collected continuously over 104 weeks on a daily basis, consecutive interventions were implemented using an AB-AB design within each sub-contractor project. Not all sub-contractors were on-site at the same time, but the sequence of interventions included: 1) Baseline 1 (4 weeks); 2) Intervention 1 (approx. 26 weeks); 3) Return to Baseline 2 (4 weeks); (4) Replication Intervention (approx. 26 weeks); and so on, until their contract was complete and they left the site.

Behavioral Safety Measures

The primary measurement variables focused on employee safety behavior (percent safe) and managerial leadership behavior (percent leadership support), both of which are categorized as safety compliance data. Total Recordable Injury Rates (TRIR) comprised the secondary variable used to assess the efficacy of the interventions, categorized as safety performance data.

Safety Behavior Checklist

Behavioral safety checklists for each contractor were developed by the behavioral safety facilitators with oversight from the author and colleagues, based on the construction activities to be undertaken. Each contained a maximum of 20 behaviors (e.g., Personnel are not manually handling loads that are too heavy) pertaining to the work area of interest. These were placed into various categories (e.g., Housekeeping, Personal Protective Equipment, etc.) to facilitate analyses and feedback.

Each checklist contained three columns: Safe, Unsafe, and Unseen that observers used to record the results of their observations (see procedural section below for observation details). Any particular behavior recorded as *safe* meant that everyone observed was performing that behavior safely. Any one person observed performing an unsafe behavior resulted in that behavior being scored unsafe (21). A frequency count of the number of persons performing a particular unsafe behavior determined the recording of unsafe behavior. The total number of safe behaviors recorded were divided by the sum of the total safe and unsafe behaviors recorded, and multiplied by 100 to calculate an Observed Percent Safe score (the primary dependent variable in this study). The unseen column was marked when a particular behavior did not occur during the 15 minute observation tour (the project team analysed these to remove infrequently recorded behaviors from subsequent intervention checklists). Project facili-

tators entered daily observation data into an online behavioral safety computer database (22) when they received the completed behavioral checklists from the observers. The database contained an exact copy of each contractor's checklists, by trade, with corresponding data entry fields in the safe, unsafe, and unseen columns. Once entered, the program automatically calculated a percent safe score (i.e., total safe/ (total safe and unsafe), multiplied by 100). The program was used to generate weekly feedback reports for each contractor/trade group that were presented to the workforce at weekly 'toolbox' talks.

Managerial Leadership Checklists

Senior, Middle and front-line managers themselves identified their Safety Leadership behaviors. The resulting checklists did not change throughout the duration of the study, with each containing between 10 and 14 items (See Figure 1 for an example). The managers were trusted to complete these once per week on a self-report basis.

Visible Ongoing Support Checklists

Each and every week as a cross-check on the managerial self-reports of Safety Leadership, observers were asked to record the amount of contact they had experienced with each of the different management levels. Observers were also asked to indicate the type of support provided by their project facilitator and from their colleagues. This measure was termed 'Visible Ongoing Support (VOS).

Injuries

The Total Recordable Injury Rate (TRIR) was used as the primary outcome measures to assess the effectiveness of the Behavioral Safety process. The site calculated these based on the number of incidents per 200,000 hours worked.

Observer Recruitment & Training

Observers were recruited from within the ranks of each contractor workforce, by their managers. A target of 2 percent of the entire workforce was set, to try to achieve a ratio of observers to workforce of 1:50. This meant we sought a total of some 950 observers (in fact we recruited and trained 1,500, giving a ratio of 1:31). Each observer was trained by the contractor facilitators, as well as the author and colleagues when they were on site. Observers were taught how to observe, give verbal feedback to individuals, set participative improvement goals with workgroups and conduct weekly workgroup feedback sessions on a one-day training course. A one-week practice period was used to identify observers not completing the checklists correctly, with appropriate coaching being given, where required.

Item	Yes	No	N/A
Category 1: People support			
1 Participated in a job start meeting			
2 Discussed safety performance with employees (one to one)			
3 Discussed safety with line management and / or client			
4 Reviewed application of a JSA (at any level)			
5 Corrected an unsafe act			
Category 2: System support			
6 Reviewed Hit list of corrective actions			
7 Developed plans for corrective actions			
8 Ensured TWT correGtive actions were closed by agreed date			
9 Reviewed safety progress with management team			
10 Reviewed an incident investigation report (as required)			
Category 3: Training support			
11 Conducted safety related coaching			
Category 4: Observer Support			
12 Promoted daily observations			
13 Offered support to an observer			
14 Assisted an observer in providing team feedback			
Total			
Total %Score: Total(Total Yes / (Total Yes + Total No)) * 100: ___%			

Figure 1. ***Example managerial Safety Leadership Index***

Implementation of the Behavioral Safety Process

To begin, we held a 'lessons learnt' review exercise of different Behavioral Safety processes operated by some of the different contractors. From this a process was developed that would build on the positives and address the areas of opportunity identified (one of the major findings was a lack of managerial support built in to the process). This resulted in a planned sequential roll-out of the Behavioral Safety process across all the contractors, with planned milestones for achievement for each individual contractor. One hour 'Sell & Tell' briefings were held with the management of all the contractors (including the Joint Venture management).

Broadly, the time-frame of the Behavioral Safety roll-out and execution activities were:

1. Trained Project coordinators – *Five days.*
2. Developed Behavioral Checklists – *Four Weeks.*
3. Conducted Managerial Alignment Sessions to obtain commitment – *6 weeks (at 2 hour sessions).*
4. Trained some 1500 Observers – *Target of 2% of entire workforce.*
5. Established Baseline performance – *1st four weeks of observations.*
6. Set work crew improvement targets – *Determined by Baseline Scores.*
7. Gave feedback – *Daily (verbal) / Weekly(written) / monthly Managerial Summaries.*
8. Developed Publicity Infrastructure – *Developed Behavioral Safety Site Induction package / Posters/ Newsletters, etc.*
9. Reviewed Process and adapted according to the Construction program – *Changed checklists to suit construction program and trained new observers.*

A comprehensive training document outlining roles & responsibilities, implementation activities and a planned implementation schedule was developed and provided to the main contractor and all sub-contractors to help facilitate self-sufficiency in the training of project administrators and observers. Specific metrics to monitor the roll-out and success of the entire process across all 14 contractor projects were also developed. These were reported monthly to the site safety committee. These included

- Total Site Manpower,
- Number of trained coordinators / observers per contractor
- Ratio of Observers to Personnel (Target = 1:50).
- Ratio of Observations Expected/ Received
- % Safe Score,
- % Safety Leadership Scores for senior, middle and front-line managers
- % VOS (Workers record of safety support received from management)
- 5 Best / Worst Scoring Behaviors,
- the Corrective Action Completion Rate
- Monthly 'Lessons Learnt' Meetings with all contractors

Results

The number of the various checklists returned and corrective actions completed with associated percentage rates were as follows:

Table I. *Number of measures returned and associated percentage rates*

Indicator	Number	% Rate
Safety Behavior Observations	2.3 million	84.67
Senior Managers Leadership Checklists	36, 215	90.36
Middle Managers Leadership Checklists	83,731	87.58
FLM Leadership Checklists	58,659	90.15
VOS checklists	36,215	86.91
Corrective Actions Completed	2,973	88.8
Observer to Worker ratio (2% target)		3.13%

Safety Behavior Results

The graph below illustrates safety behavior improved by some 30 percent over a 2 year period across all 14 contractors, for all activities. The data is aligned and collated in 'real-time', so reflects actual percent safe scores as the different contractors came and went on site.

Figure 2. *Behavioral improvement across all 14 contractors*

Injury Results

The longest straight run without a Lost-time incident was 121 million man-hours. The overall sites incident rates per 200,000 hours worked are quite remarkable, especially given the ramping up of manpower during the project, which traditionally is a time for increased incident rates in the construction industry.

Table II. *Total Recordable Incident Rates (TRIR) by year*

Year of Project	Total Recordable Incident Rate (TRIR) per 200,000hrs worked	Man-hours Worked
Year 1 (2006)	0.09	41,826,852
Year 2 (2007)	0.18	76,369,295
Year 3 (2008)	0.11	120,860,975

This can be seen more clearly in the graph below for one part of the project (Common Offplots), where manpower increased in the time period shown (9 months) from 1600 workers to over 4500 personnel.

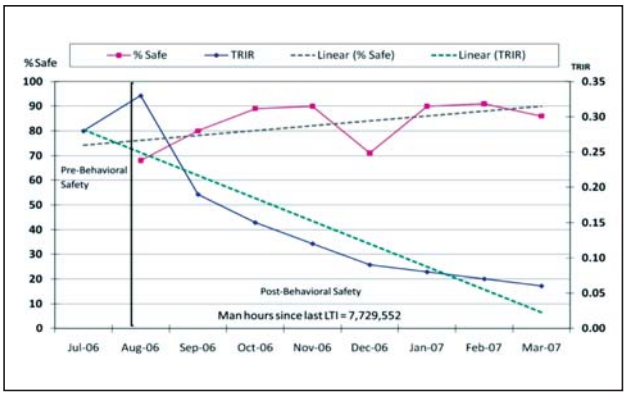

Figure 3. *Behavioral improvement and incident reduction trends*

Multiple Regression Analyses

Observed percent safe was the dependent variable with senior, middle and Front-line management Safety Leadership treated as independent variables, along with the Corrective Action Rate, observers Visible Ongoing Support records and the Observation Rate (observations expected Vs. completed).

