Culture and Information Security Awareness: Examining the Role of Organisational and Security Culture

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Declaration

This report contains no material which has been accepted for the award of any other degree or diploma in any University, and, to the best of my knowledge, this report contains no materials previously published except where due reference is made.

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Abstract

This review provides an initial assessment of the literature on Information Security Awareness (ISA), organisational culture and security culture. The relationship between aspects of organisational culture, security culture and ISA has received theoretical support. However, there is a lack of empirical research examining this relationship; therefore an empirical investigation is warranted. Given the findings of this review, future research should empirically examine the interplay between ISA, organisational culture and security culture.

Keywords: Security Culture, Organisational Culture, ISA, Cyber, Review

Introduction

Human behaviour is largely determined by culture, which affects both social and work interactions (Cronk & Salmon, 2017). Therefore, to understand and influence behaviour, looking at an individual in isolation is problematic. It is important to consider the group, the infrastructure and their interaction (Grant, 2005; Tessem & Skaraas, 2005). This is important for information security, as humans play a significant role in not only creating risks, but also preventing security breaches. In an organisational context, the primary cause of human error is non-compliance, or non-malicious unawareness, rather than malicious intent (Parsons et al., 2014; Pfleeger & Caputo, 2012; Wood & Banks, 1993). To further understand the role humans play in information security within an organisational context, this review will explore the literature on employee Information Security Awareness (ISA), organisational culture and security culture. These constructs have not previously been explored together.

Information security research has traditionally been approached from a computer science perspective, with technical measures being implemented to mitigate risks (Aurigemma & Panko, 2012). While information security and cyber security are often used synonymously in the literature, cyber security is one component of information security (von Solms & van Niekerk, 2013). Therefore, as information security encompasses cyber security, this review will use the term information security, unless referring to specific cyber security statistics. Irrespective, the importance of the human factor in information security is increasingly recognised (e.g., Herath & Rao, 2009; Metalidou et al., 2014; Vroom & von Solms, 2004). It has been well established that technical solutions, alone, cannot safeguard against all information security threats (e.g., Furnell & Clarke, 2012; Furnell et al., 2006; Pfleeger & Caputo, 2012). The role of the human is crucial as humans are often referred to as the first line of defence against information security threats (von Solms & van Niekerk, 2010; Pricewaterhouse Cooper [PwC], 2016, 2018; Schlienger & Teufel, 2003).

It has become increasingly important to not only understand, but to also influence security behaviours. Our increased reliance on technology in work and private lives has contributed to greater information security risks (Crossler et al., 2013; Reid & Niekerk, 2014; Thomson, von Solms & Louw, 2006). These risks often result in security incidents, which are on the rise with more organisations successfully being targeted through cyber-attacks (Telstra Global, 2017). This represents a significant problem, with Chief Executive Officers reporting cyber risks as their greatest overall concern (PwC, 2018). The World Economic Forum has also listed cyber-attacks and major data breaches in the top five social risks of the next decade (The World Economic Forum, 2018). Over a two-year period more than 65% of Australian organisations experienced cyber-crime, with one in ten reporting losses greater than $1 million, and 9% reporting having had the confidentiality, integrity, or availability to sensitive data compromised due to a cyber-attack (PwC, 2018). Further, the Australian Computer Emergency Response Team (ACSC, 2017) found 3% of cyber security incidents involved systems of national interest and critical infrastructure. As technical solutions alone are insufficient, it is important to more thoroughly examine the factors contributing to employee awareness.

Given the influence of culture on human behaviour (Cronk & Salmon, 2017) and the importance of human factors in information security (Metalidou et al., 2014; Parsons et al., 2014; Vroom & von Solms, 2004); this literature review will examine the constructs of ISA, organisational culture and security culture, including the relationships between them. Throughout the following sections, we provide a thorough review of the relevant ISA, organisational and security culture literature.

Information Security Awareness

Understanding Information Security Awareness (ISA) and its contributing factors is essential in mitigating information security risks. ISA refers to the degree to which employees understand the importance of their organisations' information security policies, rules, and guidelines, and the degree to which they behave in accordance with these (Bulgurcu, Cavusoglu & Benbasat, 2010; Kruger & Kearney, 2006; Siponen, 2000).

The human aspects of information security research has focused primarily on understanding human vulnerabilities at the individual level, through exploring the specific characteristics affecting information security behaviours (McCormac et al., 2017a, 2018; Shropshire et al., 2006). This research has shown ISA can, to an extent, be predicted by age, gender, resilience, job stress, education and some personality characteristics. Studies have found higher ISA to be positively associated with age (i.e., ISA scores increasing with age), gender (i.e., females have higher ISA scores than males), and education (i.e., ISA scores increasing with education level). It has also been found that individuals who are more conscientious and agreeable, have a propensity to take fewer risks, possess greater resilience, and also have higher ISA (McCormac et al., 2017a; 2018; Öğütçü, Testik & Chouseinoglou, 2016; Pattinson et al., 2016).

While substantial research has focussed on individual factors predicting ISA, limited empirical research has explored the relationship between ISA and culture, despite academics and industry practitioners recognising the importance (Da Veiga & Eloff, 2010; Schlienger & Teufel, 2003; OECD, 2004, 2015). The literature suggests a security culture should form part of an organisation's culture (Schlienger & Teufel, 2003; von Solms, 2000), as information is best protected when individuals understand, internalise and behave to information security standards (van Niekerk & von Solms, 2005; Sanders, 2016; Thomson, von Solms & Louw, 2006).

Theories & Frameworks

The Knowledge-Attitude-Behaviour (KAB) model is often applied to the ISA context. The model purports that, as an employee's knowledge of security behaviours increases, their attitude improves, resulting in improved information security behaviours (Kruger & Kearney, 2006; Parsons et al., 2014; Siponen, 2000). While this model has been criticised by some researchers, evidence of its validity is well established (Bettinghaus, 1986; Van der Linden, 2012), and its use supported (McGuire, 1969).

Measurement & Methods

Despite the importance of assessing employee ISA, little effort has been put into trying to measure ISA in a holistic manner (Öğütçü, Testik & Chouseinoglou, 2016). Although security breaches and their corresponding consequences are often measured in organisations (e.g. PwC, 2018), the impact of employee ISA is rarely considered. Additionally, specific aspects of ISA have been researched within the literature (e.g. Stanton et al., 2005; Utz, 2009); however overall ISA was not measured. Behavioural models, such as the Theory of Planned Behaviour (Bulgurcu, Cavusoglu & Benbasat, 2010), and the General Deterrence Theory (D'Arcy, Hovav & Galletta, 2009; Fan & Zhang, 2011), have also been applied to understand aspects of ISA. However, this approach is also limited, as an indication of overall ISA was not provided (Karjalainen & Siponen, 2011; Parsons et al., 2017).

More recently, research has focussed on developing a measure of ISA. These measures are at various stages of development and many still require further reliability and validation testing. For example, The Users' Information Security Awareness Questionnaire (UISAQ), measures risk behaviour, level of ISA, beliefs about information security and the quality and security of passwords (Solic, Velki & Galba, 2015; Velki, Solic & Ocevcic, 2014). The Security Behaviour Intentions Scale (SeBIS) (Egelman & Peer, 2015) focusses on adherence to computer security advice, exploring device securement, password generation, and proactive awareness and staying up-to-date. The measure has undergone preliminary reliability and validity testing (Egelman, Harbach & Peer, 2016). Öğütçü, Testik, and Chouseinoglou (2016) developed four scales to measure the security behaviours and awareness of individuals; Risky Behaviour Scale (RBS), Conservative Behaviour Scale (CBS), Exposure to Offence Scale (EOS) and Risk Perception Scale (RPS). The scales found promising results, however, as preliminary testing has only been conducted for several of these measures, further validity and reliability testing with a more generalisable sample is needed.

The Human Aspects of Information Security Questionnaire (HAIS-Q) has the most theoretical support (Parsons et al., 2014, 2017) and builds on the Knowledge-Attitude-Behaviour model (KAB). It proposes that as employee information security knowledge increases, attitude improves, resulting in improved behaviours (Bulgurcu, Cavusoglu & Benbasat , 2010; Kruger & Kearney, 2006; Parsons et al., 2014; Siponen, 2000). It was developed through a review of information security policies and standards, and through consultation with managers and information technology professionals (Parsons et al., 2017). The HAIS-Q measures an individual's ISA based on their knowledge, attitude and behaviour towards information security behaviours. The measure has undergone sufficient reliability and validity testing on diverse populations (Hadlington & Parsons, 2017; McCormac et al., 2016, 2017b; Parsons et al., 2017).

Given the influence of culture on human behaviour (Cronk & Salmon, 2017) and the importance of the human factor in information security (Metalidou et al., 2014; Parsons et al., 2014; Vroom & von Solms, 2004); the following sections will explore culture, by considering both organisational and security culture, and their relationship to ISA.

Organisational Culture

The conceptualisation of organisational culture is highly contested, however, it is colloquially referred to as 'the way things are done around here' (Lundy & Cowling, 1995, pp. 168). The most widely accepted formal definition of organisational culture has been developed by Schein:

> *A pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems.* (Schein, 1992, pp. 12)

Culture is developed based on the culmination of activities, the vision and employee behaviour at the individual, group and organisational level (Hellriegel et al., 1998; Robbins, 2001). It encompasses the norms a group shares about how the world operates; shaping their perceptions, thoughts, feelings and behaviours (Schein, 1986, 1990). The study of culture is important due to its influence on individual and group behaviours, and subsequent relationship to organisational behaviours such as job satisfaction (Fey & Denison, 2003; Schneider & Snyder, 1975; Sempane, Rieger & Roodt, 2002) and job performance (Boyce et al., 2015; Hartnell, Ou & Kinicki, 2011).

The notion of culture has a long history in anthropology and sociology (Alyesson & Berg, 1992; Berthon, Pitt & Ewing, 2001; Cameron & Ettington, 1988). The concept of organisational culture was initially discussed in 1962 (Blau & Scott), however, it was another decade later before the first major analysis of the informal dimension of organisational culture gained attention in mainstream organisational theory literature (Peters, 1978; Pettigrew, 1979).

