Psychological Character of Computer-related TECHNOSTRESS

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ABSTRACT

The strain experienced by computer-users due to the rapid developing computer environment, known as technostress, is often ignored seeing that it is not seen as a real type of psychological stress such as post-traumatic stress etc.

This paper is concerned with showing that there is theoretical congruence between computer-related technostress and psychological stress. This is accomplished by examining the onset and nature of psychological stress and comparing it with the characteristics of computer related technostress at the hand of a well-recognised psychological stress model. The resulting finding made is that strong theoretical congruence exists.

Keywords

Technostress; computer anxiety; negative computer thoughts; negative attitudes towards computers

INTRODUCTION

The first digital computer, the ENIAC, was designed and built by John W. Mauchly and J. Presper Eckert at the Ballistic Research Laboratory in the United States of America, midway through the twentieth century (Long & Long, 1986:60). At about the same time, Thomas Watson, chairman of IBM, stated that he foresaw the world market for computers to be no bigger than approximately five computers (White, 2000).

At that time the electronic computer was not expected to have a significant influence on the world, because the early computers were enormous, expensive, sophisticated, difficult to operate and only within the financial reach of governments and research institutions (Long & Long, 1986:61). They were thus completely inaccessible to the larger population. Yet, a mere 50 years later, at the turn of the century, the National Academy of Engineering (NAE) of the United States of America set out to identify and prioritise the greatest engineering achievements of the twentieth century – those achievements that have shaped and changed the world most significantly (NAE, 2000). The academy voted the computer to be number eight on their list of the 20 greatest engineering achievements of the twentieth century, and the Internet number 13 (as per Table 1 below):

1. Electrification
2. Automobile
3. Aeroplane
4. Water supply and distribution
5. Electronics
6. Radio and television
7. Agricultural mechanisation
8. Computers
9. Telephone
10. Air-conditioning and refrigeration
11. Highways
12. Spacecraft
13. Internet
14. Imaging
15. Household appliances
16. Health technologies
17. Petroleum and petrochemical technologies
18. Laser and fibre optics
19. Nuclear technologies
20. High-performance materials

TABLE 1: Greatest engineering achievements of the 20th century (NAE, 2000)

According to the NAE, the computer is a defining symbol of twentieth-century technology and a tool that has transformed businesses and lives around the world. It has increased productivity and has provided easy access to vast amounts of knowledge. Computers have relieved the drudgery of simple tasks, and have provided new capabilities to deal more effectively with complex ones. This computer revolution was fuelled by engineering ingenuity. Engineering developments have continuously made computers faster, more powerful, and more affordable (NAE, 2000) – thus bringing them into the offices and homes of ordinary people.

The computer has forever changed how individuals live and work. Graphics-driven software makes computers easy to use and has opened new worlds to countless people through the Internet. People now have access to

unprecedented amounts of knowledge, and can communicate freely in a world forum. In this respect, the real computer revolution is not one of numbers and bytes, but one in which people, regardless of geography and politics, can share information and learn from one another (NAE, 2000). Computer technology has become an integral part of modern life. Some individuals have welcomed and embraced computerisation with open arms, others feel uncomfortable around computers, while yet others find the mere thought of dealing with technology frightening (Rosen & Weil, 1992:4).

COMPUTER RELATED TECHNOSTRESS

Craig Brod alleges that the human race has fallen in love with the computer, embracing it as the cure-all for all problems (Brod, 1984:3-4). He proceeds by pointing out that the possible consequences of this infatuation are largely overlooked. The same mistake is made as was made with the advent of the motorcar. The latter technological invention enabled people to travel faster, further and more conveniently (Brod, 1984:3). Furthermore, their devotion to this new invention prevented them from realising the high price exacted by the consequences of this technological advancement, for example road fatalities, decaying railroad and public transport systems, cities divided by freeways and air pollution caused by exhaust fumes.

When considering the impact of computerised technology, one should take heed of its merits as well as its perils. The computer undoubtedly helps many people to be more productive, but its influence is not entirely benign (Brod, 1984:3). Although computers do many useful things *for* people, it also does something *to* them, namely causing technostress (Rosen & Weil, 1997a:5). Technostress may be regarded as an inability to cope with new computer technologies in a healthy way. It manifests itself in two distinct but related ways: firstly, in the struggle to accept computer technology, and secondly, in the more specialised form of over-identification with computer technology (Brod, 1984:16).

