

## **Coping with error in the workplace**

***Kerry Huish<sup>1</sup>, Arthur Poropat***  
Department of Management  
Griffith University  
Australia

### **Abstract**

In the last decade there has been an increasing focus on how individuals cope with errors, distinguishing between a proactive problem-focussed orientation and a more reactive emotional response. This paper reviews the research into error orientation, particularly that associated with the work of Rybowskiak, Garst, Frese, & Batinic (1999) and subsequent usage of the Error Orientation Questionnaire (EOQ). While there is some consistency in results using the EOQ scales, there are several discrepancies and the paper concludes that additional research is required, particularly in relation to the factor structure of error orientation and the relationship between error orientation and goal orientation.

*Keywords: Error Orientation; Coping Strategies; EOQ; Individual Differences; Goal Orientation.*

### **Introduction**

From the plays of Shakespeare and the philosophical writing of John Locke to modern poets and novelists, human error has been a focus of interest within the humanities for centuries. Interest in the subject appeared early in the development of psychological science, included within the writings of William James (1890) and Sigmund Freud's 1916 lecture series (1973). During the mid 20<sup>th</sup> century, the focus was that errors should be prevented in order to avoid the formation of bad habits, a premise closely associated with the behaviourist school (Skinner, 1968). Since then much of the research into human error has been in the context of hazardous working environments with a continued focus on error prevention, often examining work practices as part of accident investigations.

## **Error Prevention and Error Management**

Human factors (ergonomics) research has concentrated on the causes of error and the prevention of error (Reason, 1990), focussing on people and the systems with which they interact. Such environments have included nuclear power plants, the aviation industry and space programs as well as accident investigations in cases where there have been catastrophic consequences for human life and/or the environment (Broadbent, Baddeley, & Reason, 1989; Perrow, 1984; Reason, 1990). The consequences of such errors, for example the Challenger Shuttle disaster, Chernobyl, Three Mile Island and the Teneriffe airport collision of 1977, can attract considerable attention from the general public as well as those who are directly affected by the events.

In contrast, the errors by staff in an office environment may seem relatively trivial in comparison but, as will be shown below, the repercussions of such error can be substantial at an individual, organisational, national or international level. The recent Australian government inquiries into the detention of Cornelia Rau (Palmer, 2005) and the deportation and repatriation of Vivian Solon (Comrie, 2005) provide examples of errors which have had severe consequences on a range of levels. While there were many complex issues underlying these examples (Kelly, 2006), the media highlighted the errors which involved data ambiguity, data corruption and loss of data (Wilson, 2006). Problems associated with data integrity in the health sector have also been identified as posing serious risks (Roberts, Anthony, Madigan, & Chen, 1997) which clearly have the potential for what Senders and Moray (1991) referred to as *sad consequences*. More generally it has been argued that end user computing is a 'potential source of threat to any organisation with respect to maintaining data integrity and security' (Govindarajulu, 2002 page 100). So while errors in the office may seem mundane in comparison with hazardous working environments, the consequences of such errors can be far from trivial.

Govindarajulu's (2002) concerns regarding end user computing is particularly apposite given the rapidity of changes to and increasing complexity of technological

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<sup>1</sup>Ph 61-0-7-3737 3236; Fax: 61-0-7-3735 3272; k.huish@griffith.edu.au

system. While many office workers would be familiar with operating in a WYSIWYG (*what you see is what you get*) environment, in more complex systems the link between input and output is less obvious (Brehmer, 1987; Landauer, 1995). An additional problem is that the introduction of new systems has traditionally been focussed on timely implementation of the project, such that 'people are rewarded for getting a new system in 'on time'- they can 'get it right' later' (Clegg et al., 1997 page 856). This approach significantly increases the risk of what Reason (1990) called latent errors, mistakes which lay dormant in the system for extended periods of time, until a particular sequence of events creates a unavoidable error. In the context of rapid and widespread technological change and associated increased risk of error (both latent and those active errors of the end user), research into how individuals cope with error gains an equal significance to that of error prevention.