Shown in Table III, the adjusted R^2 results indicate the Corrective Action Rate impacted safety behavior by around 21.5%. Observer VOS records account for a further 32.4% improvement. Adding Front-Line Managers Safety Leadership into the equation accounted for

an additional 19.5% improvement. Middle and Senior managers Safety Leadership accounted for a further 6.7% and 5.5% respectively. Overall, the Corrective Action Rate and managerial Safety Leadership impacted employees' safety behavior, by some 85.6 percent (adjusted R^2 X 100).

Table III. ***Stepwise multiple-regression results for impacting safety behavior***

Variables	Adj R^2	% Change	P<
Corrective Actions	0.215	+21.5%	.01
Corrective Actions + VOS	0.539	+32.4%	.001
Corrective Actions + VOS +FLM	0.734	+19.5%	.001
Corrective Actions + VOS +FLM + MM	0.801	+6.7%	.01
Corrective Actions + VOS +FLM+ MM + SnrM	**0.856**	**+5.5%**	**.01**

Similarly, when the TRIR was entered as the dependent variable, the importance of the Observation Rate, Corrective Action Rate, and workers records of managerial Safety Leadership was demonstrated. Collectively they accounted for between 35-38 percent of the impact on injury rates (adjusted R^2 X 100).

Table IV. ***Stepwise multiple-regression results for impacting injury rates***

Variables	Adj R^2	% Change	P
Observation Rate	0.35	+35%	.01
Observation Rate + Corrective Actions	0.346	-0.04%	.05
Observation Rate + Corrective Actions + VOS	**0.378**	**+3.2%**	**.01**

Discussion

This study provides compelling evidence regarding the impact that management Safety Leadership exerts on employee safety behavior. This supports Zohar's (23) findings that increasing the frequency of management -subordinate safety interactions positively influences safety performance. The study results also show that in construction it is front-line management that has the most influence. Which managerial level exerts the most influence on employee safety behavior is a significant factor not yet fully explored (24). It has been hypothesized that senior managers influence the behaviors of middle managers, who in turn influence the behaviors of front-line managers, who subsequently influence employee behavior (24). The results reported here support this proposition, as managerial influence appears to increase with closer proximity to the workforce.

The Corrective Action Rate is also a proxy measure of managerial Safety Leadership, as it is they who control the resources for these to be attended to. This, in conjunction with observer records of the amount of Safety Leadership demonstrated was linked to both behavioral improvement and incident rates. In practical terms, this means attending to any Corrective Actions reported and reinforcing the perception of demonstrable Safety Leadership with the workforce are very important to improve safety performance.

Other practical lessons learnt from this project mirror those from many other projects across all industries (25).

- Employees should observe daily (can take time to get - needs constant attention)
- Corrective actions must be fixed quickly (within 30 days)
- Senior, Middle & Front-line Management Safety Leadership Support is vital
- Dedicated project coordinators are vital to keep project on track
- Monitor B-BS statistics rigorously to keep project on track
- Maintain a consistency of focus, purpose and execution

According to the International Association of Oil & Gas Producers' (OGP) reports in 2007 & 2008 this company was the safest upstream facility in the world for two years running. Such results are an 'independent' indicator of the impact that can be exerted by a well designed and run Behavioral Safety process.

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Linking production to safety: boosting productive performance through Behavior-Based Safety

Coniugare sicurezza e produttività: aumentare produzione e qualità con la Behavior-Based Safety

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ABSTRACT. Construction continues to have the largest number of fatal and major injuries among industry groups and the general rates have shown only a small amount of change over the last number of years. Safety processes can (and do) fail, resulting in injuries and incidents. Behavioral science uses data and analysis to come to conclusions about what is actually happening. Therefore, objectivity is at the core of behavioral science. This science of behavior can help us produce more effective implementations of safety solutions. B-BS processes recognize the workplace environment as the dominant factor in the creation of safe working. This focus on behavior needs to be co-ordinated with the elimination of work hazards. This paper will discuss the history, successes, and failures of B-BS, and suggest fertile areas for improving traditional safety practices. The natural effect of the pairing of a successful B-BS roll out with production occurs because the leadership is now much educated regarding human behavior. The interest and attention to planning 'how' things get done on sites is much greater when B-BS exists. This paper will discuss how roll out of B-BS has also resulted in improvements in production and early completion rates of construction Projects.

Key words: *safety, production, performance, leadership, behavior.*

RIASSUNTO. Paragonato ai diversi settori industriali, il settore delle costruzioni continua ad avere il più alto numero di morti e di feriti gravi; gli indici generali hanno mostrato solo piccoli segnali di cambiamento nel corso degli ultimi anni. I processi di sicurezza possono fallire (e lo fanno) causando incidenti e feriti. La scienza del comportamento utilizza dati e analisi per spiegare quanto sia effettivamente accaduto, facendo dell'oggettività il cuore dell'analisi. Questa scienza può contribuire notevolmente ad implementare soluzioni di sicurezza maggiormente efficaci. I processi di B-BS riconoscono che l'ambiente di lavoro è il fattore dominante nella creazione di attività lavorative sicure: a questa focalizzazione sui comportamenti deve essere associata l'eliminazione dei rischi lavorativi. L'applicazione della B-BS ha come effetto "secondario" il miglioramento dell'attività produttiva poiché quanto appreso in termini di sicurezza si generalizza naturalmente anche agli altri ambiti lavorativi: l'interesse e l'attenzione alla pianificazione di come vengono svolte le mansioni sul luogo di lavoro è assai superiore quando c'è la B-BS. Questo articolo presenta la storia, i successi e i fallimenti della B-BS e fornisce interessanti spunti di riflessione su come il lancio di progetti di B-BS ha coinciso spesso con incrementi di produttività e con la riduzione dei tempi necessaria alla lavorazione.

Parole chiave: sicurezza, produzione, performance, leadership, comportamento.

Overview

This is an attempt to say some things you may find logical, obvious and yet still interesting. Our basic premise is that workplace injuries are reduced when we understand their causes. Their causes are often related to the behavior of executives, managers, supervisors, and employees (each in different ways). If we use science to understand what causes behavior (i.e., behavioral science), then we've got a fair chance of reliably changing it, and avoiding disaster.

Companies may well have voluminous rules and regulations designed to achieve various objectives; on their own these rules will not drive behavior. It is irresponsible to think that just *creating and publishing* a set of rules will deliver various human behaviors. It is the employer's responsibility to make sure the workplace environment is safe. Safety law is not complex, it's simple, many employers make this simple goal extremely complex and in doing so create unsafe places for people to work.

For very understandable and logical reasons companies, organisations, and projects feel that they need to cover themselves against prosecution for not obeying the law of the land. This concern is translated into processes, governance and compliance in the form of written documents, training, auditing and coaching.

Behavioral science suggests that humans only have so much capacity to take things in; when you have reached saturation point there is no benefit in continuing. Many safety processes overwhelm even the most diligent of engineers and construction workers. Many processes are badly written, not written in a form suitable for the reader and do not take into account the likelihood of them ever being read at all (1). Understanding behavioral science helps us to realise the errors in our typical communication strategies, so we can change them and produce different results. This paper aims to explain some simple ways of applying behavioral science to safety management.

The case for behavior based safety

One of the leading science-based approaches to creating this sort of behavior change is called behavior-based

safety (B-BS). Behavior-based safety (B-BS) has been practiced in organizations for more than 30 years. The initial scientific studies demonstrating the efficacy of the behavioral approach were published in 1978 in the United States (2, 3). These studies, and many others, clearly showed that the use of some rather simple and straightforward behavioral science techniques could quite dramatically and very rapidly improve safety behavior (and consequently, injuries) on the job. Since the 1970's B-BS has been successfully applied around the world in a multitude of countries, cultures, and languages. B-BS applications, when correctly implemented, show an average of 20-25% year-over-year reductions in injuries and related costs (4).

The most common sequence of steps to apply B-BS involves (5):

1. Determining the controllable factors involved in injuries (e.g., processes, environmental conditions, worker and manager behavior).
2. Defining these behaviors, processes, and conditions precisely enough to measure them.
3. Implementing procedures to reliably measure the behaviors, processes, and conditions to determine their current status and setting reasonable goals for their improvement.
4. Providing feedback.
5. Reinforcing progress.

Most modern B-BS applications also include a component in which the organization's members develop ways to continuously improve these processes of identification/correction and reinforcement.