Based on their research, Rosen and Weil (1992:8-9) have found that technostress is composed of three separate but overlapping dimensions, namely *anxiety*, *negative cognitions* and *negative attitudes*.

Furthermore, Rosen and Weil's (2000b) research on an American sample has indicated that people react to computer technology in a characteristic fashion, based on the level of technostress they experience. Three groups have been identified:

Eager Adopters whom embrace and enjoy technology thus experiencing *no* technostress.

Hesitant "Prove Its" whom are not anti-technology, nor technophobic, waiting on the sidelines for prove that computer technology will benefit them. This group experiences *low* levels of technostress.

Resisters do not like technology, do not want it, and do not find it enjoyable, thus avoiding it. Resisters suffer *moderate* to *high* levels of technostress.

Rosen and Weil (2000a; 2000b) performed five field-studies between October 1995 and November 1999 to determine the presence and levels of technostress among 3129 full-time employees from a cross-section of companies in the urban southern California area. The research results indicated that there were significant changes in levels of technostress over this period. These changes were similar for both clerical/support staff and managers/executives. Three trends were evident. The number of Hesitant "Prove Its" increased while the number of Eager Adopters and Resisters decreased. (Rosen & Weil, 2000a; 2000b).

What is disturbing about the results of these studies is that 70% of all clerical/support staff and 65% of all managerial staff experience some degree of technostress, consequently making them indecisive about committing to new computer technology that otherwise, might have given their organisations an competitive edge to ensure return on investment.

Furthermore, although the modern computer has infiltrated the workplace as an integrated tool, with a great deal of information available regarding its *ergonomical* specifications, no definite information exists about the employee's *psychological reactions* to the computer.

PSYCHOLOGICAL STRESS

Since Hans Selye, the Canadian scientist, first discovered and introduced the concept of "psychological stress" in 1936, stress became a very relevant area of study. The most significant commonalties arising from this research can be summarised as follow:

Stress is unavoidable because it results from events most likely to occur in the life of normal or average individuals (Oltmanns & Emery, 1998:287; Selye, 1976:63).

Stress can be ether positive or negative where pleasant stress is known as "eustress" (meaning "good stress") and unpleasant stress as "distress" (meaning "bad stress") (Selye, 1976:74; Oltmanns & Emery, 1998:288; Strümpfer, 1986:543).

Stress has physiological and psychological effects contributing to the onset of psychosomatic disorders. (Louw, 1992:264; Carson & Butcher, 1992:146-149; Oltmanns & Emery, 1998:289; Barlow & Durand, 1995:335; Strümpfer, 1986:544).

Factors predisposing an individual to stress are a combination of the: importance, duration, accumulation, multiplicity, imminence and perception of threat opposite adjustment demands (Louw, 1992:264; Carson & Butcher, 1992:143-144; Oltmanns & Emery, 1998:288). Also an individual's level of stress tolerance and access to positive external resources as well as social and family support can cause or prevent the onset of stress (Carson & Butcher, 1992:143-144).

Coping strategies

Many coping strategies have been identified. According to Van der Linde (1999:47-50), the integration of the most prominent coping models produce two main types of strategies, namely *approach strategies* and *avoidance strategies*.

Approach Strategy (task-oriented response) when a person feels capable of handling a stressful situation, a *task-oriented response* is typical – that is, behaviour that is directed primarily at dealing with the requirements of the stressor. Typically, this response means that the individual objectively appraises the situation, works out alternative solutions, decides on an appropriate strategy, takes action, and evaluates feedback.

Avoidance Strategy (defence-oriented response) when a person's feelings of adequacy are seriously threatened by a stressor, a defence-oriented response tends to prevail – that is, behaviour is directed primarily at protecting the self from hurt and disarray, rather than at resolving the situation. Typically, the person using defence-oriented responses has forsaken more productive task-oriented action in favour of an overriding concern for maintaining the integrity of the self, however ill advised and self-defeating the effort may prove to be.