In relation to the reduced organisational effectiveness resulting from latent errors (Clegg et al., 1997), consequent compounding of adverse consequences caused by long delays before detection (Winfield, 1986) means that up to 10% of working time can be spent in the pursuit of error detection and correction (Zapf, Brodbeck, Frese, Peters, & Prumper, 1992). Other consequences of error are frustration and stress experienced by workers who make those errors (Kontogiannis, 1998; Zapf et al., 1992), resulting in decline in the quality of working life. It is little wonder that the study of human error continues to be the subject of a considerable amount of research.

Recognition of the ubiquitous nature of errors (Reason, 1990) and the sometimes negative consequences of error prevention (e.g. reduced ability to adapt: Sitkin, 1992) have resulted in the view that while error prevention strategies can be beneficial they cannot be the full answer to the problem of error (Reason, 1997). A complementary approach, known as error management (Frese, 1987), was developed which had its focus on actions to be taken after an error had occurred rather than the actions to be taken to prevent the occurrence of errors. This approach has argued that users should be encouraged to proactively manage errors and to minimise their negative attitudes toward errors, and has been developed into an approach to training using these principles (e.g. Debowski, Wood, & Bandura, 2001; Heimbeck, Frese, Sonnentag, & Keith, 2003; Wood, Kakebeeke, Debowski, & Frese, 2000). While such training is intended to improve error handling by encouraging certain behaviours and attitudes to

error, there is a question of whether there are measurable individual differences in error coping behaviour and attitudes to error. Should such individual differences exist, it raises the further question of whether these differences are associated with variations in the way in which actual errors are handled (Zhao & Olivera, 2006). The construct of error orientation is intended to represent these individual differences.

### **Error Orientation**

The first major study of error orientation focussed on the development of a reliable and valid questionnaire by which to measure the construct (Rybowiak et al., 1999) and addressed both the factor structure and the relationship of error orientation with related constructs. Error orientation emerged from the Rybowiak et al study which operationalised this construct in the form of a questionnaire (the Error Orientation Questionnaire: EOQ) to identify 'how one copes with and how one thinks about errors at work' ( p. 527). The EOQ was designed to identify individual differences in coping with error at the cognitive, affective and behavioural levels and, as such, error orientation is focussed on the effects of error on individuals and subsequent behaviour, rather than on likelihood of making an error or 'error-proneness'. Rybowiak et al proposed an 8-factor model, although concluded that a higher order factor structure was possible. The questionnaire enabled the researchers to distinguish between individuals with respect to whether they are proactive in their approach to errors and view errors as an opportunity to learn or whether they become distressed and frustrated with the mistakes they make, tending to hide or ignore errors.

### **Problem- and Emotion-Focussed Coping Strategies**

The EOQ was developed in the context of the general coping concept (Lazarus & Folkman, 1984) with the perception and anticipation of errors being the primary appraisal (by which an individual perceives threats) and the handling of errors being the secondary appraisal (by which an individual determines a response to the perceived threat). The problem / emotion dichotomy found in Lazarus and Folkman's work is also apparent in the factors which reflect the error orientation construct and the eight factors identified by Rybowiak et al (1999) can be delineated into problem-focussed and emotion-focussed (see Table 1).

Table 1: Eight factors of error orientation

Problem-focussed scales	Emotion-focussed scales
Error Competence Learning from Errors Error Risk Taking Error Anticipation Communicating about Errors Thinking about Errors	Error Strain Covering Up Errors

Although developed in relation to individual differences, Rybowskiak et al (1999) argued that the error orientation could prove to be an important organisational variable and use of the EOQ could support organisational initiatives and be a method to evaluate organisational error culture. Rybowskiak et al proposed that an organisation which was generally fearful of error would be associated with a reduced potential for innovation, as the risks associated with novel ideas would be anathema to its workers.