Some Lessons Learned - Successes and Failures of B-BS

Despite the fact that there have been a multitude of successful applications of B-BS around the world in most industries, there are those who criticise the approach and there are some potential pitfalls when implementing the process. Below, we discuss just a few of these potential pitfalls.

1. Blame the worker

Some of the large labour unions have gone to great lengths to point out what they see as shortcomings in the B-BS process. To be sure, we see these things as landmines to avoid in implementations, but they are not foregone results of every B-BS implementation. A primary criticism often levelled by the United Auto Workers (UAW, Howe, 2001) and other labour unions is that B-BS results in a "blame the worker" mentality. The suggestion is that B-BS allows management to shirk its responsibilities to provide a safe work environment through the use of engineering controls. Instead, the argument goes, employees are given the task of implementing safety processes that are not properly resourced. We believe this is important to avoid, primarily by involving leaders at all levels of the organization in the process, to ensure that everyone is doing what they can to create safe work and safe working environments.

2. Safety incentives

Another potential pitfall is the use of safety incentive systems. Incentives do work, and there are many research studies to back this claim up. However, it is very common to apply them in ways that result in under-reporting of injuries and other related problems.

For example, while working with a large corporation that had team-based quarterly cash incentives for avoiding injuries, one of us learned of a recordable injury that was covered up by a team of employees. An employee broke his leg during the last day of the quarter, and because going to the hospital would have meant that his team lost its bonus, at the urging of his team mates he worked light duty for the rest of the day and went to the hospital the next day to be treated.

This and other potentially detrimental practices (such as Safety BINGO) appear to be based in behavioral science theory, but on closer inspection they are merely the misguided attempts of those who have not taken the time to learn behavioral science.

3. Safety observations

Many organizations implementing B-BS become obsessed with collecting employee safety observations so much that they develop reward systems to promote data collection. One such system we witnessed was ill-designed: for every observation employees conducted and submitted, they earned the chance to win a car! The result was that there was a huge increase in the number of observation sheet completed, but that most of them were completed at the desk of the employee (i.e., faked, or "pencil whipped").

In behavioral science, there's an old adage that says, "Be careful what you reinforce!" In this case, the behavior that was reinforced was turning in completed observation sheets - quality was not considered in arranging the system, and therefore quality was not part of employees' responses.

B-BS applications

Since its inception the focus of B-BS application has evolved, and has progressed through at least 3 distinct phases:

1. Supervisor-driven applications
2. Employee-driven applications
3. Leadership-focused applications.

A good deal has been written about the first two phases, but little has been written about the third. In this paper, we will define these phases and give examples of each, ending with a more detailed discussion, based upon our experience in applying these concepts, of what leaders can do to support safety processes, especially in the area of construction safety.

Supervisor-driven applications

Early applications of B-BS were what we would call "Supervisor-driven" because observations, feedback, and

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reinforcement were placed in the hands of supervisors. Employees, doing "the work" of the organization, were the recipients of the safety programme, and front-line supervisors and safety personnel typically delivered the programmes.

Mid-level managers and executives were largely left out of the picture, and employees were expected to respond to the feedback delivered by the supervisors. One negative side-effect of this approach is that significant amounts of information is left on the table when one does not consult with, involve, and partner with those who "do the work" of the business. That is, employees usually know far more than anyone else about the shortcuts they are encouraged to take, and why they are encouraged to take them.

Most of the early research demonstrates this approach to applying behavioral safety where supervisors or safety personnel conducted behavioral safety observations and gave feedback to employees, who were then expected to correct their behavior and the related conditions. The research applications of the supervisor-driven method worked very well, but in practice people began to notice the lack of involvement of employees, and realized that not involving employees was a critical mistake.

Employee-driven applications

As a result, we began more and more to see applications that were called "employee-driven". The idea was to give employee teams all of the resources and support they needed to develop and "own" the safety process so that it worked for them. This worked in many respects, as having a significant say in how safety was to be managed and helped to build ownership and commitment to the safety process on behalf of employees.

Most of the books describing how to apply B-BS fall into the employee-driven category (i.e. 6, 7). However, this approach too has its drawbacks. Employee-driven applications do not tend to recognize the role of managers, executives, and other leaders in creating the environments - in our view, these processes suggest that we measure the behavior of "the victims" of environments (i.e., employee behavior alone), not the behavior of "the creators" of the environments (i.e., the behaviors of leaders in the organization).

Leadership-focused applications

The most effective applications of B-BS seem to follow more of a leadership-driven model, in which leaders at all levels of the organization, who touch the safety process in any way, are identified and involved in the process of development and execution of safety performance. In this case, because they each are expected to engage in some unique behaviors to contribute to the safety process, people working at each different level of the organization enact quite different, but overlapping, safety management systems (8).

For example, executives impact safety through the strategic focus of safety and non-safety (i.e., production) operations; through arranging and communicating policy; and through providing resources for others to execute deliverables that are consistent with the strategic focus of the organization. Middle managers are often tasked with getting the results that are set out by executives. Supervisors are tasked with directly managing the workforce, and the workforce does the work.

Each of these levels impacts safety in its own ways and without careful analysis and testing of these impacts, one would never arrive at the optimal behaviors in which people at each level should engage. A principle drawback to this approach is that it can get overwhelming and cumbersome very quickly.

The leader is the key to success

Some leaders say things like "I am 100% behind our safety programme'', "safety in this company is our number 1 priority''. Unfortunately in some cases what they really mean is that they think B-BS is a good idea but they do not know what they should be seen to be doing which would confirm that they are indeed supporting the safety programme.

The benefit of using behavioral science as the vehicle to improve safety is that if the Company executives are willing to be measured on their behavior then improvements can be achieved. Surveys, especially anonymous surveys are the first step in a "leadership led" B-BS programme.

By carrying out anonymous surveys the leadership can come to terms with the real safety concerns in their company. These concerns always look completely different to the customary ways of reporting on safety. In the typical construction company some or all of the following can be in place:

- Voluminous lagging measures.
- Unusual scoring systems, which put the local manager at threat.
- Scores from audits of paperwork rather than behavior.
- Unhelpful reactions to incidents and injury.
- Senior managers exhibiting the wrong behavior when they visit sites.
- Some Companies' unsophisticated base culture is not compatible with B-BS.

Having successfully rolled out B-BS programmes they work very well when the following conditions exist:

- A mix of leading and trailing measures.
- Lean safety processes tied to the B-BS programme.
- Audit scores on behavior as well as processes.
- Adult (calm, rational) responses when injury or incidents occur.
- Senior managers who know how to behave when on site.
- An enlightened (positive environment, not scary!) base Company culture exists.

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The Safety Leadership

La Safety Leadership

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ABSTRACT. In this paper the authors present a careful consideration about the role of leadership, the fundamental element for the success of Behavior-Based Safety (B-BS) programs within companies. Lees and Faulkner have been training, coaching and writing about Behavior-Based Safety for the last ten years. Considerable data has been gathered during this process and the paramount factor in its success is leadership. An effective leader can create many spectacular successes. The success stories are all predicated on good leadership, without that a good product, great processes and quality people are all wasted and often find themselves on the rocks of frustration.

Key words: *safety, leadership, behavior.*

RIASSUNTO. L'articolo propone una riflessione degli autori sul ruolo della leadership, fondamentale per il successo dei programmi di Behavior-Based Safety (B-BS) realizzati nella aziende. Lees e Faulkner, forti della loro decennale esperienza di lavoro nel realizzare progetti di B-BS e sulla base dei numerosi dati raccolti, sottolineano la centralità della leadership: un leader capace può ottenere successi notevoli anche in tema di sicurezza. Le storie di successo sono tutte basate sulla buona leadership, senza la quale un buon prodotto, ottimi processi sono insufficienti e le persone di qualità sperimentano spesso un profondo stato di frustrazione.

Parole chiave: sicurezza, leadership, comportamento.

1.1 Introduction

At first glance safety performance is like any other area of business performance: it is a function of its environment. However, safety related behavior needs to be more consistent and accurate. A business will continue to function with countless minor errors in spreadsheets or missed appointments, but with regard to safety, small variations in behavior can lead to incidents and injury. The angle a Stihl saw is held can make the difference between a safe cut and an exploding blade. An offhand comment from a Director can lead to an unsafe working environment, days, even months after the comment was made.

It must be stressed that B-BS is not a replacement for current safety processes; it is a valuable tool which will help improve safe conditions for workers by increasing the chances of making sustainable improvements to safety using behavioral science as the catalyst.

B-BS is quite fashionable right now and there are a considerable number of 'behavioral products' on the market in the UK. Sadly, we have not encountered one which could be described as 'behaviorally sound' (i.e. fully in line with the scientific principles of behavior analysis). Consequently, these products tend to fail in achieving long-term results.