Basic psychological stress models

Since the inception of psychological stress as concept, progressive models evolved as the result of ongoing research. Initially Hans Selye, defined psychological stress as "an adverse reaction" (a *response*) and coined the R model of stress (Oltmanns & Emery, 1998:288). Then came researchers such as Holmes and Rahe, whom defined stress as "a life event" (a *stimulus*) and developed the S-model (Oltmanns & Emery, 1998:287). Later Richard T. Lazarus, defined stress more comprehensively as *both a stimulus and a response* by developing the so-called S-R model of psychological stress (Oltmanns & Emery, 1998:289).

Stimulus-Organism-Response model of D. Strümpfer

Strümpfer (1986:536) expanded on Lazarus's model by referring to any factor in the environment that acts as a stimulus to stress as the *stressor*. He also stated that the stressor has to be perceived and appraised by the individual before it will have any effect, and the internal, psychological experience of this effect is referred to as *stress*. Perceived stress, in turn, leads to external effects (like physical or mental ill health) or behavioural consequences, referred to as *strains*. Strümpfer approached his model of stress from an organisational point of view and did his research within the South African context. Strümpfer's most important contribution is his expanded stimulus-organism-response (S-O-R model) of organisational stressors and their interaction with one another. (Strümpfer, 1986:536).

To explain this S-O-R model, and especially the dynamic interplay back and forth between the stress variables, Strümpfer (1986:537) uses the flow diagram in Figure 1 below.

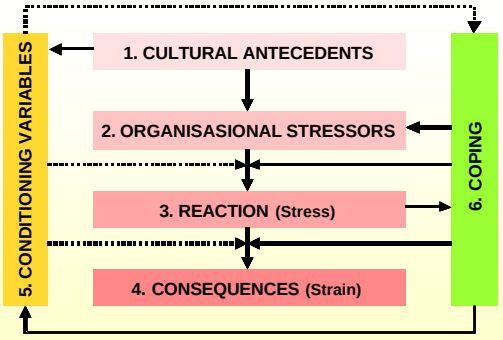

FIGURE 1 : ***Strümpfer's SOR model for psychological stress***

TECHNOSTRESS' CONGRUENCE WITH PSYCHOLOGICAL STRESS

The variables referred to within the expanded S-O-R stress model of Strümpfer will be used to conceptualise the congruence of technostress with stress. The method followed to achieve this involves moving the focus from organisational issues to computer-related issues within the construct. The adapted model is depicted in Figure 2 below.

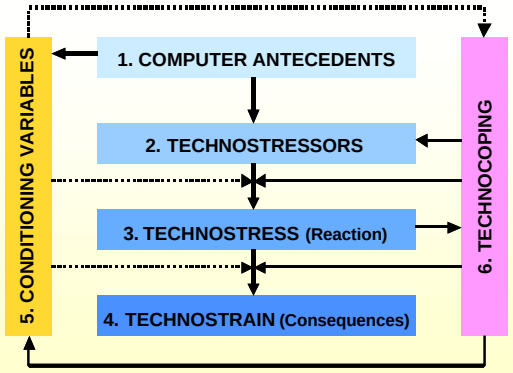

FIGURE 2 : ***Technostress model adapted from Strümpfer (1986:537)***

In addition, relevant literature about technostress will be consulted to explore and confirm the likely level of congruence between technostress and stress.

Computer antecedents

In his model, Strümpfer emphasises that stress should not be considered in the individual context only, but rather in an environmental context, to include all influences and systems impacting on the individual or group (Strümpfer, 1986:538).

Considering this, as well as the nature of the current fourth-generation computers, the influence of the technological background is evident. There is an increasing demand upon employees to adopt to computer-based work-systems and practices, with particular emphasis on developing the necessary work-skills for task accomplishment by using and mastering unfamiliar technology (Fisher, 1999). This environment of change, even though it is constant and has direction, makes adaptation difficult for the human, because

he/she has no choice in the matter (Kunishige, 1997). The work environment has undergone rapid computerisation, with constantly improving technology (Figueiredo, 1994). Such technologies change so rapidly that there is no time to respond adequately causing technostress (Rosen & Weil, 1997a:8).