The terms organisational *culture* and organisational *climate* are often used synonymously in the literature, despite some distinctions (Schneider et al., 2017; Schwartz & Davis, 1981; Wallace, Hunt & Richards, 1999). Organisational culture was initially conceptualised as the collection of fundamental values and belief systems that give meaning to organisations (Geertz, 1973; Mohr, 1982; Schein, 1985), and was almost exclusively measured qualitatively through ethnographic research, including case studies (Rousseau, 1990; Schein, 2004; Schneider, Ehrhart & Macey, 2011). Organisational climate, however, placed greater emphasis on factors closer to the surface of organisational life that are easier to decipher (Guion, 1973; James & Jones, 1974), focussing on the impact organisations have on groups and individuals (Ekvall, 1987; Joyce & Slocum, 1984; Koys & DeCotiis, 1991). It was derived from the Lewin field theory (Drexler, 1977; Lewin, 1951; Lewin, Lippit & White, 1939) and quantitative observation (Barker, 1965; Likert, 1961; O'Driscoll & Evans, 1988). Currently distinctions are primarily in interpretation rather than the phenomenon itself (Denison, 1996; Moran & Volkwein, 1992).

Theories & Frameworks

One of the most cited theories is Edgar Schein’s (1985, 1992, 2004) theory of organisational culture (Buchanan & Huczynski, 2016). Schein conceptualises culture into three hierarchical levels: Artefacts, Espoused Values, and Basic Underlying Assumptions. The Artefacts level consists of overtly apparent, visible, organisational features (e.g., staff uniforms). The Espoused Values level encompasses the elements and guiding principles essential to inform artefacts and govern employee behaviour (e.g., mission statement). Lastly, Basic Underlying Assumptions shape the core of the organisations culture; they are held implicitly and are not readily observable (e.g., how employees perceive others' behaviour). Other prominent researchers also dominate the field of organisational culture, each offering a unique perspective. Table 1 summarises the most notable theories.

Table 1.

Prominent Organisational Culture Theories

Theorist	Theory Title
Cameron, & Quinn *(2011)*	Competing Values Framework
Cooke & Szumal *(1994)*	Organisational Culture
Deal & Kennedy *(1982)*	Deal & Kennedy Culture Types
Denison *(1990, 1996)*	Denison Model Of Organisational Culture (DOCS)
Flamholtz *(2011)*	Organisational Culture Components
Grant *(2012)*	Norms of Reciprocity
Hampden-Turner & Trompenaars *(1997)*	Cultural Dimensions
Handy *(1986)*	Organisational Culture
Harris *(1994)*	In-Organisation Schema
Harrison *(1972, 1975)*	Typologies of Organisational Culture
Hofstede *(1990)*	Cultural Dimensions Theory
Johnson & Scholes *(1997)*	Cultural Web
O'Reilly, Chatman & Caldwell *(1991)*	Organisational Cultural Profile (OCP)
Schein *(1985, 1992, 2004)*	Organisational Culture
Schneider *(1985)*	Schneider Culture Model

These organisational culture theories vary in their complexity, applicability and empirical support. Numerous theories categorise organisational culture based on, for example, competence or productivity, hierarchical structure or a collaboration focus (Cameron & Quinn, 2011; Deal & Kennedy, 1982; Handy, 1986; Harrison, 1972, 1975; Schneider, 1985; Quinn & Rohrbaugh, 1983). While the approach of exploring culture through fixed overarching categories, rather than on a spectrum, allows for ease in comparing groups, it can be limiting when attempting to understand the deeper level of culture and the reasoning behind employee behaviour.

O'Reilly, Chatman, and Caldwell's (1991) approach focusses on person-environment-fit. Johnson's Cultural Web (1997) assesses organisational culture through six domains; while it is useful for cultural change, it is less beneficial in research settings where the aim is to compare organisations. Other organisational culture theories explore a specific aspect of culture, rather than devising an all-encompassing theory (Grant, 2012; Harris, 1994; Hofstede, 1990; Martin & Siehl, 1983; Trompenaars & Hampden-Turner, 1997).

Denison’s (1996) model of organisational culture classifies culture into four sub-facets (traits), with three subscales nested within each; Involvement (Empowerment, Team Orientation, and Capability Development), Consistency (Core Values, Agreement, and Coordination & Integration), Adaptability (Creating Change, Customer Focus, and Learning), and Mission (Strategic Direction, Goals, and Objectives). The four overarching traits and their subscales interact to determine whether the organisation is internal or external facing, and whether the organisation has a preference for stability or flexibility. Additionally, the traits can be applied to predict behavioural outcomes linked to performance, satisfaction, and innovation. Denison’s model and the associated instrument is the most widely used for assessing organisational culture (Kokina & Ostrovska, 2013; Sackmann, 2011; Schneider, Ehrhart, & Macey, 2011).

Recently there has been a shift from conceptualising organisational culture toward quantitatively measuring culture, partially due to the recognition of the importance of culture and its relationship with organisational performance (Boyce et al., 2015; Hartnell, Ou & Kinicki, 2011; Sackmann, 2011). This has meant that industry is placing a greater focus on culture, relying on measurement methods for comparison and improvement.

Measurement & Methods

The ease of application and the systemisation, repeatability, generalisability and comparability of quantitative measures has led to the development of many organisational culture measures in academia and in practice (Ashkanasy, et al., 2000; Ott, 1989; Schein, 2004; Tucker, McCoy & Evans, 1990). As organisational culture measures vary considerably in terms of their theoretical basis, validity and reliability, a degree of caution should be exercised when choosing a measure.

Several organisational culture measures currently exist. Table 2 lists several of the most common ones. The reason for the popularity of these tools is primarily due to their stronger theoretical underpinning, psychometric properties and ease of application. Additionally, it is important to note that uptake of measures is often dependent on whether there is an associated cost, whether raw data can be obtained by the researcher, and the survey duration.

Table 2.

Organisational Culture Measures

Theorist	Measure	Properties
Cameron & Quinn (2011)	Organisational culture Assessment Instrument (OCAI)	Reliability: Cronbach Alpha .70-.90 Confirmatory Factor Analysis: Good model fit
Cooke & Lafferty (1983)	Organisational culture Inventory (OCI)	Reliability: Cronbach Alpha .67-.92
Denison (2006)	Denison Organisational culture Survey (DOCS)	Reliability: Cronbach Alpha .80-.97 Confirmatory Factor Analysis: Good model fit Criterion-related validity: Job satisfaction, .42-.79
O’Reilly, Chatman, Caldwell (1991)	Organisational Cultural Profile (OCP)	Reliability: Cronbach Alpha .85-.96 Exploratory Factor Analysis: 75% of variance

Of these, the DOCS is the most widely used organisational culture measure (Kokina & Ostrovska, 2013; Sackmann, 2011; Schneider, Ehrhart & Macey, 2011), due to its confirmed reliability, validity and demonstrated link to behavioural outcomes (e.g., Gillespie et al., 2008; Kotrba et al., 2012; Yilmaz & Ergun, 2008). The DOCS (Denison et al., 2006) follows the same categorisation as Denison’s culture theory, measuring four traits of organisational culture, with three nested indexes.

Security Culture

An understanding of organisational culture is fundamental to understanding security culture. This is because effective security culture is strongly entrenched within organisational culture (Da Veiga & Martins, 2015) and cannot be assessed in isolation. The focus on security culture is relatively new. Its growth in the literature is primarily attributed to our significant reliance on information systems and digital devices, coupled with the social and political environment surrounding the safeguarding of information. The implementation of solely technological solutions is inadequate in preventing security breaches (Borck, 2000; Pfleeger, 1997). Therefore, focussing on the human aspects at the group level, by measuring culture, could provide a more comprehensive understanding. Security culture is often explained as a sub-culture of organisational culture (Borck, 2000; Chia, Maynard, & Ruighaver, 2003; Connolly et al., 2017). It is shaped through a combination of both internal and external environments (Da Veiga & Martins, 2015; Thompson, von Solms & Louw, 2006). The internal environment consists of factors such as leadership and organisational structure. Whereas, the external environment, includes factors ranging from the economic climate to an industry’s technology use.

Security culture incorporates the assumptions, attitudes, beliefs, values and knowledge that individuals use to interact with the organisation’s systems, procedures, daily tasks and activities. These result in certain behaviours that reflect the way things are habitually done in specific organisations (Da Veiga & Eloff, 2010; Mahfuth et al., 2017; Schlienger & Teufel, 2003). A strong security culture exists when individuals are aware of security risks and preventative measures, assume responsibility, and take the required steps to improve the security of their information systems and networks (OECD, 2004). The primary objective of a strong security culture is to protect information assets by influencing employees. This can be achieved through increasing ISA in order to improve the security behaviour of employees (Furnell, 2007).

Theories & Frameworks

The current literature on security culture is primarily theoretical, with research focussing on conceptual models and frameworks. While some researchers have argued that security culture is too complex to be summarised in a single model (Ruighaver, Maynard, & Chang; 2007), others have developed theoretical frameworks based on organisational culture theories (Schlienger & Teufel, 2003; Vroom & von Solms, 2004).

The security culture literature draws on various disciplines including psychology, economics, behavioural sciences and management. However, the literature primarily focusses on extending Schein's three-tier organisational culture model of Assumptions, Espoused Values and Artefacts (Schlienger & Teufel, 2003). Van Niekerk and von Solms (2010) adapted Schein's (1985) three-tier model by including an additional tier, Information Security Knowledge. The addition of the knowledge tier is paramount, as behaviour is guided by knowledge (Mahfuth et al., 2017; Parsons et al., 2017). While it is assumed individuals have the knowledge to undertake their core role successfully, the same assumption cannot be made for having sufficient knowledge of information security. The contents of Schein's (1985) other dimensions were also marginally altered to better reflect the security culture context.

Da Veiga and Eloff (2010) also adapted Schein's (1985) organisational culture theory. They focus on the interaction between information security, behaviour and culture, across the individual, group and organisational levels. They suggest that information security policies, procedures and practices influence information security behaviour, which in turn cultivates a security culture. This model has suggested a slightly different causal direction than most culture research. Due to the difficulty in determining causation, they suggested culture and behaviour can each exert influence over the other.

Several others propose a security culture framework, either by using the organisational culture literature as a foundation (D'Arcy, Hovav & Galletta, 2009; Hassan, & Ismail, 2012; Knapp et al., 2006; Ruighaver, Maynard, & Chang, 2007) or by summarising the existing security culture literature (Alhogail, 2015; Tang, Li & Zhang, 2016). However, this work is less comprehensive than the work of van Niekerk and von Solms (2010) and Da Veiga and Eloff (2010).