Surveys show that company Directors really do want to create a safe place for people to work. They are usually willing to buy a solution from an external provider which they think has the potential to improve safety performance. Unfortunately, no solution could possibly have a sustainable impact if the Directors themselves are not also involved in the improvement process. An improved safety performance must mean different behaviors from all the people in the company including those at the top. Interestingly, our data also shows how little Directors know about the impact of their own behavior on the safety performance in their company.

1.2 How can you use behavioral science?

Using the power behind behavioral science requires people to read, participate in courses, and most importantly practise as they learn the subject. At the same time, it al-

so requires them to make the time to read, listen and learn. All staff must feel 'safe' and free from threat if they are to try new things and learn effectively.

Learning how to use B-BS skills is a requirement for everyone in the business if safety performance is to be genuinely improved. There are many examples where B-BS has achieved just that. Some major companies have not had an injury or incident for many years.

It is important to understand that all current behaviors are contingent on the local environment the performers find themselves in (e.g. an office or a work site). In other words, behaviors are shaped by what goes on in the environment. Primarily, there are reinforcers and punishers that are driving day to day behaviors, and these consequences are key in producing safe or unsafe performance (1).

1.3 How is behavioral science most effective?

Those companies who impose a 'bought in, off the shelf' B-BS product bypass a critical step. No new product could possibly work if there is no analysis performed on what is reinforcing all the current behaviors in play. Bought in products superimpose a solution on current workplace environments assuming that everything else is ok and the performer is to blame for injury and incidents. Without first obtaining data on the existing workplace environments you could not possibly succeed with an imposed solution (2).

1.4 Why should you use B-BS? - The simple logic

1. We want to achieve better safety performance in the future.
2. If we carry on doing the same things, we will not see change.
3. What does our data say we are getting now?
4. What does our data say about our current systems and procedures?
5. Are we really taking into account that most safety issues are behavior related?
6. What could we now do differently and which measures would prove we have achieved genuine improvements?

Spreading the knowledge of behavioral science to people in a company will produce a permanent change within the company. People will better understand the downstream impact of their own behavior and that of others. This knowledge combined with new slim Safety processes which recognise what's really important will engender an improvement in the current safety and general workplace behaviors.

1.5 B-BS and Safety professionals

The safety fraternity is made up of professionals who are qualified in safety competencies and usually have a good idea of what the law requires everyone to do. They usually find themselves trying to enforce regulations whilst providing senior managers with reports, responses and reassurance of compliance.

Some safety professionals are enlightened to B-BS and play more of an educational and coaching role. Safety professionals that attend B-BS courses sometimes find it difficult to wrestle themselves out of their own world of paperwork and compliance. Those who have managed to break free have become great advocates of behavioral methods and have discovered the benefits of observing, measuring and analysing before acting. They are also implementing sensible processes and procedures.

We all need to be aware that every employee or worker has a primary consequence provider they will take notice of. This is a powerful lesson to those that try to influence the behavior of total strangers whilst visiting a site. Safety Advisors who influence and coach the site agent and foreman have a much bigger impact on safety than those who try to influence the worker directly.

1.6 The simple B-BS process

1. Make some behavioral observations in the work place.
2. Write down your data/measures and look for patterns, consistency etc.
3. Present your findings (in simple graphic form).
4. Set a new expectation and repeat the process.

By far the largest cause of injury or incidents in construction is behavior based. Incidents or injury occurring from equipment or just plain bad luck is not common.

In facilities or on sites it is easy to make observations of activity as there is physical work going on. This is where the behaviors within the local environment manifest themselves. Conducting observations here is the litmus test of the verbal behaviors which created the site environment. If you see consistent safe behavior, consistent adherence to PPE, consistent site tidiness, there is a good chance the existing data reflects this also, both incident data and audit data. The next step in data collection is 'observation' data.

Most workers know how to behave in a safe manner on a site, and most people are competent at what they do for a living. Most unsafe activity will occur where the performer feels in some way obliged to perform an unsafe or risky action. The obligation derives from either supervisor or peer pressure. The opposite of course is also true: safe performance is derived from supervisor or peer pressure.

Ultimately, the key behaviors in creating a safe working environment are the verbal exchanges between the management and supervisors and the supervisors and the workforce. It is the creation of safe verbal behavior in the upper levels of a company that creates the long-term safe working environments on sites (3).

1.7 The best place to start observing behavior

The best person to start observing is you.

Many people have stated in courses that as they learn about B-BS they are becoming more conscious of their

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own behavior. The process of pinpointing a behavior and observing the impact on others is very powerful in making us aware of how sensitive we are to what was said, who said it and how we responded. We will find that we respond differently depending on who is doing the talking. Typically, we think that we have a set of personal values that we are consistent with, but this turns out not to be true (4).

If you say to someone "*I'll ring you back after lunch*" and then you don't, what impact will this have on the person? If it happens frequently will they distrust you? It seems a minor infraction but consider how you would feel and what you would do if someone consistently did this to you. Look at these events from the point of view of both parties; this is a valuable lesson.

It is very common to hear a boss say that "*safety is paramount*". It is also very common that their own behavior (what they do and say) does not support this statement. How many people actually point out the discrepancy to the boss? Potential consequences in the environment of bosses are usually pretty scary for most people, and so even though people will hear something they disagree with they often say nothing to point it out. In reality, bosses tend to be oblivious to these opinions. But if they don't get any feedback, how can they be aware of this problem?

Being conscious that you are not delivering honest feedback is part of the overall problem. Success thrives on honest feedback, and without it decisions are made that can make situations worse. High levels of trust require high levels of honest feedback. Some bosses find it difficult to embark on B-BS as they do not like receiving honest feedback. Often they have conditioned themselves to live in a happy bubble and enjoy exercising their ego. Starting to say things you didn't say before is a matter of self management. Yes, it requires nerve, and it's very hard. But it's worth it.

1.8 "How do I say what's on my mind"?

The best thing to do is to pinpoint a behavior you want to deliver feedback on. Consider a range of things you could say and pick something you are comfortable with. Pick the right time and the place to do it. Deliver your message. Look for a reaction. Most of the time our fears about how someone will react to something we say are unfounded. We tend to operate on a very low threshold of where we think something will be confrontational. The best thing to do is to experiment by trying out saying different things erring on the safe side. When your confidence is high you will find you are much happier delivering feedback, you will feel good about it.

1.9 "I feel people in our company will not support this."

Peter Block (5) coined the expression:

'Helpless and distressed team working for a tyrannical boss'.

Professor Bill Redmon coined the expression:

'Reactive and compliant management systems'.

A large number of people work in a local environment which combines the above two terms. The B-BS term for this situation is 'working in an aversive environment'. It is impossible to achieve high performance in an aversive environment, especially if there is great spatial distance between the workers and the supervisors. In this case:

1. It's difficult to get things done.
2. You are always asking for permission/approval.
3. It would be impossible to work to all the rules as you have not read them all.
4. You get audited and just suck up whatever they say.
5. You can get things done but you risk breaking rules (especially safety rules) in order to finish stuff off.
6. You are impacted by people who have no responsibility for delivery, this is frustrating.
7. You are blamed if accidents occur.
8. Performance measures are imposed on you from above that you had no part in deciding.
9. You are not asked your opinion very much.
10. There is a lot of paperwork; stifling your thinking and creativity.
11. You are sent on training you don't want to go on.
12. You would not dream of saying any of the above to your boss for fear of reprisal.

All is not lost. Many people work in an aversive environment and they find ways of making it tolerable. If an environment is not very effective and is certainly not much fun, why is it then that so many people tolerate it?

It is common to be conditioned into thinking that you could not have an impact on another person's behavior or 'the system', but in most cases this is not true. You just haven't found out how to do it yet.

1.10 How to do something different

If you really care about providing a safe place for people to work in then start at a strategic level and look at what's happening right now. You are likely to find lots of safety rules, lots of process, lots of 'permission to proceed' type paperwork. This places the performers under threat of punishment ('do this or else'), and we know from behavioral science that people don't perform well in aversive environments.

As well as reading your course material, carrying out case studies and graduating your B-BS course, you can carefully observe the key behaviors that are causing the dysfunction. The key ones are likely to be verbal behaviors. It's important to get into the habit of writing these down, to make a note of when something is promised and to record whether it was delivered on time. Observe decision making in the choice of suppliers and subcontractors, and note anything inconsistent with safe delivery. Observe what happens after an incident or injury and analyse whether the subsequent actions by others will create a sustainable safer site in the future.

1.11 Safety bulletins and the real dangers of too much paperwork

You may observe the distribution of safety bulletins from 'corporate' following incidents that are similar to this one:
"urgent notice to all staff, don't stick a pencil in your eye, it hurts, it can blind you, it will also make our safety statistics look worse, if anyone is caught sticking a pencil in their eye they will be dismissed".

These kinds of bulletins provide a smoke screen for the really important bulletins, and people can become desensitised from reading masses of bulletins. After a while, they read none of the bulletins presented to them.