According to Brod (1984:13) we have been abruptly placed in this environment, with the reassurance that the computer is merely a new and easily digestible addition to current office equipment. Yet, most employees end up feeling incompetent, ill at ease, and blaming themselves for a lack of adaptability to systems that are actually difficult to comprehend. The high-tech industry has tried to allay this anxiety by claiming that the computer is merely a tool to be used as we see fit.

By simply naively accepting computer technology, many people have failed to understand the new values, integral to a technocentred culture, that they have to absorb (Brod, 1984:13). This may result in symptoms such as frustration, job inefficiency and feelings of being overwhelmed and out of control (Bland, 1999).

Technostressors

The environmental factor that has to be perceived and appraised by the individual before it has an effect is referred to as the *stressor* (Strümpfer, 1986:536).

With reference to technostress, the factors from the corporate computer environment that affect the individual are referred to as *technostressors*. The most common of such technostressors are:

Organisational factors

A computer user in a company does not work in a sealed bubble or vacuum. He/she operates in the context of an organisation of people each performing different duties within a larger framework of the organisation's facilities, policies, culture and management, all influencing the impact of stressors and the individual's response to them. If there are not enough staff members and/or equipment to provide more than rudimentary services, if staff perceive that their ideas are ignored and their efforts unnoticed, if no rewards or inducements are offered for professional development, if the organisation's priorities are unclear or its rhetoric so broad as to be meaningless, technostress is more likely to lead to frustration and avoidance, rather than to engagement and mastery (Kupersmith, 1992). All these can contribute to a sense of malaise and abandonment, especially for the individual that is least able to deal successfully with technology and its demands (Kupersmith, 1992).

Information overload

Tension is created when the sheer volume of incoming information about new technologies and techniques exceeds what the individual can reasonably absorb. Intellectual and professional curiosity can turn into frustration when data about new systems, or changes in existing systems, come in so rapidly that there is no chance to find meaningful patterns or to develop a base of experience. Kupersmith (1992) quotes Richard Saul Wurman as saying that information anxiety can take the form of "a chronic malaise, a pervasive fear that we are about to be overwhelmed by the very material we need to master in order to function in this world". Furthermore, narrowing one's field of information is essential; yet, many approach such decisions with apprehension because they involve eliminating possibilities (Kupersmith, 1992).

Role conflicts

Underlying the obvious problems of learning and performing new tasks, are the questions of identity and self-worth that arise when employees feel the friction between different, and sometimes contradictory, functions and self-definitions. Many employees entered their professions when the normal paradigm of service involved providing answers from printed reference sources (Kupersmith, 1992). However, now, with the rapid emergence of new technologies, employees are forced to work differently. This changes their roles continuously, because the technological changes are ongoing.

Multitasking

According to Pendlebury *et al*. (1998:2), change means no longer being the same, but being in a state of evolution or flux. In this process, *businesses aim for ever-higher levels of performance* in all areas: quality of products and services, frequency of new product launches, speed of response to customer demand, productivity, and so on. One way of achieving this is by using the latest computer technology available, because computer systems are designed to be efficient multitaskers (Weil, 1997). By using computers effectively, multitasking (polyphasic activity) is accomplished more rapidly and more efficiently, thus improving productivity (Baldwin, 1995).

Human beings have the ability to multitask (Weil, 1997), but only to a certain level. Switching from one task to the next without finishing any one of them over-stimulates the physiological capabilities as well as the cognitive capabilities. This leads to, for example, sleep interruption, or waking in the middle of the night with one's brain firing off ideas, which one feels compelled to scribble down immediately for fear of forgetting them. It also leads to forgetfulness, as well as difficulties with concentration (Weil, 1997) – and eventually technostress.

Constant interim

Pendlebury *et al.* (1998:1-3) point out that computer technologies quickly become obsolete. The shelf life of products is becoming increasingly more limited, and competition leads to more and more innovation. This situation of *"being temporary and subject to change"* presents many problems, such as the *feeling of being continuously in an interim stage* easily leads to dissatisfaction and to lower standards of skill, quality and effectiveness. Any imperfection or dysfunction is more

readily accepted if the situation it derives from is regarded as temporary.