Measurement & Methods

Despite ample literature, measurement of security culture is limited. A publicly available, comprehensive, validated and reliable security culture instrument is not currently available. A number of other security culture tools have been developed. Unfortunately, some of these measures either demonstrated poor psychometric properties, have not been well validated, or have not been released for public use (Al-Mayahi & Mansoor, 2013; Alhogail & Mirza, 2014; Ashenden, 2008; Da Veiga & Martins, 2015; Flores & Ekstedt, 2016; Karlsson, Åström & Karlsson, 2015; Martins & Eloff, 2002; Schlienger & Teufel, 2003). This means organisations are unable to accurately and objectively measure their security culture. This affects their ability to measure risk and monitor change.

An exploratory scale, developed by Parsons et al. (2015) seeks to measure security culture through six statements. This measure has demonstrated promising reliability and acceptable face-validity. However, further validity testing is needed. Given the importance of organisational culture and security culture in determining secure behaviours, the following section will address the empirical literature that has explored the relationship between aspects of culture and information security.

Previous Research: ISA, Organisational Culture, Security Culture

Although research has not specifically explored the relationship between ISA, organisational culture, and security culture, some aspects of culture and ISA have been studied. For example, an exploratory quantitative study by Parsons et al. (2015) found a positive relationship between decision making and information security culture. Employees from organisations with better information security culture were more likely to have knowledge, attitudes, and behaviours in accordance with information security policy and procedures. These findings were supported by D'Arcy and Greene (2014).

Despite these exploratory findings, most information security literature has explored only some aspects of culture (e.g., organisation's mission, leadership, structure and style) and ISA, rather than measuring culture as a holistic construct. These components and others are discussed in relation to ISA.

A mixed-methods study by Schlienger and Teufel (2003) found support for an organisation's security mission in influencing an information security culture. It is suggested that effective organisational security policy should incorporate clear definitions of responsibilities to guide employees' understanding of acceptable and responsible security behaviour (Höne & Eloff, 2002; Schlienger & Teufel, 2003). The importance of an organisation's mission was supported by Ruighaver, Maynard, and Chang (2007), who found that long-term security policies and procedures were crucial to maintaining a strong security culture.

Employing a combination of field studies and structured surveys, Fourie (2003) found management support as the most significant factor affecting information security management activities. This was best achieved by defining and communicating a security policy, allocating specific responsibilities, making resources readily available for continual upkeep and control, monitoring and reviewing information security effectiveness, and supporting the establishment of a security culture. Other studies have found similar results and have emphasised the importance of senior management in encouraging good security behaviours through strategic management and planning, communication, and decision making (Stewart, 2005; Zakaria et al., 2007).

The influence of management on ISA is further supported by an industry based global survey that determined leadership support as the largest contributing factor to information security, above training and technical controls (Knapp et al., 2004). Management's preference for control or autonomy has also received preliminary support in relation to ISA. A self-report survey of 87 senior managers in Taiwan found a relationship between organisational culture and information security management control (Ernest Chang & Lin, 2007). It was found organisations with a control focussed culture were conducive to the development of information security management, with higher control indirectly discouraging information sharing among staff.

Further literature exploring individual autonomy and control has linked ISA and security behaviours to punishment. The literature suggests that constant monitoring and enforcement of individual employees' behaviours will influence compliance with policy. This suggests that individuals can be motivated to adopt security behaviour through drills and threats of punishment to non-compliance (Adams & Sasse, 1999). However, this study also noted employees typically required a perceived need for these behaviours. This is further supported by Xue, Liang, and Wu (2011) who found the effect of punishment expectancy on IT compliance was overshadowed by the perceived justice of punishment. This suggests that compliance is more strongly related to the shared attitudes concerning punishment. A more recent study suggests that an influencing strategy, including education and individual accountability, may be more effective than an enforcing one (Guo & Yuan, 2012). However, inconsistent punishment findings exist (Chen, Ramamurthy & Wen, 2012; Parsons et al. 2015; Sasse, Brostoff & Weirich, 2001), with Siponen and Vance (2012) suggesting punishment may only provide short-term benefits.

The style preference of an organisation is another aspect of culture that has received preliminary support. To date, ISA research has explored the comparison between people-oriented and task-oriented organisations. Connolly et al. (2017) found organisations that focussed more on developing people rather than measuring productivity were more likely to see greater compliance with information security. They were also more likely to have a positive-orientation to security behaviours. Additionally, high task-orientation was related to greater work pressure, which is linked to a negative-orientation to security behaviours, and a decreased likelihood of information security rule adherence. These findings were supported by Albrechtsen (2007) who found high information security workload can create a conflict of interest between functionality and information security behaviours.

A review by Chipperfield and Furnell (2010) found that flatter structures enabled better information security as the organisations could adapt to the external environment quicker, involved less bureaucracy, and received greater employee support. Having a structure that allows for collaboration has also received empirical support. Ruighaver, Maynard, and Chang (2007) also analysed security governance processes and structures, and showed that a lack of collaboration with stakeholders in daily decision-making negatively affected motivation and work orientation, leading to a narrow security focus. Koh et al. (2005) also found that collaboration in the security decision making process can be beneficial. This is because collaboration ensures employees feel responsible for their workplace security, and have a sense of ownership (Freeman, 2000; Ruighaver, Maynard & Chang, 2007).

Despite the positive influence of collaboration on security culture, it is imperative this is done in a structured and secure way. This is primarily because informal and social organisations have been linked to a negative-orientation to security behaviours due to mediocracy, consensus, and group think (Connolly et al., 2017). Additionally, it has been found that cooperativeness is negatively related to confidentiality, highlighting the difficulty in holding information secure, in an information sharing environment (Ernest Chang & Lin, 2007).

While these findings are limited, Crossler et al. (2013) and Shinn (2000) note that as our reliance on technology increases, change should be carefully managed as security is never guaranteed and organisations must ensure their security posture is not static. While these are the only studies that suggest flexible organisations display greater information security behaviours, adapting to the external environment is an important aspect of information security, due to the constant evolution of technology. These results have implications, discussed in the following section.

Discussion

In this review, we provide a detailed overview of the ISA, organisational culture and security culture literature, as well as the literature on the relationship between ISA and aspects of culture. In this section, we briefly discuss the theoretical and applied implications of this review, and propose a way forward.

Implications

The link between organisational culture and security culture has strong theoretical support (Martins & Eloff, 2002; Schlienger & Teufel, 2003), with both constructs sharing the basic underlying principles and structures proposed by Schein (1985). As discussed in this review, the relationship between aspects of organisational culture and ISA has received theoretical support. Although this is promising, there is a clear gap in the literature, due to the lack of empirical research examining this relationship.

Theoretically, this review provides a starting point for information security researchers. It has brought together multidisciplinary literature to provide a succinct summary of the problem space. This means it can be used to guide further theoretical developments and much needed empirical research. From an applied perspective, this review provides a summary of valid and reliable measurement instruments, that organisations can implement to assess their baseline level of organisational and security culture, and ISA.

Limitations & Future Research Directions

Security culture is a multi-disciplinary field, drawing on myriad of research methods, analyses and interpretations. Nonetheless, most studies rely on self-report (e.g. quantitative questionnaires, interviews, and focus groups). Although self-report is prone to common method variance and social desirability (Austin et al., 1998; Podsakoff & Organ, 1986; Spector, 1994), it enables systemisation, repeatability, comparability and convenience (Tucker, McCoy & Evans, 1990). Therefore, using valid and reliable self-report measures is recommended, particularly for exploratory research. Once empirical support has been established, mixed-method designs combining self-report, observational sampling, and case studies will increase the breadth of understanding (Workman et al., 2008). To reduce the effects of bias and enable generalisability of results (Faber & Fonseca, 2014), it is also recommended that future sample sizes are of a sufficient size.

While preliminary support exists for the relationship between ISA, organisational culture, and security culture; a study is yet to empirically explore all three. This literature review has identified a gap in the research and emphasises that an empirical examination is warranted. Based on these findings, future research should empirically examine the relative contribution of organisational culture and security culture on ISA, including the interplay between the three variables. Also, the extent to which security culture is a sub-component of organisational culture, as has been argued in the literature.

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Culture and Information Security Awareness: Examining the Role of Organisational and Security Culture

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Declarations of interest: none

Abstract

The relationship between security culture and ISA has received preliminary support; however, its interplay with organisational culture is yet to be empirically explored. Therefore, this study examined the relationship between ISA, organisational culture, and security culture. A total of 508 working Australians completed an online questionnaire. ISA was measured using the Human Aspects of Information Security Questionnaire (HAIS-Q); organisational culture was measured using the Denison Organisational Culture Survey (DOCS); and security culture was assessed through the Organisational Security Culture Measure. Our results showed that while organisational culture and security culture were correlated with ISA, security culture mediated the relationship between organisational culture and ISA. This finding has important applied implications. Organisations can improve ISA by focussing on security culture rather than organisational culture, saving them time and resources. Future research could further extend current findings by also considering national culture.

Keywords: Security Culture, Organisational Culture, ISA, Cyber

1. Introduction

Human behaviour is largely determined by culture, affecting interactions in social and work environments (Cronk & Salmon, 2017). Therefore, when attempting to understand and shape human behaviour, looking at an individual in isolation is problematic. It is also important to consider the group, the infrastructure and their interaction (Grant, 2005; Tessem & Skaraas, 2005). This is important for information security, as humans play a significant role in not only creating risks, but also preventing security breaches. In an organisational context, the primary cause of human error is non-compliance, or non-malicious unawareness, rather than malicious intent (Parsons et al., 2014; Pfleeger & Caputo, 2012; Wood & Banks, 1993). To further understand the role humans play in information security, this study explores the relationship between employee Information Security Awareness (ISA)[1], and organisational and security culture. These constructs have not been empirically studied in combination.

Traditionally, information security has been approached from a computer science perspective, focussing solely on technical measures to mitigate risks (Aurigemma & Panko, 2012). However, the importance of the human factor has become increasingly recognised (e.g., Herath & Rao, 2009; Metalidou et al., 2014; Vroom & von Solms, 2004). It has been well established that technical solutions in isolation cannot sufficiently mitigate security breaches (e.g., Furnell & Clarke, 2012; Pfleeger & Caputo, 2012; Schulz, 2005). The role of the human is crucial with humans being the weakest link in information security (IBM, 2014; Schlienger & Teufel, 2003; von Solms & van Niekerk, 2010).