Understanding behavior means understanding that you can detect the threshold at which point people can't take in any more safety materials. Testing to see if people are actually reading is paramount if you are distributing written material, 'spray and pray' is not an effective way of communicating information.

It is very important to send out bulletins that can genuinely affect safety e.g. "stop using the RX420 compactor as it has an inherent fault, please use the RX424 from now on".

One solution may be to have a process that distinguishes between:

- 'Important safety bulletins' and 'Really important safety bulletins'.
- 'Notices required to be posted by law' and 'Notices we would like you to actually read'.

1.12 Subcontractors and suppliers

A quality safety strategy means that subcontractors and suppliers must be chosen on actual safety performance record. They should not be chosen by procurement simply on the basis of lowest cost with a placatory self assessment safety declaration. It is not difficult to set up supply chain agreements and also not difficult to make them contingent on safe performance. It is also advisable to make suppliers and subcontractors take part in the B-BS process, because they are an extension of the main contractor, who is an extension of the client (from a safety perspective). Safety as a value transcends all involved in projects and business. A full understanding of B-BS across all parties will ensure safety performance improvements are sustainable.

1.13 New worker arrives on site

At present any new worker to a construction site will hear the top-level safety message at induction. He will then walk out onto site and be able to observe whether the site culture indicated at induction is real. He will look around, and if he sees inconsistency, he will feel a little insecure about what to do. He will certainly not want to get in trouble with, or be tested by either the foreman or his work colleagues. Peer pressure and supervisor pressure will prevail; he will want to 'fit in'.

The example above is the key moment of the behavioral process: Do we mean what we say?

If the picture painted at induction was true and safety behaviors are of top priority to everyone involved, then the chances of this worker behaving safely after entering on the site is high.

If the picture painted was false, then the chances he will do so are greatly reduced.

1.14 Leadership behaviors

Most people can relate to worker behaviors quite easily. The worker is or isn't behaving in a safe manner, which we can all observe and agree upon.

On the other hand, it's more difficult to deal with the safe or unsafe behavior of leaders or everyone else involved in the project. This list has been put together to help people decide what to observe in themselves and others which may help them be pinpointed, allow for feedback and ultimately help improve behavior.

Communication

Always ask "Can you show me how this will impact on safety".

Be calm. Well run companies run on confidence; don't do anything which gives the impression of panic.

Coaching not emailing. Coaching is the most effective way of engaging people in the business. E mail is the least effective way of engaging people in the business.

Be a role model in your communication and actions. Leaders need to be reliable, reply to e mails, phone calls, turn up on time, complete actions, finish on time, this will engender trust, others will see this and copy it. Leaders are role-models, yes, you are a role model.

Planning

Plan well and hire competent people. High levels of safety performance come from well planned jobs which are competently staffed, it is the leaders' job to create an environment where good planning occurs and where good people are hired and developed.

Ensure competent foremen are hired. The route to improved safety on sites is concentrated at the foreman level, competent foremen are the key, and leaders need to create environments which hire and train competent foremen. Foreman should understand behavior change, pinpointing and feedback.

Plan frequent safety audits. Traditional audits measure results on sites at the time of audit, re-evaluating auditing behaviors will lead to more useful measures which can in turn effect safety improvements.

Put dead time in your diary. Making yourself too busy is destructive, it gives the impression you are not in control. It's very important to put dead time in your diary which will be taken up by the inevitable urgent demands on your time, measure how much dead time needs to be there.

Performance Measurement

Regularly evaluate staff performance. Leaders should check that their staff are competent, using objective measures. The best way is to solicit feedback from teams and clients.

Determine what controls the current safety performance. Leaders should learn what natural reinforcers exist in their company environment, it may be depressing but a better view of the reality of the company will inevitably lead to better business (and safety) decisions.

Set goals. Leaders should help safety professionals find a useful positive role in the business, setting improvement goals for them will change their direction. Safety advisors must feel they are part of the decision making team.

Provide public feedback. Leaders should solicit feedback and publish measurements on their own critical behaviors. They need to demonstrate that they are serious about this and also experience for themselves what they are asking others to do.

Safety advisors should help leaders with surveys, climate surveys, RF surveys, paper surveys, web based surveys, digital pen surveys.

Safety advisors should be analysing the data from surveys and making compelling cases for what the data show.

Provide specific reinforcement. Leaders should make their R+ contingent on something they observed, make it specific and it will be very powerful. Platitudes do nothing but irritate the troops.

Focusing on Safety

Create an environment that supports safety.

Bid managers and some other senior managers will be under so much pressure to win jobs where safety will suffer, leaders must set up the environment where this is minimised.

Lump sum jobs should have the same monetary value on safety as cost reimbursable ones, leaders can ask if this is the case and ask for evidence.

Don't give up on safety. Safety issues need to be challenged, always, do not allow people to use the law as an excuse for a complicated process, they simply didn't make enough time to write a simple process.

Trust your employees. Self-auditing is possible, with imagination we can use more of this, leaders should make this point, it says, "I trust you".

Set up an environment supportive of B-BS. Leaders should control the threat of something new (B-BS) in the environment, or people's energy will be on killing it. Align reinforcement for this new initiative and the behaviors that support it.

Be consistent. Leaders should have a consistent approach. Being behaviorally sound about one particular issue, then reverting to type over others will just confuse people and erode trust.

1.14 Summary

- Local workplace environment drives behavior.
- Management creates this environment for workers.
- Leadership creates the environment for the Management.
- B-BS will help us solve how to make the improvements required in all these different environments.

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D. Nielsen

Behavior-Based Safety in Health Care Environments

La Behavior- Based Safety in ambito medico-sanitario

Quality Safety Edge

ABSTRACT. Behavior-based safety approaches to improvements in health care settings will be identified. Major areas for improvement and general strategies will be introduced. A specific hospital safety intervention and results will be presented.
The intervention targeted overextension injuries during patient transfers in a hospital setting. The participants were eight nursing staff in a small rural hospital in the US. The phases of the intervention were baseline, information, video scoring, graphic feedback, and withdrawal. Five participants demonstrated overall improvement during the intervention. Some maintenance of improved performance occurred during the withdrawal phase.

Key words: *safety, Behavior-Based, healthcare, employee safety.*

RIASSUNTO. L'articolo presenta l'applicazione della Behavior-Based Safety per il miglioramento dei comportamenti di sicurezza nell'ambitosanitario-ospedaliero descrivendo le strategie generali d'intervento e le principali aree di miglioramento.
Viene presentato un caso che ha come oggetto di studio gli infortuni da iperestensione derivanti dallo spostamento manuale dei pazienti negli ospedali. Lo studio è stato realizzato su otto soggetti, componenti uno staff infermieristico di un piccolo ospedale rurale degli Stati Uniti. Le fasi dell'intervento sono state: la misura dello stato attuale, l'informazione, l'utilizzo di punteggi e di feedback grafici, la sospensione degli interventi. Cinque partecipanti hanno dimostrato un complessivo miglioramento durante l'intervento. Si è osservato un certo mantenimento del miglioramento nella performance anche durante la fase di sospensione.

Parole chiave: sicurezza, comportamento, sanitario, ospedaliero, Behavior-Based Safety.

Healthcare workers are exposed to a wide variety of safety hazards in a complex settings. In the US, the leading causes of injuries are overextension, falls, contact with sharp objects, exposure to harmful solutions, and environmental hazards. According to the United States Bureau of Labor Statistics, the annual rate among US workers is 7.7 per 100 full time workers (1).

Healthcare accident and injury reduction programs have ranged from general to sometimes specific in their approaches. Safety training is often a "show and go" approach. That is, a desired safe behavior is provided by example but there is no demonstration of mastery by the employees. There is often not even a check to determine if there is an understanding of the desired behavior by the employee.

Many healthcare companies do not use effective, behavioral safety training. An example of effective training is a three phase performance-based instruction developed by Brethower and Smalley (2). The three phases of this type of instruction are guided observation, guided practice, and demonstration of mastery.

Behavioral safety is an approach that applies the principles of organizational behavior management (OBM) to achieve improvements in safe behaviors in the workplace. According to survey articles by Geller and by Sulzer-Azaroff and Austin, the typical behavioral intervention includes identifying safe behaviors, developing behavior checklists, implementing measurement systems, and goal setting, feedback, and reinforcement (3, 4).

Behavioral approaches to safety improvement have been used in a wide variety of applications but there have been few studies in healthcare settings. Behavior-based safety opportunities in healthcare settings were identified by Nielsen and Austin (5). Recently there have been a few behavior-based studies in healthcare settings, including in a hospital operating room (6) and in a rural hospital (7).

There are many potential areas for behavior-based improvements in healthcare settings. Safety practitioners should probably focus on the most common areas of injury identified earlier.

An intervention to address a specific type of injury will be presented first. Then, general guidelines to address other areas of healthcare employee injuries are suggested.