Change, then, becomes the *perfect alibi for a failure* to give total commitment to the current state of affairs. This is a common phenomenon among businesses that change their systems every time there is a change in fashion.

Similarly, there is a danger that *technical staff will become less competent*, since achieving full competence in this new world requires a considerable amount of effort over a shorter stretch of time. The pressure to acquire knowledge quickly is offset by the realisation that everything will soon have to be relearned in order to keep up with technological developments. Nothing is acquired for good. Everything is continually called into question.

Time compression

The reality is that technology *can* do things faster than before. People, however, have their limitations. Constant exposure and habituation to the omnipresent clock, and the tendency to measure oneself against the speed at which technology accomplishes tasks, causes one to misperceive time and fall victim to what is called "time compression" (Rosen & Weil, 1997a:117). Time compression is the phenomenon of estimating the amount of time it takes to do something as a much shorter period than it really is. People think that since technology can work quickly, so can they. They also do not take into account all the important parts of a task in their time estimations. Rather than looking at the whole process, they only consider a piece or component.

People become highly self-critical when they cannot complete a task in the time they estimated they would need to complete it. As they watch the clock slide past the expected completion time, they become frustrated and wonder what is wrong with them. They find themselves always feeling as if they are falling behind, always rushing around, and always battling a sense of failure (Rosen & Weil, 1997a:118).

Cognitive labour

In the modern organisation, most work is done mentally, not physically. Work is increasingly defined as intellectual information processing enhanced by available technology. To be successful, the individual must know a lot and be able to think his/her way through new problems (Baldwin, 1995). Even at home adults must constantly contend with new information: helping children with complex homework assignments, using a calculator or home computer, learning to operate a VCR, DVD or a microwave oven. The human mind goes a mile a minute all day, every day, trying to cope with all it has to do. Because mental information processing and problem-solving can go on no matter where one is, it becomes increasingly difficult to turn off the process long enough to relax and unwind, even when it is necessary (Baldwin, 1995).

Abstraction

The reason why computers are so complicated, according to Rosen and Weil (1997a:33), is because today's technology is invisible. Previously, most broken things could be taken apart, fixed, and put back together. Should one see a television with the back panel removed one would easily be able to identify the tube. If the vacuum cleaner stopped suctioning, the bottom could be removed, the belt replaced, and it could be put back together. Mechanical things are easily fixable, but computerised technology not necessarily. Taking apart a computer, one finds boards and miniaturised computer chips, whose functions do not relate to their form. There are no longer understandable pieces, such as tubes, pulleys, belts or gears that allow one to make some sense of how they function.

And how do computers work anyway? How does e-mail really cross vast distances? What happens inside a fax machine? The workings of today's technology are not obvious. One has difficulty understanding what one cannot see, touch or fix. And, of course, it is human nature to fear or avoid what we cannot understand or explain (Rosen & Weil, 1997a:33).

Diffused boundaries

Just as interpersonal and perceptual boundaries protect the physical area in which one operates, *time-role boundaries* enable the individual to switch roles during the day without slipping into utter chaos. Most people assume a variety of roles – professional, parent, friend, lover, child, playmate, and more, all in the span of 24 hours (Rosen & Weil, 1997a:54). One way to keep sane among all these changes is through the use of time boundaries assigned to various roles. One sets the alarm clock to go off when it is time to wake up, marking the start of one's daily roles. One knows when it is time to get the kids to school (parent role), time to leave for work (professional role), time to go home (parent/spouse role), and so on. Throughout the day, people set internal expectations of what they will be doing and what will be expected of them, which helps maintain time-defined roles (Rosen & Weil, 1997a:54).

Since people cannot assume more than one role at a time, they are accustomed to switching from one role to another. They expect to switch between certain roles within a particular time frame, which makes such transitions easier. However, even these expected switches can be stressful (Rosen & Weil, 1997a:54).

The most difficult and disruptive kind of role switching takes place when the individual is caught by surprise. For example, an individual does not typically expect to assume certain roles, such as professional and parent, at the same time, so they do not make for an easy back-and-forth transition. That is why it is so disturbing to be at work and receive a telephone call from one's child's school, or to be at home and get a call from one's boss (Rosen & Weil, 1997a:55). Rosen and Weil (2000b) found that both managers and clerical/support staff drastically increased

their use of computers after hours at home to perform surplus office work. Significantly, this caused increased levels of technostress, because of bringing the office role home.