Understanding and influencing these security behaviours is becoming increasingly important. Our increased reliance on technology in work and private lives has contributed to greater information security risks (Crossler et al., 2013; Reid & Niekerk, 2014; Thomson,

[1] ISA: Information Security Awareness

von Solms & Louw, 2006). Risks often result in information security incidents, which are on the rise as more organisations are successfully targeted by cyber security attacks (Telstra Global, 2017). This represents a significant problem, with Chief Executive Officers reporting cyber risks as their greatest overall concern (Pricewaterhouse Cooper [PwC], 2016, 2018). The World Economic Forum has also listed major data breaches and cyber-attacks in the top five social risks of the next decade (The World Economic Forum, 2018). Over a two-year period more than 65% of Australian organisations experienced cyber-crime, with one in ten reporting losses greater than $1 million, and 9% reporting having had the confidentiality, integrity, or availability to sensitive data compromised (PwC, 2018). Further, the Australian Computer Emergency Response Team found 3% of cyber security incidents involved systems of national interest and critical infrastructure (ACSC, 2017). As technical solutions alone are insufficient, and with the increase in information security risks, it is important we understand the factors contributing to ISA. The current study will examine the relationships between ISA, organisational culture, and security culture. These constructs will be discussed in the following sections.

1.1 Information Security Awareness

Understanding Information Security Awareness (ISA) and its contributing factors is essential in mitigating information security risks. ISA refers to the extent to which employees understand the significance of their organisations information security policies, rules, and guidelines, and the extent to which they behave in accordance with these policies, rules and guidelines (Bulgurcu, Cavusoglu & Benbasat, 2010; Kruger & Kearney, 2006; Siponen, 2000).

The Knowledge-Attitude-Behaviour (KAB) model has been applied to the ISA context. Based on the model, as an employee’s knowledge of security behaviours increases, their attitude improves, resulting in improved information security behaviours (Bulgurcu, Cavusoglu & Benbasat, 2010; Kruger & Kearney, 2006; Parsons et al., 2014; Siponen, 2000). While this model has been criticised by some researchers, evidence of its validity has been established (Bettinghaus, 1986; Van der Linden, 2012), and its use supported (McGuire, 1969).

The KAB model underpins the Human Aspects of Information Security Questionnaire (HAIS-Q). The HAIS-Q has received significant theoretical support (Parsons et al., 2014, 2017) and has undergone sufficient reliability and validity testing on diverse populations (Hadlington & Parsons, 2017; McCormac et al., 2016, 2017b; Parsons et al., 2017). Other attempts to measure ISA have been limited by either focussing on information security breaches or aspects of ISA (D'Arcy, Hovav & Galletta, 2009; PwC, 2018; Stanton et al., 2005), and require further reliability and validity testing (Egelman, Harbach & Peer, 2016; Öğütçü, Testik & Chouseinoglou, 2016; Solic, Velki & Galba, 2015; Velki, Solic & Ocevcic, 2014).

To date, human aspects of information security research has primarily focused on understanding human vulnerabilities at the individual level, by exploring the specific characteristics that may affect information security behaviours (McCormac et al., 2017a, 2018; Shropshire et al. 2006). This research has shown that ISA can, to an extent, be predicted by age, gender, resilience, job stress, education and some personality characteristics. For example, studies have found higher ISA is positively associated with age (i.e., ISA scores increase with age), females, individuals who are more conscientious and agreeable, individuals displaying greater resilience, individuals with a higher education level, and those with a propensity to take fewer risks (McCormac et al. 2017a; McCormac et al., 2018; Öğütçü, Testik, & Chouseinoglou, 2016; Pattinson et al., 2016).

While research has focused on the individual factors that may predict ISA, limited empirical research has explored the relationship between ISA and culture. Although academics and industry practitioners recognise the importance of security culture (Da Veiga & Eloff, 2010; OECD, 2004, 2015; Schlienger & Teufel, 2003) research in the area is still preliminary. Current literature suggests that security culture should be part of organisational culture (Schlienger & Teufel, 2003; von Solms, 2000), as information is best protected when individuals understand, internalise and behave to information security standards (van Niekerk & von Solms, 2005; Sanders, 2016; Thomson, von Solms & Louw, 2006).

1.2 Organisational Culture

The conceptualisation of organisational culture is highly contested, however, it is most colloquially referred to as 'the way things are done around here' (Lundy & Cowling, 1995, pp. 168). The most widely accepted formal definition of organisational culture has been developed by Schein:

> *A pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems* (Schein, 1992, pp. 12).

Culture encompasses the norms a group shares about how the world operates; shaping their perceptions, thoughts, feelings and behaviours (Schein, 1986, 1990). Schein's (1985, 1992, 2004) theory of organisational culture conceptualises culture into three hierarchical levels: Artefacts, Espoused Values, and Basic Underlying Assumptions. His work is pivotal in understanding organisational culture and many theorists have based their culture models on this. Other prominent researchers also dominate the field of organisational culture, each offering a unique perspective on the complex phenomenon. These theories vary in their approach, complexity, applicability and empirical support (Cameron & Quinn, 2011; Deal & Kennedy, 1982; Harrison, 1972; O'Reilly, Chatman, & Caldwell 1991; Quinn & Rohrbaugh, 1983).

Building on the work of Schein, Denison's (1996) model and survey on organisational culture classifies culture into four sub-facets, with three nested subscales (Denison et al., 2006). Due to its confirmed reliability, validity and demonstrated link to behavioural outcomes (e.g., Gillespie et al., 2008; Kotrba et al., 2012; Yilmaz & Ergun, 2008), the Denison Organisational Culture Survey (DOCS) is the most widely used measure for assessing organisational culture (Kokina & Ostrovska, 2013; Sackmann, 2011; Schneider, Ehrhart, & Macey, 2011). Other measures also demonstrate similar reliability estimates, however, they have not been linked as strongly to behaviour (e.g., OCP - O'Reilly, Chatman & Caldwell, 1991), are of a longer duration (e.g., OCI - Cooke & Szumal, 1994) or are quite costly, with an inability to receive raw data (e.g., OCAI - Cameron & Quinn, 2011).

The study and measurement of culture is important due to its influence on individual and group behaviours and subsequent relationships with organisational behaviours such as job satisfaction (Fey & Denison, 2003; Sempane, Rieger & Roodt, 2002; Schneider & Snyder, 1975) and job performance (Boyce et al., 2015; Hartnell, Ou & Kinicki, 2011; Sackmann, 2011). It should also be noted that the terms organisational culture and organisational climate are often used synonymously in the literature. Some distinctions including their conceptualisation and research methods had traditionally distinguished them (Ryder & Southey, 1990; Schneider et al., 2017: Schwartz & Davis, 1981), however, now distinctions are primarily in interpretation (Denison, 1996; Moran & Volkwein, 1992).

1.3 Security Culture

An understanding of organisational culture is fundamental when trying to understand security culture (Ruighaver, Maynard & Chang, 2007; Mowday & Sutton, 1993). This is because effective security is strongly entrenched within organisational culture (Da Veiga & Martins, 2015) and is often explained as a sub-culture of organisational culture (Borck, 2000; Connolly et al., 2017; Ruighaver, Maynard & Chang, 2007). Therefore, it cannot be assessed in isolation. The focus on security culture is relatively new. Its growth in the literature is primarily attributed to our significant reliance on information systems and digital devices, coupled with the social and political environment surrounding the safeguarding of information. Therefore, the current literature on security culture is primarily theoretical, with research focussing on conceptual models and frameworks.

The security culture literature draws on various disciplines including psychology, economics, behavioural sciences and management, with a focus on the organisational culture literature as a foundation (D'Arcy, Hovav & Galletta, 2009; Hassan & Ismail, 2012; Knapp et al., 2006). The most extensive adaptations of Schein's (1985) organisational culture theory to security culture were developed by Da Veiga and Eloff (2010), and van Niekerk and von Solms (2010). Van Niekerk and von Solms (2010) adapted Schein's (1985) model to better reflect security culture, and also included an additional knowledge tier. Da Veiga and Eloff (2010) focus on the interaction between information security, behaviour and culture, across the individual, group and organisational levels.

While other theories exist, there is consensus that security culture incorporates the assumptions, attitudes, beliefs, values and knowledge that individuals use to interact with the organisation's systems, procedures, daily tasks and activities. It is shaped through a combination of both the internal and external environments (Da Veiga & Martins, 2015;

Thompson, von Solms & Louw, 2006). The internal environment consists of factors such as leadership and organisational structure, and the external environment includes factors ranging from the economic climate to the industry's technology intensity.

These result in certain behaviours that reflect the way things are habitually done in specific organisations (Da Veiga & Eloff, 2010; Mahfuth et al., 2017; Schlienger & Teufel, 2003). A strong security culture exists when individuals are aware of security risks and preventative measures, and when individuals assume responsibility and take the required steps to improve the security of their information systems and networks (Business and Advisory Committee to the OECD, 2004). The primary objective of a strong security culture is to protect information assets by influencing employees. This can be achieved through increasing information security awareness in order to improve the security behaviour of employees (Furnell, 2007).

Despite ample theoretical support, the measurement of security culture is limited. While security culture tools have been developed (Al-Mayahi & Mansoor, 2013; Alhogail & Mirza, 2014; Ashenden, 2008; Da Veiga & Martins, 2015; Flores and Ekstedt, 2016; Karlsson, Åström & Karlsson, 2015; Martins & Eloff, 2002; Schlienger & Teufel, 2003), a publicly available, comprehensive, validated and reliable security culture instrument is not currently available. An exploratory scale, developed by Parsons et al. (2015) has demonstrated promising reliability and acceptable face-validity; however, further validity testing is recommended.

Given the importance of organisational culture and security culture in determining secure behaviours, the following section will address the empirical literature that has explored the relationship between culture and ISA.

1.4 Previous Research: ISA, Organisational Culture, Security Culture

As previously explained, theoretical support exists for the relationship between organisational culture and security culture (Nosworthy, 2000) and between security culture and ISA (Da Veiga & Eloff, 2010; Schlienger & Teufel, 2003). Despite this, limited empirical support exists.

An exploratory quantitative study by Parsons et al. (2015) found a positive relationship between ISA and security culture. Employees from organisations with better information security culture were more likely to have knowledge, attitudes, and behaviours in accordance with information security policy and procedures. D'Arcy and Greene (2014) had similar findings in their empirical study.

While previous literature has not specifically explored the relationship between ISA and organisational culture, components of culture that relate to ISA have received preliminary support. Strongest support was found for the influence of leadership support on information security management (Fourie, 2003; Knapp et al., 2004) and the creation of a security culture (Stewart, 2005; Zakaria et al., 2007). These studies emphasised the importance of leaders in encouraging good security behaviours through strategic management and planning, communication, and decision making. In addition, it was also found that an organisations security mission was strongly linked to their security culture (Höne & Eloff, 2002; Ruighaver, Maynard, & Chang, 2007; Schlienger & Teufel, 2003).