The intervention presented targeted overextension injuries during patient transfers in a hospital setting. Specifically, it was designed to prevent injuries in hospital nursing staff. The participants were eight nursing staff in a small

rural hospital in the US, randomly assigned to two groups (A and B). All participants in the intervention were female and ranged in age from 20 to 49. The phases of the intervention were baseline, information, video scoring, graphic feedback, and withdrawal.

During the baseline phase, participants completed patient transfers in their usual manner. Participants from group A completed wheelchair to standing patient transfers. Participants from group B completed standing to wheelchair transfers. During the information phase, a checklist of the appropriate components of the patient transfers was reviewed individually at the beginning of each shift and patient transfers were recorded at the beginning of shifts. The checklist and the appropriate components were developed in conjunction with the hospital physical therapy staff. The participants individually reviewed and scored one recording showing a model completing one patient transfer type (guided observation). Participants were then recorded completing a patient transfer at the beginning of each shift.

A graphic feedback phase was introduced for one participant from each of the two groups after the video scoring phase had not been effective for these participants. During this phase, the investigator met individually with the two participants to review a performance graph showing the percentage of lift components performed safely from the previous shift. Components not correctly completed were then identified (guided practice).

The independent variables for this study were an information phase for each participant followed by a video scoring phase, with a feedback phase for two of the participants. The dependent variable was the percentage of safe lifting components, defined as the number of safe components divided by the total number of components for the lift. Each patient transfer varied in the number of components, ranging from 17 to 24.

The results of the intervention were some improvement for five of the participants. Two participants from group A and three participants from group B demonstrated overall improvement. The information phase alone appeared to not sustain safe behavior. Some maintenance of improved performance occurred during the withdrawal phase.

The results suggest that information, video scoring, and feedback on patient lifting may increase safe lifts. This may result in a lower risk of back injury. The reduced risk would be a benefit of health care workers, the healthcare facilities that employ them, and to the patients themselves.

There were several strengths associated with this intervention. This intervention was cost effective. It used a multiple baseline across participants design. The intervention was socially valid in that safer behaviors for nursing staff were identified and improved. This intervention was also a novel approach for the nursing staff.

In this intervention, nursing staff were trained in only one type of lift and future studies could attempt to train more than one type of lift. Future studies might also have one group of nurses lift the same patients over several sessions and compare the results with another group who lift different patients for each session. This could reduce one of the variables that may be responsible for variability in lifting behaviors among some of the nursing staff.

The case study presented specifically targeted overextension injuries in a healthcare setting. The other leading causes of injuries among healthcare workers, falls, contact with sharp objects, exposure to harmful solutions, and environmental hazards, could be addressed in a manner similar to the intervention described here.

The principles of behavioral safety could be applied to each of the areas of potential injury in healthcare settings. An assessment of specific work area conditions within a healthcare facility could be completed and a review of recent injury data conducted. A checklist of safe environmental conditions and behaviors would be created based on identified safe behaviors and data from injury reports. Exact behaviors that produce the greatest results would be identified and included on behavior checklists.

Using the behavior checklists, observations would be completed of the healthcare workers as they complete their assigned tasks. Frequent feedback would be provided to the workers based on the observations, identifying safe behaviors and suggestions for safe behaviors where they are unsafe. Data from the checklists would be collected and used to drive the process and to develop safety action plans. Within each work group, observation data could be posted and individual and group recognition planned.

Successful behavior-based safety interventions can be effectively developed and maintained using an employee steering committee. Employees interested in serving on such a committee would be chosen and would serve for a specific time period. Eventually, other employees are rotated through the steering committee. A steering committee could develop and manage checklists, manage the observation and feedback process, and present safety data to all employees. Committee members would model, encourage, and reinforce safe work behaviors. The steering committee would also set safety goals, develop safety action plans specific to their areas, and plan celebrations. When using a steering committee to drive a behavioral safety process, it is essential that committee members receive specific training and ongoing support for each of these critical areas.

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D. Nielsen

Behavioral Self-Monitoring for Safe Driving

B-BS per la riduzione degli incidenti in itinere e su mezzi di trasporto: tecniche e risultati

Quality Safety Edge

ABSTRACT. Self-monitoring is an approach to change behavior by manipulating antecedents, observing and recording target behaviors, and receiving feedback and consequences. In the present paper the basic procedures of self-monitoring and safe driving are identified. Self-monitoring checklist development is presented and a case study using antecedents to signal behavior is discussed. The purpose of this study was to determine if a prompt can increase the use of turn signals of drivers. The study incorporated three phases, a baseline phase, an intervention phase, and a return to baseline phase (ABA). The effectiveness of the intervention, a prompt to use turn signals, appeared to be an effective in increasing turn signal usage among motorists, from 33.5 percent (phase A) to 70.3 percent (phase B).

Key words: *self-monitoring, safety, Behavior-Based, driving.*

RIASSUNTO. L'auto-osservazione è un approccio finalizzato a modificare i comportamenti attraverso la manipolazione degli antecedenti, l'osservazione, la registrazione dei comportamenti desiderati e l'erogazione di feedback e conseguenze. L'articolo chiarisce le procedure base per l'auto-osservazione e per la guida sicura. Viene presentato lo sviluppo delle checklist di auto-osservazione ed illustrato un caso di studio in cui si utilizzano antecedenti per segnalare il comportamento sicuro da adottare. In particolare, lo scopo dello studio è stato quello di presentare un segnale ai guidatori, al fine di aumentare l'utilizzo degli indicatori di direzione in fase di sorpasso. Lo studio è stato suddiviso in tre fasi, misura iniziale, fase di intervento e ritorno allo stato iniziale (ABA). L'intervento, vale a dire l'utilizzo del segnale che ricordava di usare gli indicatori di direzione, ha dimostrato di essere efficace nell'aumentare il comportamento sicuro dal 33.5 percento (nella fase A) al 70.3 percento (nella fase B).

Parole chiave: auto-monitoraggio, sicurezza, comportamento, Behavior-Based Safety, guida.

Safe driving requires a number of simultaneous and often complex behaviors. The trend in accidents and injuries in many countries is increasing. Speeding and distractions are two of the many factors involved in accidents and injury.

Self-monitoring basics for drivers is presented in this report. Then, a case study using antecedents to signal safe behavior among drivers is discussed.

Self-monitoring for drivers is an approach to change their behavior by manipulating antecedents, observing and recording target behaviors, and receiving feedback and consequences. There are basic elements to a self-monitoring approach. Drivers must have an understanding of the process and driver representatives need to be involved in the development of the process. Target behaviors are identified and a method for recording behaviors is developed. Once a baseline is established, attainable goals are identified along with behavior change strategies. As the process moves along, data is shared with employees.

There are some key features necessary to the development of a self-monitoring process for drivers. This process is valuable for promoting safety among these often isolated employees. It is essential to have upfront involvement of workers throughout the process.

Self-observation processes are different from peer observation processes in a few key ways. For example, safety checklists are typically much shorter than peer observation checklists.

Observations are usually prompted by a supervisor or other employee by contacting the driver by cell phone, radio, pager, or other signalling devise. The driver then completes the checklist at the next stop. Effort is made to randomize the time and day of the signal to complete an observation.

Research related to self-observation for drivers is somewhat limited. Olson and Austin used self-monitoring and feedback to increase safe driving by bus drivers (1). Improvements for drivers ranged from 2% to 42% over baseline.

In another study, Hickman and Geller used self-monitoring and computer recordings of data to improve driver's behavior (2). Speeding was reduced by 19% and extreme braking was reduced by 49%.

There are several things to consider when developing checklists for self-observations. It is important to identify safe behaviors to monitor and what practices would pre-

vent incidents. The format that will be easiest to use needs to be identified. Different checklists for different situations may need to be developed.

A self-observation checklist for drivers might include items such as:

- Vehicle maintenance and condition
- Dash/floor clear of clutter
- Seat belts used
- Maneuvering clearances

Each of these checklist items would include specific definitions.

Process specifics need to be identified. For example there needs to be a determination of how often and when observers will conduct observations. Who will supply checklists, where will the checklists be stored, and where to deposit the completed checklists needs to be identified.

Once completed observation checklists begin to be collected, the data concerning the frequency of safe behaviors needs to be posted for the employees. The data will be used to determine goals for improvement and to provide an ongoing refinement of the safety process. Data will also be used to determine group and individual recognition.

There are several key features for this and other behavior based safety processes that may be essential for success. For example, many safety processes ensure that the identity of the employee being observed is protected. It is also important that the process have a positive focus and provide immediate feedback to the employee being observed. With self-observation processes, the employee can receive their own feedback based on their observation. Supervisors can also use the completed observation form to provide feedback to the employee. Of course, keeping the process short and simple is helpful to increase the likelihood that employees will stay involved in the process. Many safety programs make the process voluntary and do not tie discipline into the observation process.

Using a steering committee to drive this process is preferred. A steering committee could manage the process in several ways. They could be responsible for developing and revising observation checklists, presenting safety data to employees, setting goals, and planning safety celebrations. Steering committee members could also model, encourage, and reinforce safe work behaviors. Training for steering committee members in each of these areas is essential.