Constant learning and change

Technology, according to Baldwin (1995) not only processes information quickly, it also rapidly produces new information. A major consequence of this capability is that individuals, no matter what their careers might be, are constantly barraged with new and relevant information. In many cases, new information triggers change. New laws, new procedures, and myriad journals to read have become a reality of our current lifestyle, both personally and professionally. Consequently, no professional can ever feel completely up-to-date in his/her field. Ongoing learning is required to keep up with change.

Increased time spent in sedentary work

Computer users sit before computers and telecommunications equipment for long hours each day. At home, they also spend hours in front of the television set, video games, and other electronic equipment. The trend towards home-based offices increases the tendency to lead a sedentary life. Mental labour consumes a great deal of energy and produces a deep emotional and intellectual fatigue that is quite different from physical fatigue – resulting in increased technostress (Baldwin, 1995).

Difficulty separating from work

In the past, when work was more physical and less cognitive, it was relatively easy to remove oneself physically from one's work, because one could not take it home. While there were telephones, they were only a minor intrusion into home life compared with today's paging systems, fax machines, e-mail networks, teleconferencing facilities, cellular telephones and portable computers. Because of this new technology, it is much more difficult to go home (or on vacation) and truly get away from one's work. One cannot relax when one is carrying a beeper that may go off any minute, or when one has telephone messages or faxed material constantly delivered at one's hotel room. Stress builds up when one is perpetually anticipating such interruptions of one's leisure time (Baldwin, 1995).

Technostress (reaction)

Stress, according to Strümpfer (1986:536), is the internal psychological experience of the individual after he/she has perceived and assessed a stressor to have an effect on his/her functioning. Similarly, technostress is the individual's *reaction* to computer technology after he/she has perceived changes due to the influence of technology and the negative effect of these changes on his/her thoughts, attitudes, behaviour or body (Rafter, 1998).

Research done by Rosen and Weil revealed that technostress consists of three internal psychological reactions (Rosen & Weil, 1998:4).

Anxiety reaction

This means that the individual experiences anxiety symptoms such as tension headaches, sweaty palms, heart palpitations and a queasy stomach when thinking about or using computer technology (Rosen & Weil, 1997b). The individual can also experience anxiety about possible present or future interactions with computers or computer-related technology (Rosen & Weil, 1992:7) as well as anxieties related to future job stability, the ability to perform, compensation, position, stature, and working relationships (Pendlebury *et al*., 1998:xi).

Brod (1984:16) further elaborates on the symptoms of technostress: "The primary symptom of those who are ambivalent, reluctant, or fearful of computers is anxiety. This anxiety is expressed in many ways: irritability, headaches, nightmares, and resistance to learning about the computer or outright rejection of the technology. Technoanxiety most commonly afflicts those who feel pressured – by employers, peers, or the general culture – to accept and use computers."

Cognitive discomfort

In the case of cognitive discomfort, the individual may not experience any physiological signs or symptoms, but instead is bombarding himself/herself internally with many self-deprecating statements and *thoughts*, such as "I'm never going to figure this out" or "I'm going to hit the wrong key and this is going to blow up" (Rosen & Weil, 1997b). Cognitive discomfort thus involves specific negative cognitions or self-critical internal dialogues during actual computer interaction or when contemplating future computer interaction (Rosen & Weil, 1992:8).

Bipolar discomfort

Bipolar discomfort involves both the cognitive discomfort and the anxiety symptoms described above, thus creating a definite *attitude* towards computer technology (Rosen & Weil, 1997b). This aspect may thus be defined as negative global attitudes about computers, their operation or their societal impact (Rosen & Weil, 1992:8).

Technostrain (consequences)

Perceived stress, in turn, leads to external effects like physical or mental ill health, or behavioural consequences such as excessive smoking, low productivity or lack of job satisfaction (Strümpfer, 1986:536). From the researched resources, the following consequences are evident:

Physical consequences

The most common physical consequences of technostress are tension headaches, sweaty palms, heart palpitations, queasy stomach (Rosen & Weil, 1997b), irritability, headaches and nightmares (Brod, 1984:16).