Limited support has been found for other culture constructs. Benefits of collaboration in decision making was found to improve both security behaviours and culture (Koh et al., 2005; Ruighaver, Maynard & Chang, 2007), as involvement gave employees a sense of ownership around security management. It was also found people-oriented organisations were more likely to see a positive-orientation to ISA (Albrechtsen, 2007; Connolly et al., 2017), as a focus on task-orientation can create a conflict of interest between functionality and information security behaviours. Lastly, while findings vary for the influence of punishment on ISA (Chen, Ramamurthy & Wen, 2012; Parsons et al. 2015; Sasse, Brostoff & Weirich, 2001), the importance of punishment expectancy and the perceived justice of punishment on ISA has been noted (Xue, Liang, & Wu, 2011).

These findings provide preliminary empirical evidence to support the strong theoretical literature linking ISA, organisational culture and security culture.

1.5 Study aims

While theoretical support exists for the relationship between ISA, organisational culture, and security culture; a study is yet to empirically examine the contribution of all three. This study aims to empirically investigate the relationship between ISA, organisational culture and security culture. Given the previous findings relating to demographic variables (e.g. age and gender) and their relationship to ISA (McCormac et al., 2017a, 2018; Pattinson et al., 2016), the influence of these variables will also be analysed. Therefore it is hypothesised that organisational culture, security culture and ISA will be positively related.

2. Method

Data collection involved an online survey, administered through the web-based survey platform Qualtrics. Data was collected over a two-week period in July 2018. Ethics approval was granted by the Human Research Ethics Subcommittee of the University of Adelaide School of Psychology. Participants took on average 20 minutes to complete the survey.

2.1 Participants

A total of 508 (300 females, 207 males, 1 gender unspecified) working Australians completed the online questionnaire. Participants were primarily casual/contracted workers (*n* = 303) as opposed to full time (*n* = 138) or part time (*n* = 67) workers, and were evenly distributed between management (*n* = 255) and non-management (*n* = 253) positions. Participants represented various industries, roles and levels (see Table 1 for detailed participant demographics). Comparative to the Australian population (ABS, 2016) our sample demographics were relatively representative, however, included a larger proportion of females and younger adults.

Table 1
Participant Demographics

	Participants (*N* = 508)
	N (%)
Age Categories	
18-29	144 (28)
30-39	144 (28)
40-49	85 (17)
50-59	75 (15)
> 60	62 (12)
Employment Sector	
Government	172 (34)
Non-Government	335 (66)
Industry	
Health and Community Services	75 (15)
Retail and Wholesale	110 (25)
Education & Research	54 (11)
Finance, Banking, Insurance & Business Services	55 (11)
Mining, Manufacturing and Construction	66 (13)
Government and Defence	30 (6)
IT	28 (6)
Other	90 (18)

2.1.1. Inclusion and Exclusion Criteria

Participants were required to be over the age of 18, currently employed, working within Australia, and spent some of their time at work on a computer. Quality control measures were also implemented. Participants who declined the question ‘do you commit to thoughtfully provide your best answers to each question in this survey?’ or who appeared to not be providing considered responses were removed during survey participation. For example, this included participants who responded using only one response category, irrespective of reverse scoring. Additionally, a further eight responses were excluded from the sample, as their answers indicated a lack of content responsiveness. Exclusion was based on the content non-responsivity criteria, outlined in Parsons et al. (2014).

2.2 Measures

2.2.1. Demographic Information

The participants were asked to provide individual demographics including age and gender, as well as organisational demographics including, employment status, position level, industry sector, organisation size, frequency of using electronic devices at work, and information security education.

2.2.2. Information Security Awareness: The Human Aspects of Information Security Awareness Questionnaire (HAIS-Q)

The HAIS-Q measures an individual's ISA based on their knowledge, attitude and behaviour in relation to good security behaviours (Parsons et al. 2017). The tool consists of 63 statements answered on a 5-point Likert scale, ranging from 1 = 'Strongly Disagree' to 5 = 'Strongly Agree'. In this study, Cronbach's alpha score was .96 for ISA. These are consistent with alpha levels reported in previous studies (e.g., McCormac et al. 2016, 2017a). For detailed validity and reliability assessments of the HAIS-Q, refer to Parsons et al. (2017) and McCormac et al. (2016). A sample knowledge item is "*I can't be fired for something I have posted on social media.*"

2.2.3. Organisational Culture: DOCS Denison Organisational Culture Survey

The DOCS (Denison et al., 2006) measures organisational culture through four traits; involvement, consistency, adaptability and mission. The 60-item tool utilises a 5-point Likert scale, ranging from 1 = 'Strongly Disagree' to 5 = 'Strongly Agree'. This study yielded an overall Cronbach's alpha of .97, which is considered reliable and is consistent with previous studies (Kotrba et al., 2012). The DOCS has demonstrated adequate Factor Analysis and validity (Denison & Mishra, 1995; Kotrba et al. 2012). A sample item from the involvement: empowerment index is “*Most employees are highly involved in their work.*”

Consistent with the approach of Boyce et al. (2015), we derived an index for overall culture by taking the mean across all four culture traits. While this approach is not sensitive to potential differences at the trait level, given the high trait correlations, resulting in consistent mediation patterns, and the exploratory purpose of the study, this method was most suitable.

2.2.4. Security Culture: Organisational Security Culture Measure

The Organisational Security Culture Measure assesses an organisation’s information security culture (Parsons et al., 2015) using six statements measured on a 5-point Likert scale ranging from 1 = ‘Strongly Disagree’ to 5 = ‘Strongly Agree’. An alpha level of .71 has been previously reported (Parsons et al., 2015), and the results of this study found the measure to have an alpha value of .69. A sample item is “*Most of my colleagues generally behave in a secure manner when they are using a computer.*”

3. Results

Table 2 presents a correlation matrix, including mean and standard deviation scores, to examine the relationship between ISA, organisational culture, security culture, gender, and age. Organisational demographic variables relating to position level, employment sector, industry, and organisation size were also examined. There were no significant relationships found between organisational demographic variables and ISA, organisational culture and security culture. Therefore, they are not reported further.

Inspection of the distribution of scores indicated that ISA scores were slightly negatively skewed, whereas, organisational culture and security culture were normally distributed. However, it is generally accepted that most parametric and non-parametric tests, are largely robust to such minor violations of normality (Edgell, Noon & Zeaman, 1984; McHugh, 2013). Parametric testing has demonstrated robust effects even when the assumption of normality is violated (Edgell, Noon & Zeaman, 1984; Schmider et al., 2010), particularly when sample size is greater than 200 (Tabachnick & Fidell, 2013). Four outliers were identified from the organisational culture measure. However, Cook's Distance score ascertained that the four outliers, as determined by Mahalanobis Distance, didn't change the significance of reported results. Therefore, they were included in the analysis to better represent the diversity of the population. Collinearity diagnostics analysis revealed that tolerance values were all greater than .10 and the variance inflation factor values were all well below 10, suggesting that multi-collinearity had not been violated.

Table 2

Correlations and Descriptive Statistics; ISA, Organisational Culture, Security Culture, Age, Gender (N=508)

Variables	Gender	Age	ISA	Security Culture	Organisational Culture
Age	- .13**				
ISA	.16**	.25**			
Security Culture	.10*	.11*	.55**		
Organisational Culture	.03	.01	.25**	.50**	
Mean	***	***	259.33	3.57	3.59
SD	***	***	35.71	.64	.59

Note. **p* < .05; ***p* < .001: ***Mean and SD scores for gender and age are unavailable, as gender is a nominal variable, and age range, rather than exact ages, were provided by participants.

3.1 ISA, Age, Gender

A two-way between-groups ANOVA was conducted to explore the effect of gender and age on ISA. While the interaction effect between gender and age was not statistically significant, *F* (5, 495) = 1.313, *p* = .26, there was a statistically significant main effect for age, *F* (5, 495) = 7.67, *p* < .001, partial ή^{2}= .07. Post-hoc comparisons using the Tukey HSD test indicated that the mean ISA scores for the 20-29 age group (*M* = 248.62, *SD* = 39.49) was significantly different to the 40-49 group (*M* = 265.13, *SD* = 33.99), the 50-59 group (*M* = 268.05, *SD* = 33.30), and the 60+ group (*M* = 272.73, *SD* = 25.76). The mean score for the <19 age group (*M* = 241.32, *SD* = 34.28) was also significantly different to the 60+ age group. The main effect for gender, *F* (2, 495) = 4.44, *p* = .12, did not reach statistical significance. There was a trend for ISA to be higher for female participants, when compared to male participants (except for <19 years); however examination of the raw data showed that these gender differences reduced in older age brackets, consistent with previous findings (e.g., McCormac et al., 2017a).

3.2 ISA, Organisational Culture, Information Security Culture

A three-stage hierarchical regression was used to investigate the extent to which organisational culture and security culture predicted ISA. Preliminary analyses were conducted to ensure no violation of the assumptions of normality, linearity, multicollinearity and homoscedasticity. The results of the regression are summarised in Table 3.To control for the effects of age and gender, which have been previously found to predict ISA (McCormac et al. 2017a), these variables were entered at Stage 1. Strong theoretical literature highlights the importance of organisational culture on individual and group behaviours (Boyce et al., 2015; Cronk & Salmon, 2017); therefore, this variable was entered at Stage 2. The addition of organisational culture to the model, explained an additional 5% of variance. As security culture is often explained as a sub-component of organisational culture (Borck, 2000; Connolly et al., 2017; Ruighaver, Maynard & Chang, 2007; Schlienger & Teufel 2003), it was entered at Stage 3. Entering security culture into the model explained an additional 20% of variance, with the final model explaining a total of 35% variance in ISA. However, despite the initial contribution and significant correlation with ISA, the contribution of organisational culture was no longer significant. To further investigate this we conducted a mediation analysis, examining the relationship between ISA, organisational culture and security culture.