A different approach to positively influence safe driving behaviors is now presented. Fifty seven percent of drivers don't use their turn signals, perhaps as a result of ineffective contingencies that promote turn signal use (3). The use of turn signals is probably maintained by one or more contingencies related to safe behavior.

The purpose of this study was to determine if a prompt can increase the use of turn signals of drivers. The dependent variable was a driver's pass and use of a turn signal after passing my car on the left and pulling back into my lane, at the driver's first opportunity to change lanes. A pass was recorded if the passing vehicle changed lanes, within 30 seconds of passing me.

The independent variable for this study, a magnetic sign which said, "Please use turn signals." Data was collected on passenger cars, motorcycles, pickup trucks, and vans, excluding commercial vehicles. Data collection occurred only during daylight hours and during different days of the week. All data was collected on Interstate 94 in Michigan, between my hometown and Detroit Metro Airport. The study incorporated three phases, a baseline phase, an intervention phase, and a return to baseline phase (ABA).

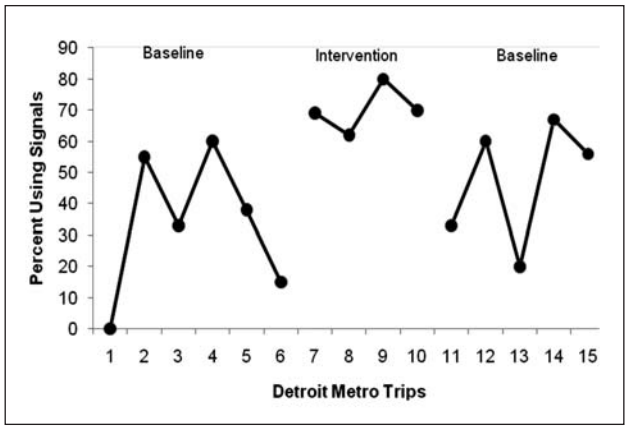

Figure 1. ***The results of the study***

Figure 1 displays the results of the study. During the initial baseline (phase A), the average number of motorists using a turn signal after passing me was 33.5 percent over six trips. During the intervention (phase B), the average number of motorists using a turn signal after the pass was 70.3 percent over 4 trips. During the return to baseline phase, the average number of motorists using a turn signal after the pass was 47.2 percent during 5 trips.

The effectiveness of the intervention, a prompt to use turn signals, appeared to be an effective in increasing turn signal usage among motorists traveling on Interstate 94 in Michigan. There were significantly more drivers who used their turn signals after passing me when I displayed the prompt on the back of my vehicle compared to when the prompt was absent. Antecedents can signal consequences. In the case of this study, it is surmised that the antecedent, the reminder to use turn signals, may have signaled potential consequences. The potential consequences may have included self-talk about safe driving or about avoiding a ticket for failure to use turn signals.

There are certainly a number of limitations with this study. For example, providing goal setting and feedback to motorists would probably be effective strategies in increasing their use of turn signals. Perhaps this is an area for further study.

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The B-BS challenge: Effectively motivating managers at all levels

La sfida della B-BS: motivare i manager a tutti i livelli dell'organizzazione

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ABSTRACT. To ensure safety in the workplace, it is necessary to galvanize all managers to work together in concert. Unfortunately, such alignment is notoriously difficult. A Task Force member analyzing Texaco's lackluster results in reducing discrimination pointed out: "The need was obvious to senior executives but was not apparent among the lower management ranks." But we already know from the Operant Model of Effective Supervision that exemplary leaders motivate by monitoring and providing consequences (1). This information only goes so far, however, when myriad managers are doing myriad, often unseen tasks. So what should a CEO do? Regretfully, I do not have a quick fix. But for a similarly daunting area, I created a performance matrix, reflecting the weighting and progress toward a variety of managerial tasks that a CEO can use as a basis for reinforcement (2). I recommend developing a comparable index to build a community of reinforcement for safety.

Key words: *managers, motivation, safety in the workplace.*

RIASSUNTO. Garantire la sicurezza nei luoghi di lavoro è compito primario dei manager, che devono operare congiuntamente per raggiungere questo risultato. L'esperienza più volte ha testimoniato come ottenere questo lavoro di squadra sia difficile soprattutto quando la stessa esigenza non è condivisa da tutti.
La Behavior Analysis sottolinea che la motivazione è frutto del numero e della qualità delle conseguenze che seguono le nostre azioni: come fare allora a monitorare e a "rinforzare" il comportamento dei manager, sempre più spesso coinvolti in una miriade di compiti invisibili?
Per rispondere a questo interrogativo, l'autrice propone l'utilizzo di una matrice di prestazioni che comprende un'ampia varietà di compiti manageriali e che può essere utilizzata come base per elargire rinforzi.

Parole chiave: manager, motivazione, sicurezza nei luoghi di lavoro.

To ensure that safety remains a top priority, the CEO must foster meaningful and sustained support from the bottom to the top of the organization. As Terry McSween (3) points out: "The active and visible support of management and supervision is critical to the long-term success of a behavioral safety process" (p. 155). The problem, however, is how to build and keep the motivation of managers confronted with a myriad of often invisible, sometimes conflicting tasks.

Two Cases Illustrate The Formidable Hurdles That Must Be Overcome To Ensure Substantial and Lasting Changes Throughout the Organization

To establish any system-wide change, it is important that executives, managers, and supervisors work in concert together. Such alignment, however, is notoriously difficult. To illustrate the intimidating challenges that organizations face, as reported in (2), I describe the cases of Texaco and Coca-Cola as they aimed over five years, as part of a settlement agreement overseen by Task Forces, to prevent discrimination throughout their organizations.

Texaco's CEO Peter Bijur committed to "specific, effective policies that will ensure that discrimination is wiped out." Of particular interest was the fair appraisal of performance particularly given the complaints of bias about the Performance Management Process. In response, Texaco zeroed in on improving the PMP with both employees and managers attending specially designed workshops and learning how to fill out new forms. A close examination of five annual reports, however, showed few meaningful improvements to the appraisal system. Employees voiced on a survey their dissatisfaction with the fairness of their evaluations. In Year 1, employees rated the new PMP as "more fair and objective" (5.0 out of 9) in contrast with the old PM (3.6 out of 9). The Company saw the change as a "significant improvement in satisfaction," but still viewed it as "low." The explanation offered was that employees filled out surveys after most of the workshops took place but before employees had an opportunity to fill out the new PMP form. Two years later, employees were asked whether "the employee evaluation process sup-

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ports a fair and unbiased environment." Alas, only 37% agreed. "A lot of work," concluded the Task Force, "must be done before employees judge the PMP to be 'fair and unbiased'." That unfortunately was the last reported survey. By the end of the fifth and final year and despite well-meaning efforts to change their evaluation (and promotion) practices, the desired results were lackluster. What happened? Luis Nogales, who served on the Texaco Task Force overseeing changes mandated by the court settlement, pointed to a failure common to many change efforts: "The need was obvious to senior executives but was not apparent among the lower management ranks. The issue had not been high enough on (these) managers' radar screens" (4). Why? In his words, "competing demands, superseding priorities ....diversity (is)... number five on the public list (but) number ten on the practice list." Texaco offered incentives, but limited them to senior managers. Hence, it was probably not unreasonable that the CEO's call to action was not as warmly embraced at the lower ranks and the results tepid.

Coca-Cola benefited from Texaco's experience. Coca-Cola too had problems with its appraisal system. Like Texaco, it developed a single evaluation system and provided training for managers and employees. In contrast, however, the Coca-Cola Company did not assume that the systems would work as designed. Instead, they monitored three different ways: during process audits, adverse impact analyses, and rater calibration sessions. Although inconsistencies were uncovered (and then rectified), the evaluation process was found, with some exceptions, to be implemented as designed (e.g., managers did not always comment on strengths and developmental opportunities but both managers and employees did provide ratings, which were not significantly different from one another). Furthermore, the Company included on managerial evaluations the quality of their supervisors' appraisals. Not until the fifth and final year were there demonstrable indications of progress. Even then reactions to the evaluations varied. Employees showed "a substantial increase in their perceptions of the fairness" of their appraisals. Among the very lowest responses on the survey, however, were those related to advancement being based on who you know. "This perception of favoritism remains as an issue for the Company across all employee groups." Unlike Texaco, substantial gains were made in diversifying the senior leadership for both female and minority officers. Strikingly, these numerical gains were accompanied by employees' reacting positively to the climate for diversity. Senior management was singled out for their commitment to diversity and workplace equity. And, in contrast to Years 1 through 4 when employees' views had changed little if any, these more favorable views were shared by whites, Hispanics, Asian Americans, and African Americans. Because of the multifaceted changes, touching on virtually every aspect of personnel practices, it is difficult to say exactly what made the difference. The Task Force, however, heralded their "mission a success."