Subsequent studies examining the factor structure of the EOQ have failed to fully replicate the results of Rybowskiak et al (1999), although most of the studies have used variations of the questionnaire designed to measure organisational error culture (van Dyck, 2000; van Dyck, Frese, Baer, & Sonnentag, 2005) or managerial error orientation (Korsten, Stanz, & Blignaut, 2004) rather than individual error orientation. The earlier van Dyck (2000) study identified a 4-factor structure comprised of Mastery (Competence and Learning), Social (Communication and Helping), Awareness (Risk-Taking and Acceptance) and Aversion (Strain and Prevention) while her later research (van Dyck et al., 2005) used a 2-factor structure of an Error Manage culture (comprising items from the problem-focussed scales) and an Error Averse culture (comprising items from the emotion-focussed scales). In a study using the individual EOQ Harteis Bauer and Gruber (submitted for publication) identified a three factor structure, consisting of Appraisal of Mistakes (Learning and Risk Taking), Strategies to Learn from Mistakes (Thinking and Communicating) and Negative Emotions regarding Mistakes (Covering up and Strain). While there is little consistency in the findings across these four studies, possibly explicable in terms of their differing foci, what is consistent is the presence of at least one problem-focussed

and one emotion-focussed factor in every model, supporting the dichotomy which underpinned the development of the error orientation construct. The preliminary results of an Australian study also support the problem/emotion dichotomy, finding three problem-focussed factors (Learning from Errors, Thinking about Errors and Communicating about Errors) and two emotion-focussed factors (Covering Up Errors and a new Communication factor addressing emotional needs).

A further difficulty with the questionnaire is that Rybowskiak et al (1999) identified low reliability of the Error Competence and Error Communication scales in the English language version of the EOQ, which was in contrast to the German and Dutch versions. In spite of this finding, researchers have used the Error Communication (Hofmann & Mark, 2006; Mark et al., 2007) and Error Competence (Schell & Conte, 2008) in studies conducted in English-speaking countries. In fact, Schell and Conte confirmed the poor reliability of the Error Competence scale in the results of their research undertaken in the USA. Initial results from a study undertaken in Australia, with participants having English as their mother tongue, support the findings of Rybowskiak et al (1999) in that several scales (including Error Competence and Error Communication) have unacceptably low reliability, as measured by Cronbach alpha. This suggests that the continued use of these scales in research involving English language version of the EOQ is questionable.

### **Error Orientation and other psychological constructs**

In addition to developing the initial factor structure for error orientation, Rybowskiak et al (1999) also reported the results of their nomological net analysis, identifying how error orientation 'fits in' with other related but distinct psychological constructs. These relationships identified by Rybowskiak et al and by later researchers suggest that a problem-focussed error orientation is associated with a proactive approach to tasks and to the errors that occur in completing them, while emotion-focussed error orientation factors are associated with a more reactive and defensive response to errors occurring in the workplace. For example, Rybowskiak et al found that Error Competence, Learning from Errors and Error Risk Taking were positively correlated with Self-Efficacy, Self-Esteem, Planning Orientation, Action Orientation after Failure and Readiness for Change. In a study which considered Conservatism and

Error Risk Taking, Fay & Frese (2000) found that this problem-focussed error orientation factor was associated with Innovation, Personal Initiative and Participation while in an investigation into entrepreneurs a significant correlation was identified between Communicating about Error and Meta-cognitive Ability (associated with planning, monitoring and revising performance) (Konig, Steinmetz, Frese, Rauch, & Wang, 2007).