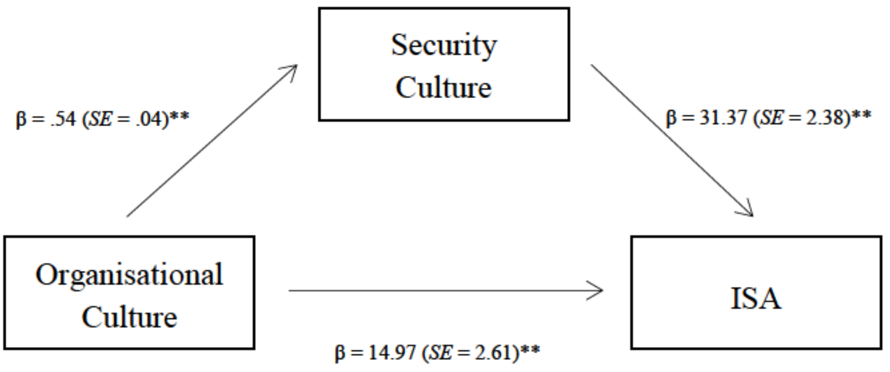
Table 3

Summary of the Hierarchical Regression analysis for Organisational Culture, Security Culture, Age, and Gender predicting ISA (N=508)

Variable	*β (standardised)*	*t*	*p*
Stage 1	$F_{(2, 507)}$ = 27.43, adjusted R^2 = 0.10**		
Age	6.88	6.41	<.001
Gender	13.88	4.52	<.001
Stage 2	$F_{(3, 507)}$ = 30.97, adjusted R^2 = 0.15**		
Age	6.80	6.55	<.001
Gender	13.39	4.50	<.001
Organisational culture	14.53	5.87	<.001
Stage 3	$F_{(4, 507)}$ = 68.78, adjusted R^2 = 0.35**		
Age	5.21	5.67	<.001
Gender	9.60	3.66	<.001
Organisational culture	-1.02	- .41	.68
Security culture	28.88	12.41	<.001

Note. *p < .05; **p < .001

To examine the mediation effect of security culture between the relationship of organisational culture and ISA, the Sobel test was conducted (Baron & Kenny, 1986). As shown in Figure 1, the unstandardised regression coefficients between organisational culture and security culture, security culture and ISA; and organisational culture and ISA were statistically significant. The statistic for the Sobel test was 9.43, *SE* = 1.80, *p* < .001, indicating that the overall effect of organisation culture on ISA is significantly affected by an organisation's security culture. This result has applied implications, discussed in the following sections.



Note. ** $p < .001$

Figure 1: Model testing hypothesis; Security Culture mediates the relationship between Organisational Culture and ISA.

4. Discussion

A large body of literature explores aspects relating to organisational culture and ISA separately, however, there is limited literature exploring the relationship between ISA, organisational culture and security culture. Therefore, the aim of this study was to empirically examine the relationship between ISA, organisational culture, and security culture. The following sections will discuss the study’s findings, applications, limitations and future directions.

4.1 Findings and Implications

In line with the overarching hypothesis, we found a significant positive relationship between ISA, organisational culture and security culture. Furthermore, after controlling for age and gender, organisational culture and security culture predicted approximately 25% of the variance in ISA. A strong positive linear relationship was found between organisational culture and security culture; as organisational culture increased, so did security culture. This relationship is supported by the theoretical literature (Da Veiga & Martins, 2015) and can be partially explained by suggesting security culture is a sub-component of organisational culture (Schlienger & Teufel 2003; van Niekerk & von Solms 2005), with both constructs sharing the same theoretical underpinning derived from Schein’s (1985) theory.

A significant positive liner relationship was also found between security culture and ISA, consistent with the theoretical (Da Veiga & Eloff, 2010) and preliminary empirical literature (Parsons et al., 2014). As security culture increased, so did ISA; individuals from organisations with higher security culture scores were more likely to have higher ISA. Conversely, individuals from organisations with lower security culture scores were more likely to have lower ISA scores.

Despite these linear relationships, the study found a more complex relationship which explained the interplay between organisational culture, security culture and ISA. Our findings suggest that security culture mediates the relationship between organisational culture and ISA. This means that while a relationship between organisational culture and ISA exists, it is strongly affected by security culture. This suggests that irrespective of an organisation's overall culture, a strong security culture may be a better predictor of employee ISA. Therefore, organisation-wide improvements in ISA may be best achieved by focusing on security culture, rather than organisational culture more broadly. However, as organisational culture is still a predictor of performance (Boyce et al., 2015; Hartnell, Ou & Kinicki, 2011; Sackmann, 2011), job satisfaction (Fey & Denison, 2003; Sempane, Rieger & Roodt, 2002), and ISA, its importance within the information security literature still remains.

Relationships between ISA and demographic variables were also found. A positive linear relationship between age and ISA was found, with ISA improving as age increased. However, the distinction between age brackets began to plateau as age increased (>40 years). Similar findings were also reported by Pattinson et al. (2015), McCormac et al., (2017a), and McCormac et al. (2018). Further support for age-related ISA differences have also been found in phishing studies (Jagatic et al., 2007; Pattinson et al., 2012; Sheng et al., 2010). Inconsistent with previous research (McCormac et al., 2017a, 2018), a significant main effect was not found between male and female ISA scores.

4.1.1 Applied Implications

These findings have both theoretical and practical implications. The results contribute to the theoretical literature by providing support for the relationship between ISA, organisational culture and security culture. More specifically, the study provides empirical support to confirm the relationship between security culture and ISA, which to date has been primarily theoretical (Da Veiga & Eloff, 2010; van Niekerk & von Solms, 2010). It also provides further support for the relationship between organisational culture and ISA, by suggesting that the relationship is largely mediated by security culture.

Organisational culture is deeply ingrained within an organisation and can be difficult to change (Schein, 1999). However, as security culture is a sub-component of organisational culture (Schlienger & Teufel, 2003; van Niekerk & von Solms, 2005), and is less encompassing, it may be easier to change. Therefore, from a practical perspective, organisations would more effectively utilise their resources by focusing on security culture to improve ISA. Changing culture more broadly would require greater resources, making it more time-consuming and costly. In addition, positive cultural changes that improve ISA may also result in improvements in overall organisational culture as well. It is therefore recommended that organisations hoping to improve ISA may target security culture through infrastructure (e.g., technical and procedural) and group norms (e.g., mechanisms such as management support) rather than overall organisational cultural change.

4.2 Limitations and Future Direction

This study has clear theoretical and applied contributions; however, some limitations are noted. As culture is a multifaceted and multilayered construct, quantitative methods alone may be unlikely to provide a thorough assessment of organisational culture (Ashkanasy et al., 2000; Ott, 1989; Sackmann, 2011; Tucker, McCoy & Evans, 1990). However, this method allows for the identification and measurement of culture across organisations (Schein, 2004). In addition, self-report is prone to common method variance and social desirability (Austin et al., 1998; Podsakoff & Organ, 1986; Spector, 1994), yet it allows for systemisation, repeatability, comparability and convenience (Tucker, McCoy & Evans, 1990).

Given this was an exploratory study, using a survey-based quantitative method alone was justified. In addition, to reduce the previously mentioned effects, this study also implemented quality control measures, and guaranteed confidentiality and anonymity (Donaldson & Grant-Vallone, 2002). However, to offset some of these weaknesses and to provide a greater breadth of understanding, it is recommended that future studies use a mixed methods design.

The measurement tools used in this study may also present a limitation. A short security culture measurement tool was used. Currently a comprehensive, valid and reliable measure of security culture is yet to be published. However, the 6-item tool demonstrated sound reliability, and due to the exploratory nature of this study was sufficient. Given these findings, further development and validation of a security culture measure is warranted. In addition, the DOCS culture tool has shown considerable reliability and validity, and is the most widely used organisation culture assessment tool (Kokina & Ostrovska, 2013). However, one limitation is that the sub-facets are highly correlated, (Denison et al., 2006), meaning it is difficult to ascertain whether the traits are distinct areas of culture that can be compared. This means it is difficult to compare whether certain sub-facets were more predictive of security culture and ISA than others. This is something that needs to be considered in future studies.

While this study has focussed on the relationship between organisational culture, security culture and ISA, there are other aspects that may predict ISA including national culture and individual differences. While the DOCS model is applicable for assessing organisational culture globally (Denison et al., 2012), the influence of national culture on organisational culture, security culture and ISA is likely. Hofstede and Minkov (2010), Schein (2004) and House et al. (2004), have found that Western and Asian countries have profoundly different national and organisational cultures. Given the relationship between national culture and organisational culture, a global sample would contribute to the understanding of this relationship. While considerable research has documented the relationship between individual differences and ISA (McCormac et al. 2017a, 2018; Pattinson et al., 2016; Shropshire et al. 2006), incorporating these into a more comprehensive model with culture could be beneficial. This would give organisations and industry practitioners a greater understanding of the factors contributing to ISA of their employees. In turn, this could influence and inform intervention initiatives such as training programs, strategy development, risk analysis modelling and culture change.

4.3. Conclusion

This study empirically examined the relationship between ISA, organisational culture and security culture. It was found that security culture played a mediating role in the relationship between organisational culture and ISA. These findings have important theoretical and applied implications. Theoretically, the results of this study can be further developed by future research to more comprehensively investigate these relationships. From an applied perspective, rather than focussing on the broader organisational culture which may be more time consuming and resource intensive, organisations may achieve greater employee ISA by focussing on developing and strengthening their organisation's security culture.

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Appendices

Appendix A: Journal Guidelines for Submission

Computers & Security

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[dataset] Oguro M, Imahiro S, Saito S, Nakashizuka T. Mortality data for Japanese oak wilt disease and surrounding forest compositions, Mendeley Data, v1; 2015. https://doi.org/10.17632/xwj98nb39r.1.
Note shortened form for last page number. e.g., 51–9, and that for more than 6 authors the first 6 should be listed followed by "et al." For further details you are referred to "Uniform Requirements for Manuscripts submitted to Biomedical Journals" (J Am Med Assoc 1997;277:927–34) (see also Samples of Formatted References).

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Appendix B: Questionnaire

Computers at Work

The purpose of this research is to investigate the knowledge, attitude and behaviour of individuals, whilst using a computer for work, and how factors, such as their organisation may affect their use.

Your participation is completely voluntary. This survey will take you approximately 20 to 30 minutes to complete and will time-out in 60 minutes.

This project is being conducted by researchers from the University of Adelaide and the Defence Science and Technology Group. The principal researcher is Agata McCormac.

To take part in this survey, you must be an adult living in Australia. You must be employed (full time, part time or casually) and must spend some work time using a computer or portable device. You must also confirm that you have read and understood the Information Sheet.

Please click on the following link to view the Participant Information Form.

I have read the Information Sheet titled “Computers at Work?” and I consent to take part in the current study.

○ Yes (1)
○ No (2)

If No Is Selected, Then Skip To End of Survey

Are you an adult (at least 18 years old) living in Australia?