Operant Conditioning Theory As The Basis for Identifying What Effective Leaders Should Do When Motivating Others

What if anything do we know about effective leaders galvanizing those around them? An answer is provided by the Operant Model of Effective Supervision (1). Unlike other leadership models, which emphasized traits (e.g., charismatic/ transformational leadership) or were empirically derived (e.g., Ohio State studies), the operant model had a conceptual foundation, inspired by the theory of operant conditioning (5).

The major tenet of the theory is that behavior is shaped and maintained by its consequences. What occurs *after* rather than before the behavior of interest is the focus. First-rate managers were predicted to provide *consequences* such as compliments for a job well done, an acknowledgement of the receipt of the work, feedback on the quality of the task done, a graph showing performance plotted over time, as well as the avoidance of such distasteful events as unwarranted criticism, punching in on a time clock, or the processing of complaints or grievances.

Because consequences need to be related to what employees actually have done, I conjectured that effective supervisors would frequently *monitor* or inquire about performance, particularly by directly sampling the work. The original rationale was a logical one: managers who monitor are more likely to have dependable and up-to-date information with which to provide contingent consequences. Later, it was found that managers who monitored were more likely than those who provided directives to have subordinates who discussed their performance, which in turn increased the likelihood of back-and-forth exchanges between the two (6). Hence, the model emphasizes the two behaviors of monitoring and providing consequences.

Empirical support for the model has been established in seven criterion-related validity studies with diverse samples - insurance and newspaper managers, sailboat skippers, bank managers, government agency supervisors, construction site managers, and police sergeants - across different nationalities - American, Finnish, and Australian (1, 7). Criteria ranging from ratings of effectiveness in motivating others to outcome measures (e.g., time to complete task, race finish) were significantly related to the time leaders spent monitoring or providing consequences, or both.

Recommendations for Effectively Motivating Managers throughout the Organization on Myriad, Often Conflicting Tasks

Knowing that exemplary leaders go beyond giving directives to monitor and provide consequences is helpful but only up to a point. CEOs do not have the luxury of dealing with only a few managers on a few tasks. Instead, as the Texaco and Coca-Cola cases attest, they must of necessity contend with multiple managers juggling an awesome array of tasks some of which cannot be seen and clash with one another. So how does a CEO realistically monitor and provide consequences under these conditions? Alas, I do not have a quick fix. But I can offer a performance matrix (Table I), reflecting

Table I. *Performance Appraisal and Award System Promoting Justice for CEO of Coca-Cola*[1]

Name *E. Neville Isdell* Period *4th quarter* Date *12/30/07*

	Baseline					*Goal*	*Goal overachievement*				
		Points									
Pinpoints	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*Weights*	*Pts*[29]
A. Steps enabling evenhandedness											
1. Revise performance appraisal (PA) for each job until pass IRA test: # of PA systems	.05	1	2	3	(4)	5	6	7	8	5	*45*
2. Ensure supervisors pass IRA test during training: % supervisors passed	.05	5	10	15	20	25	30	35	(40)	5	*65*
3. Ensure at least 2 IRA tests conducted per supervisor during formal appraisal: mean # tests per supervisor	.05	.75	1	(1.5)	1.75	2	2.1	2.2	2.3	5	*40*
4. Promote 2-way dialogue: % trained	.05	15	30	45	60	75	80	85	(90)	5	*65*
B. Monitor evenhandedness											
1. By surveying employees about reactions to PA: % employees rating B or above	37	38	39	(40)	41	42	43	44	45	10	*80*
2. By tracking IRA tests during formal appraisals: mean % score	40	45	50	55	60	65	70	(75)	80	10	*120*

	Baseline					*Goal*	*Goal overachievement*				
		Points									
Pinpoints	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*Weights*	*Pts*[29]
C. Steps enabling minorities/women at elite levels											
1. Identify "high potentials" and mentors in Division X	by 12/30		by 12/1			by 11/1	by 10/15	(by 10/1)		1	*12*
2. Make challenging assignments or provide specialised training or other in Division Y: %	20	22	24	26	28	30	35	(40)	45	2	*24*
3. Have mentor discuss action plan or take to meeting out of area of expertise in Division Z: % promotable persons	35	36	38	40	45	50	60	70	(80)	2	*26*
4. Promotions/retention of women & minorities at mid-level: % increase	–5%		.5%			(1%)	2%	3%	4%	15	*150*
D. Monitor at elite levels[30]*:*											
% minorities	21.0	21.2	21.4	21.6	(21.8)	22.0	22.2	22.4	22.6	5	*45*
% women	27.0	27.2	27.4	27.6	27.8	28.0	28.2	28.4	(28.6)	5	*65*
E. Rearrange consequences											
1. Feedback: # per quarter	.10	.15	.25	.5	.75	(1)	1.5	2.0	2.5	5	*50*
2. Incentives for enabling & outcomes	No enabling	10%	25%	33%	50%	67%	75%	90%	(All enabling)	5	*65*
3. Bonus in proportion to goal attainment; forfeiture for < half goals met: % done	55	60	70	80	(90)	100		Extra Compen.		5	*45*
4. Retrain those failing during training or appraisal & screen out those failing three or more times: lowest %	.05		(15)		20	25	30	35	90	10	*70*
5. Promotion for exceeding justice goals: # managers	1			(2)		3	4	5	6	5	*40*
									Total	100	*1007*

the complexities and weighting of myriad managerial tasks that can be used as a basis for rewards. The matrix - originally published in (2) - was created as a model for the CEO of Coca-Cola for a similarly daunting area, that of preventing discrimination.

Following the format of Aubrey Daniels's (8) performance matrix, it includes a variety of pinpoints or "actionable strategies." In Table I, the pinpoints consist of the evenhandedness of evaluation (pinpoints A, B) and the representation of minorities/women at elite levels (pinpoints C, D). Because of the importance of the outcomes as well as those actions enabling the outcomes, both are included. An enabling action - ensuring the test of interrater reliability agreement (IRA) is passed (pinpoint A1, A2) or conducted (A3) - and an outcome - the rating of employees about their appraisals with a letter grade B or above (pinpoint B1) are listed in Table I. In line with the Operant Model of Effective Supervision, monitors are included (pinpoints B, D), as well as a variety of consequences: feedback (pinpoint E1), compensation (E2), bonuses (E3), negative sanctions for those who repeatedly fail interrater reliability agreement tests (E4), as well as

[1] Originally published as Table 5 in Komaki, J. Daring to dream: Promoting social and economic justice at work. *Appl Psycho Int Rev* 2007; 56: 624-662. Reprinted with permission.

promotion for those who substantially exceed goals (E5).

Furthermore, one can identify how close managers come to meeting or even overachieving their goals. Point values range from 5 to 13 in Table I (in columns 2 to 10): for baseline, 5 points; for meeting the goal, 10 points; for overachieving the goal, 11 to 13 points. For example, in the first pinpoint, 8 points are given when the human resources department revises two systems.

To reflect the importance of each pinpoint, weights are given. In Table I, the first three pinpoints (in column 11) are each weighted 5%, the survey 10%, and the IRA scores 15%. Together, the weights total 100%. If and when priorities change, the weights can be modified.

The score is calculated by multiplying the points earned for each pinpoint times its weight (e.g., 8 x 5 = 40) and then adding the points together (e.g., 1007). A score of 1000 means that, on average, the CEO achieved the goal on every pinpoint. Hence, the total score reflects how the CEO did on all the pinpoints. The CEO would set up similar evaluations for Vice Presidents, who would, in turn, set up evaluations for division heads, and so on. With such an index, the CEO and all direct reports can see *at a glance* whether relevant information is being monitored and consequences provided as designed.

To reduce on-the-job injuries, I recommend developing a comparable safety index. To facilitate the making of safety observations, for example, one could pinpoint an outcome, the number of safety observations made per month per department, whereas an enabling action might be the rate of observer feedback per observation by the safety committee. Point values for the number of observations per month could range from .5 to 6: for baseline, .5; for meeting the goal, 2; for overachieving the goal, 3 to 6. Weights could vary so that the number of observations is weighted 5%, whereas the rate of feedback is 10%. Depending on how well managers do, one can change the point values. For example, if the number of observations falls below a certain level, its weight can be increased to reflect its increasing importance.

In grappling with how to help an organization make momentous changes up and down its ranks, I have been struck with how hard it is to capture the enthusiasm of all the key players. Most change agents lavish their attention on on-line employees. Behavior analysts are no exception. Rarely do we develop sensitive and accurate measures and provide frequent, contingent, and positive consequences for those in charge. While it is important to ensure that employees are reinforced, just as critical are those lower and middle-level managers who often toil in obscurity. If acknowledgment could be cascaded from the CEO to vice presidents, division heads, committee heads, managers, and supervisors and eventually to employees, then we could build a true community of reinforcement. While the recommended performance matrix has yet to be enacted, it holds promise of motivating managers at all levels and hence dramatically improving safety throughout the organization.

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