In contrast, the emotion-focussed factors (Error Strain and Covering Up Errors) were associated with Psychomatic Disorders, Depression, Negative Affect and Control Rejection (not wanting to take responsibility) (Rybowiak et al 1999) and negative correlations to all constructs which had been positive for problem-focussed factors. Not surprisingly, the problem-focussed, proactive orientation is considered by many researchers to be preferable to the negative (Rybowiak et al., 1999; van Dyck et al., 2005) and is reflected in the Error Management approach to training, which attempts to encourage exploratory behaviour and reduce negative responses, such as frustration and stress. The objectives of error management training suggest that individual error orientation can be redirected and modified, implying that error orientation is able to be changed rather than being a highly stable trait. In fact, several researchers (Rybowiak et al., 1999; van Dyck et al., 2005) have suggested that the emotional, error averse responses by individuals may be the result of a working environment that is punitive or intolerant of mistakes, rather than an underlying personality trait.

Conceptually similar results have been obtained for goal orientation and the problem / emotion focussed error orientation factors, although the number of studies into error and goal orientation is surprisingly few. The relationship between error and goals is widely accepted, on the basis that errors can only occur in the context of goal-directed behaviour where 'a planned sequence of mental or physical activities fails to achieve its intended outcome' (Reason, 1990 Page 9). As goal orientation influences goal-directed behaviour, then it should have an influence on how blockages to those goals (e.g. errors) are handled and consequently be related to error orientation. Arenas, Tabernero & Briones (2006) found a relationship between Error Communication and a Learning Goal Orientation, but failed to find a significant relationship between Error Strain and Perform Goal Orientation. More recently Schell and Conte (2008) identified a relationship between Error Competence and a Learn Goal Orientation and

Error Strain and a Perform Avoid Goal Orientation. However, both of these studies used only a small number of the error orientation factors and there is considerable scope for further investigation into error orientation and its relationship with goal orientation as well as with other constructs associated with work motivation. The initial results of research undertaken on an Australian student sample revealed that a Learn Goal Orientation was positively correlated with problem-focussed error orientation factors but negatively with Covering Up Errors. In contrast, a Performance Avoid Goal Orientation was positively correlated with emotion-focussed error orientation factors (Covering Up Errors and a Communication factor addressing emotional needs) but negatively related to Learning about Errors.

In applied research using the EOQ the settings have predominantly involved nursing environments. In a German study, Bauer and Mulder (2006) used hypothetical but realistic situations where a misjudgement about procedure had occurred and included the error orientation factors of Error Learning, Error Strain and Covering Up Errors. To overcome the difficulties of both direct observation and the use of scenarios, Hofmann and Mark (2006) utilised archival data on errors (including needlestick accidents and back injuries, medication errors and urinary tract infections) to investigate the relationship between error and safety climate. The error orientation factors of Covering Up Errors (reverse worded), Communicating about Errors and Thinking about Errors were incorporated into an overall measure of safety climate. Using a sample of more than 1,000 nurses in the USA Hofmann and Mark found that safety culture was significantly related to errors (as measured by the archival material listed above) as well as a number of satisfaction measures. A subsequent longitudinal study by Mark et al (2007), using the same error orientation factors, supported the finding of a relationship between safety culture and injuries.

In a study across organisational forms, Van Dyck (2005) identified a relationship between an Error Management Culture (comprising Error Competence, Learning Communication, Thinking) and organisational performance. However, the researchers failed to find a relationship between an Averse Error Culture and poor organisational performance. From the results of applied research, there is limited evidence which indicates that problem-focussed coping is associated with positive outcomes, but the consequences of emotion-focussed coping is less clear.

## Conclusion

From this overview of error orientation research it can be seen that there is considerable scope for continued work on a number of levels. Several researchers have investigated the factor structure of error orientation and a number of alternatives have been proposed. The common ground between these alternatives appears to be the problem and emotion dichotomy which underpinned the development of the EOQ. This dichotomy also provides a useful basis on which to interpret the various nomological network analyses and construct validation results, including the relationship between error orientation and goal orientation, although additional work is required in terms of situating error orientation within the larger framework of work motivation theory. Finally, there is a need for far more research in applied settings which incorporates a broad range of error orientation factors.

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