○ Yes (1)
○ No (2)

If No Is Selected, Then Skip To End of Block

What is your age?

○ 19 and under (1)
○ 20 - 29 (2)
○ 30 - 39 (3)
○ 40 - 49 (4)
○ 50 - 59 (5)
○ 60 or over (6)

What is your gender?

○ Male (1)
○ Female (2)
○ Other (3)

What is your country of origin?
[open text answer]

What country did you undertake most of your studies?
[open text answer]

What language do you speak most at home?
[open text answer]

Do you have more than one job?
If you have multiple jobs, please answer the questions in this survey based on your primary place of work.

○ Yes (1)
○ No (2)

What is your employment status?

○ Not employed (1)
○ Part-time (2)
○ Contract / Casual (3)
○ Full-time (4)

If Not employed Is Selected, Then Skip To End of Block

What percentage of your time at work is spent using a computer or portable device (e.g. laptop, tablet, smartphone)?

○ No time at all (1)
○ 20% or less (2)
○ 21% - 40% (3)
○ 41% - 60% (4)
○ 61% - 80% (5)
○ 81% - 100% (6)

If No time at all Is Selected, Then Skip To End of Block

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What is your job / occupation (i.e. your job title / job role)?
[open text answer]

What kind of business or industry do you work for?
○ Health and Community Services (1)
○ Retail and Wholesale (2)
○ Education (3)
○ Finance, Banking and Insurance (4)
○ Mining, Manufacturing and Construction (5)
○ Government and Defence (6)
○ Other, please specify (7) ____________________

Approximately how many people are employed by your place of work?
○ 1-4 (micro enterprises) (1)
○ 5-19 (small) (2)
○ 20-199 (medium) (3)
○ 200+ (large) (4)

What type of employer do you work for?
○ Public (1)
- a) Local
- b) State
- c) Federal

○ Private (2)
- a) International organisation
- b) Australian organisation
- c) Local company ?
  - i) Not-For-Profit
  - ii) For-Profit

What category would best describe your job level?
○ Management / Leadership Position (1)
○ Supervisor / Team Leader (2)
○ Team Member / Regular Staff Member (3)

Does your place of work have rules about computer use and information security?
○ Yes, there is a formal policy (1)
○ Yes, there is an informal policy or basic rules (2)
○ No (3)
○ Unsure (4)

Have you completed any subjects in the area of information security? (e.g , University / TAFE / Private college)?
○ Yes (1)
○ No (2)

How frequently does your place of work provide information security education, training or awareness programs?
○ Never (1)
○ Every two years (2)
○ Every year (3)
○ Every six months (4)
○ Every three months (5)
○ At least once a month (3)
○ Other (please specify) _____________

What types of information security education, training or awareness programs have you received at your place of work?
○ Instructor led lecture (1)
○ Instructor led workshop (2)
○ Emails (3)
○ Training videos (4)
○ Pop-up messages (5)
○ Newsletters or online bulletins (6)
○ E-learning (7)
○ Review a policy document (8)
○ Posters (9)
○ Discussions with colleagues (10)
○ Other (please specify) __________ (11)
○ None (12)

We care about the quality of our data. In order for us to get the most accurate measures of your opinions, it is important that you thoughtfully provide your best answers to each question in this survey.
Do you commit to thoughtfully provide your best answers to each question in this survey?
○ I will provide my best answers (1)
○ I will not provide my best answers (2)
○ I can't promise either way (3)

If I will not provide my best answers or I can't promise either way Is Selected, Then Skip To End of Block

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Please confirm you are not a robot via Captcha.

[PAGE BREAK]

You will now be asked to complete three sets of questions about using a computer for work.

These sets of questions are about:

1. Your *knowledge* of computer use guidelines.
2. Your *attitude* towards these computer use guidelines.
3. Your *behaviour* when using a computer for work.

[PAGE BREAK]

Knowledge
The following statements are about your *knowledge* of how you should use a computer for work.

[PAGE BREAK]

Knowledge
The following statements are about your *knowledge* of how you should use a computer for work.

	SD (1)	D (2)	NAnD (3)	A (4)	SA (5)
I can't be fired for something I post on social media. (9)	○	○	○	○	○
I am allowed to enter information on any website if it helps me do my job. (10)	○	○	○	○	○
Sensitive print-outs can be disposed of in the same way as non-sensitive ones. (8)	○	○	○	○	○
I am permitted to open every email in my inbox. (6)	○	○	○	○	○
If I see someone acting suspiciously in my workplace, I should report it. (22)	○	○	○	○	○
A mixture of letters, numbers and symbols is necessary for work passwords. (2)	○	○	○	○	○
When working in a public place, I have to keep my laptop with me at all times. (25)	○	○	○	○	○
I am allowed to download any files onto my work computer if they help me to do my job. (23)	○	○	○	○	○
I must not ignore poor security behaviour by my colleagues. (26)	○	○	○	○	○
I can post what I want about work on social media. (30)	○	○	○	○	○
When working on a sensitive document, I must ensure that strangers can't see my laptop screen. (31)	○	○	○	○	○
If I find a USB stick in a public place, I shouldn't plug it into my work computer. (33)	○	○	○	○	○
It's acceptable to use my social media passwords on my work accounts. (34)	○	○	○	○	○
I am allowed to send sensitive work files via a public Wi-Fi network. (35)	○	○	○	○	○
It's optional to report security incidents. (37)	○	○	○	○	○
I am allowed to open email attachments from unknown senders. (41)	○	○	○	○	○
I must periodically review the privacy settings on my social media accounts. (45)	○	○	○	○	○
I am allowed to leave print-outs containing sensitive information on my desk overnight. (47)	○	○	○	○	○
I am allowed to share my work passwords with a colleague. (50)	○	○	○	○	○
I am not permitted to click on a link in an email from an unknown sender. (51)	○	○	○	○	○
While I'm at work, I shouldn't access certain websites. (53)	○	○	○	○	○

[PAGE BREAK]

Attitude
The following statements are about your *attitude*.
You've told us about your *knowledge* of computer use guidelines. Now please tell us what you *think* about these guidelines.

[PAGE BREAK]

Attitude

The following statements are about your *attitude*.

You've told us about your *knowledge* of computer use guidelines. Now please tell us what you *think* about these guidelines.

	SD (1)	D (2)	NAnD (3)	A (4)	SA (5)
It’s safe to use the same password for social media and work accounts. (11)	○	○	○	○	○
It’s a bad idea to share my work passwords, even if a colleague asks for it. (22)	○	○	○	○	○
It’s safe to have a work password with just letters. (19)	○	○	○	○	○
It’s always safe to click on links in emails from people I know. (7)	○	○	○	○	○
Nothing bad could happen if I click on a link in an email from an unknown sender. (16)	○	○	○	○	○
It’s risky to open an email attachment from an unknown sender. (23)	○	○	○	○	○
It can be risky to download files on my work computer. (21)	○	○	○	○	○
Just because I can access a website at work, doesn't mean that it’s safe. (5)	○	○	○	○	○
If it helps me to do my job, it doesn’t matter what information I put on a website. (18)	○	○	○	○	○
It’s necessary to regularly review my social media privacy settings. (6)	○	○	○	○	○
It doesn’t matter if I post things on social media that I wouldn't normally say in public. (20)	○	○	○	○	○
It's risky to post certain information about my work on social media. (29)	○	○	○	○	○
When working in a café, it’s safe to leave my laptop unattended for a minute. (30)	○	○	○	○	○
It’s risky to send sensitive work files using a public Wi-Fi network. (31)	○	○	○	○	○
It's risky to access sensitive work files on a laptop if strangers can see my screen. (32)	○	○	○	○	○
Disposing of sensitive print-outs by putting them in the rubbish bin is safe. (33)	○	○	○	○	○
If I find a USB stick in a public place, nothing bad can happen if I plug it into my work computer. (34)	○	○	○	○	○
It’s risky to leave print-outs that contain sensitive information on my desk overnight. (35)	○	○	○	○	○
If I ignore someone acting suspiciously in my workplace, nothing bad can happen. (36)	○	○	○	○	○
Nothing bad can happen if I ignore poor security behaviour by a colleague. (37)	○	○	○	○	○
It’s risky to ignore security incidents, even if I think they’re not significant. (38)	○	○	○	○	○

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Behaviour

The following statements are about your *behaviour*.

You've told us what you *know*, and what you *think* about computer use guidelines. Now please tell us what you *do* when using a computer for work.

[PAGE BREAK]

Behaviour

The following statements are about your *behaviour*.
You've told us what you *know*, and what you *think* about computer use guidelines. Now please tell us what you *do* when using a computer for work.

	SD (1)	D (2)	NAnD (3)	A (4)	SA (5)
I use a different password for my social media and work accounts. (13)	○	○	○	○	○
I share my work passwords with colleagues. (14)	○	○	○	○	○
I use a combination of letters, numbers and symbols in my work passwords. (4)	○	○	○	○	○
I do not always click on links in emails just because they come from someone I know. (15)	○	○	○	○	○
If an email from an unknown sender looks interesting, I click on a link within it. (16)	○	○	○	○	○
I do not open email attachments if the sender is unknown to me. (1)	○	○	○	○	○
I download any files onto my work computer that will help me get the job done. (17)	○	○	○	○	○
When accessing the Internet at work, I visit any website that I want to. (18)	○	○	○	○	○
I assess the safety of websites before entering information. (11)	○	○	○	○	○
I do not regularly review my social media privacy settings. (7)	○	○	○	○	○
I do not post anything on social media before considering any negative consequences. (9)	○	○	○	○	○
I post whatever I want about my work on social media. (22)	○	○	○	○	○
When working in a public place, I leave my laptop unattended. (23)	○	○	○	○	○
I send sensitive work files using a public Wi-Fi network. (24)	○	○	○	○	○
I check that strangers can't see my laptop screen if I'm working in a café. (25)	○	○	○	○	○
When sensitive print-outs need to be disposed of, I ensure that they are shredded or destroyed. (26)	○	○	○	○	○
I wouldn't plug a USB stick found in a public place into my work computer. (27)	○	○	○	○	○
I leave print-outs that contain sensitive information on my desk when I'm not there. (28)	○	○	○	○	○
If I saw someone acting suspiciously in my workplace, I would do something about it. (29)	○	○	○	○	○
If I noticed my colleague ignoring security rules, I wouldn't take any action. (30)	○	○	○	○	○
If I noticed a security incident, I would report it. (31)	○	○	○	○	○

[PAGE BREAK]

Please read each statement carefully and decide if you ever feel this way about your job. If you have never had this feeling, cross the '0' (zero) in the space after the statement. If you have had this feeling, indicate how often you feel it by crossing the number (from 1 to 6) that best describes how frequently you feel that way.

	Never (0)	Almost Never (1)	Rarely (2)	Someti mes (3)	Often (4)	Very Often (5)	Always (6)
At my work, I feel bursting with energy	○	○	○	○	○	○	○
At my job, I feel strong and vigorous	○	○	○	○	○	○	○
I am enthusiastic about my job	○	○	○	○	○	○	○
My job inspires me	○	○	○	○	○	○	○
When I get up in the morning, I feel like going to work	○	○	○	○	○	○	○
I feel happy when I am working intensely	○	○	○	○	○	○	○
I am proud on the work that I do	○	○	○	○	○	○	○
I am immersed in my work	○	○	○	○	○	○	○
I get carried away when I'm working	○	○	○	○	○	○	○

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How strongly do you agree or disagree with the following statements?

	SD (5)	D (4)	NAnD (3)	A (2)	SA (1)
Some of my colleagues will ignore information security policies to get the job done.	○	○	○	○	○
I would feel comfortable reporting a mistake I made at work that could have information security implications.	○	○	○	○	○
I believe that meeting deadlines is more important than complying with information security policies.	○	○	○	○	○
My colleagues generally behave in a secure manner when they are using a computer.	○	○	○	○	○
I would feel comfortable reporting a mistake someone else made at work that could have information security implications.	○	○	○	○	○
In my organisation, it is expected that I meet deadlines even if it means ignoring information security policies.	○	○	○	○	○

[PAGE BREAK]

How strongly do you agree or disagree with the following statements?

	SD (1)	D (2)	NAnD (3)	A (4)	SA (5)
Most employees are highly involved in their work	○	○	○	○	○
Decisions are usually made at the level where the best information is available	○	○	○	○	○
Information is widely shared so that everyone can get the information he or she needs when it's needed	○	○	○	○	○
Everyone believes that he or she can have a positive impact	○	○	○	○	○
Business planning is ongoing and involves everyone in the process to some degree	○	○	○	○	○
Cooperation across different parts of the organisation is actively encouraged	○	○	○	○	○
People work like they are part of a team	○	○	○	○	○
Teamwork is used to get work done, rather than hierarchy	○	○	○	○	○
Teams are our primary building blocks	○	○	○	○	○
Work is organised so that each person can see the relationship between his or her job and the goals of the organisation	○	○	○	○	○
Authority is delegated so that people can act on their own	○	○	○	○	○
The "bench strength" (capability of people) is constantly improving	○	○	○	○	○
There is continuous investment in the skills of employees	○	○	○	○	○
The capabilities of people are viewed as an important source of competitive advantage	○	○	○	○	○
Problems often arrive because we do not have the skills necessary to do the job (RS)	○	○	○	○	○

[PAGE BREAK]

ISA & CULTURE

How strongly do you agree or disagree with the following statements?

	SD (1)	D (2)	NAnD (3)	A (4)	SA (5)
The leaders and managers “practice what they preach”	○	○	○	○	○
There is a characteristic management style and a distinct set of management practices	○	○	○	○	○
There is a clear and consistent set of values that governs the way we do business	○	○	○	○	○
Ignoring core values will get you in trouble	○	○	○	○	○
There is an ethical code that guides our behaviour and tells us right from wrong	○	○	○	○	○
When disagreements occur, we work hard to achieve “win-win” solutions	○	○	○	○	○
There is a “strong” culture	○	○	○	○	○
It is easy to reach consensus, even on difficult issues	○	○	○	○	○
We often have trouble reaching agreement on key issues (RS)	○	○	○	○	○
There is a clear agreement about the right way and the wrong way to do things	○	○	○	○	○
Our approach to doing business is very consistent and predictable	○	○	○	○	○
People from different parts of the organisation share common perspective	○	○	○	○	○
It is easy to coordinate projects across different parts of the organisation	○	○	○	○	○
Working with someone from another part of this organisation is like working with someone from a different organisation (RS)	○	○	○	○	○
There is a good alignment of goals across levels	○	○	○	○	○

[PAGE BREAK]

How strongly do you agree or disagree with the following statements?

	SD (1)	D (2)	NAnD (3)	A (4)	SA (5)
The way things are done is very flexible and easy to change	○	○	○	○	○
We respond well to competitors and other changes in the business environment	○	○	○	○	○
New and improved ways to do work are continually adopted	○	○	○	○	○
Attempts to create change usually meet with resistance (RS)	○	○	○	○	○
Different parts of the organisation often cooperate to create change	○	○	○	○	○
Customer comments and recommendations often lead to changes	○	○	○	○	○
Customer input directly influences our decision	○	○	○	○	○
All members have a deep understanding of customers wants and needs	○	○	○	○	○
The interests of the customer often get ignored by our decisions (RS)	○	○	○	○	○
We encourage direct contact with customers by our people	○	○	○	○	○
We view failure as an opportunity for learning and improvement	○	○	○	○	○
Innovation and risk taking and encouraged and rewarded	○	○	○	○	○
Lots of things “fall between the cracks” (RS)	○	○	○	○	○
Learning is an important objective in our day-to-day work	○	○	○	○	○
We make certain that the “right hand knows what the left hand is doing”	○	○	○	○	○

[PAGE BREAK]

How strongly do you agree or disagree with the following statements?

	SD (1)	D (2)	NAnD (3)	A (4)	SA (5)
There is a long-term purpose and direction	○	○	○	○	○
Our strategy leads other organisations to change the way they compete in the industry	○	○	○	○	○
There is a clear mission that gives meaning and direction to our work	○	○	○	○	○
There is a clear strategy for the future	○	○	○	○	○
Our strategic direction is unclear to me (RS)	○	○	○	○	○
There is widespread agreement about goals	○	○	○	○	○
Leaders set goals that are ambitious, but realistic	○	○	○	○	○
The leadership has "gone on record" about the objectives we are trying to meet	○	○	○	○	○
We continuously track our progress against our stated goals	○	○	○	○	○
People understand when needs to be done for us to succeed in the long run	○	○	○	○	○
We have shared vision of what the organisation will be like in the future	○	○	○	○	○
Leaders have a long-term viewpoint	○	○	○	○	○
Short-term thinking often compromises our long-term vision (RS)	○	○	○	○	○
Our vision creates excitement and motivation for our employees	○	○	○	○	○
We are able to meet short-term demands without compromising our long-term vision	○	○	○	○	○

[PAGE BREAK]

We invite you to comment on this questionnaire
[open text answer]

While completing this survey were you only focussing on this task?

○ Yes (1)

a) Yes - Only focussing on this task

○ No (2)

a) No - Switching between tasks on this device (e.g. completing other surveys or checking social media)
b) No - Participating in tasks outside of this device (e.g. childminding or watching television)
c) No - Other

Did you respond randomly at any point during the study?

○ Yes (1)
○ No (2)

○ **Did you search the internet (via Google or otherwise) to assist with answering any questions?**

○ Yes (1)
○ No (2)

Thank you for taking the time to complete this survey.

It is greatly appreciated.

If you have any questions or feedback related to the study, please contact us via the details below:

Ms Agata McCormac
Phone: (08) 7389 5787
Email: Agata.McCormac@adelaide.edu.au

If you wish to speak with an independent person, please contact Paul Delfabbro, Chair of the Subcommittee for Human Research Ethics in the School of Psychology on (08) 8313 4936 or Paul.Delfabbro@adelaide.edu.au

Thank you again for taking the time to take part in this study!

Appendix C: Participant Information Sheet

PARTICIPANT INFORMATION SHEET

PROJECT TITLE: Computers at Work - Investigation of the Human Aspects of Cyber Security.
HUMAN RESEARCH ETHICS COMMITTEE APPROVAL NUMBER: H-18-38
PRINCIPAL INVESTIGATOR: Ms Agata McCormac

Dear Participant,

You are invited to participate in the research project described below.

What is the project about?
This research project is investigating people's knowledge, attitude and behaviour towards computer use at work. Through this research, we hope to better understand how individuals use computers, laptops, smartphones and tablets for work purposes and how this relates to their organisation.

Who is undertaking the project?
This project is being conducted by researchers from the University of Adelaide and the Defence Science and Technology Group. The principal researcher is Agata McCormac.

Why am I being invited to participate and what will I be asked to do?
This project is seeking participants who are adults living in Australia. Individuals must also be employed (full-time, part-time or casually) and must use a computer or portable device for some of their time spent at work. You will be asked to complete an online survey.

How much time will the project take?
The survey will take you approximately 30 minutes to complete.

Are there any risks associated with participating in this project?
There are no foreseeable risks. In the case of any unforeseen event or incident, which may have an effect on you as the participant, you can contact the researchers. Furthermore, you can discuss any issues with Paul Delfabbro, Chair of the Subcommittee for Human Research Ethics in the School of Psychology.

What are the benefits of the research project?
While there are no direct benefits to participants, this study will enable us to better understand employees' knowledge, attitude and behaviour towards using computers at work. This should help to inform organisations on appropriate policies and procedures.

Can I withdraw from the project?
Participation in this project is completely voluntary. If you agree to participate, you can withdraw from the study at any point before the submission of the survey. After this point, because your data is anonymous, we are unable to remove it.

What will happen to my information?
The information gathered in this survey will be stored electronically, retained for a minimum of five years. Identifiable data will only be accessible to the research team and non-identifiable data may be

shared with collaborative research partners. All data is non-identifiable, which means it is not possible for the researchers to identify a specific individual. The results will be published in conference proceedings and journals.

Who do I contact if I have questions about the project?
If you have questions or problems associated with the practical aspects of your participation in the project, or wish to raise a concern or complaint about the project, then please contact Ms Agata McCormac [redacted]

What if I have a complaint or any concerns?
The study has been approved by the Human Research Ethics Subcommittee of the University of Adelaide School of Psychology (approval number H18/38). If you wish to speak with an independent person regarding concerns or a complaint, the University's policy on research involving human participants, or your rights as a participant, please contact Professor Paul Delfabbro, Chair of the School of Psychology, Human Ethics Subcommittee on (08) 8313 4936 or paul.delfabbro@adelaide.edu.au

Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

If I want to participate, what do I do?
Please return to the online survey, and complete the question, *'I have read the Information Sheet titled "Computers at Work" and I consent to take part in the current study'*.

Yours sincerely,

Ms Agata McCormac