Mental consequences

The mental consequences of technostress largely centre on frustration and feelings of being overwhelmed and out of control (Bland, 1999). These consequences also involve self-deprecating statements and thoughts regarding

computer usage (Rosen & Weil, 1997b), future job stability, ability to perform, compensation, position, stature, and working relationships (Pendlebury *et al*., 1998:xi). Mental consequences may also manifest as a resistance to learning about the computer or an outright rejection of the technology (Brod, 1984:16).

Behavioural consequences

Brod (1984) identifies two primary behaviours:

Technocentred behaviour

Technocentred people are people who perceive computer technology as non-threatening and over-identify with it. Such individuals are highly motivated and eager to adapt to new technologies, adopting a mindset that mirrors that of the computer itself (Brod, 1984:17). Technocentred people easily lose track of time (Brod, 1984:93), while displaying signs of a high degree of factual thinking, poor access to feelings, an insistence on efficiency and speed, a lack of empathy for others, and a low tolerance for the ambiguities of human behaviour and communication (Brod, 1984:17).

Rosen and Weil refer to this category of individuals as Eager Adopters (Rosen & Weil, 1997a:17). Eager Adopters love technology and are usually the first to buy new technological gadgets (Rosen & Weil, 1997a:17), regard technology as fun and challenging and enjoy playing and tinkering with it because it holds a high intrinsic attraction for them and they are literally drawn to it (Rosen & Weil, 1997a:18). Eager Adopters expect to have problems with technology and either figures out the solution or finds someone who can. In fact, for the Eager Adopter, solving problems with technology can be fulfilling and satisfying. From their research, Rosen and Weil have established that Eager Adopters account for 10% to 15% of the American population (Rosen & Weil, 1997a:18).

Within this category hides an extreme pathological reaction also referred to as "computer philia", or "computer addiction" (Barker, 1997). Individuals experiencing this reaction display microcomputer mania, with the following symptoms: cruising computer stores, using computer terms in non-computer conversations, social withdrawal in favour of terminal time, sleep disturbance, lack of exercise, relationship problems resulting from excessive terminal time, overspending on computers, and high states of anxiety when separated from their computers (Barker, 1997).

Technoanxious behaviour

Technoanxious people, on the other hand, perceive computer technology to be threatening. They are ambivalent towards, reluctant about and fearful of computers, and struggle to accept such technologies (Brod, 1984:17).

Rosen and Weil have identified the following two subcategories in this technoanxious group:

Resisters avoid technology. Rosen and Weil found this group to be the second-largest technological group in America, encompassing 30% to 40% of the population (Rosen & Weil, 1997a:19). Resisters want nothing to do with technology, no matter what anyone says or does to convince them that some of it is useful. Technology is absolutely no fun for these people, who are certain that they will break any machine or gadget that they touch. Because of this, they feel intimidated, embarrassed, or downright stupid. And, sadly, because they generally believe they are the only ones who feel this way, they do not talk about it; they simply try to avoid the computer technology (Rosen & Weil, 1997a:20).

Hesitant "Prove Its" do not think technology is fun and prefer to wait until the worth of a new technology has been proved before trying it. Even then, they hesitate to invest in the technology, wanting to be convinced they need something before buying it. However, if one can demonstrate to a Hesitant "Prove It" how something new will benefit him/her, he/she is willing to consider it (Rosen & Weil, 1997a:18). Hesitant "Prove Its" knows there are problems with technology. Unlike Eager Adopters, however, these people do not think solving such problems is fun. Hesitant "Prove Its" personalise any glitches and assume that they have created the problems. They also differ from Eager Adopters in that they do not believe that solutions are readily available. Hesitant "Prove-Its" account for 50% to 60% of the American population (Rosen & Weil, 1997a:19). In psychological terms, this type of behaviour is somewhat of a misfit. The only possible explanation is that Hesitant "Prove Its" start off by being Resisters, opposing the use of or association with new computer technology, by following a defence-oriented coping response. However, they are not true Resisters at heart. Once the benefit of such new computer technology has been understood, they change from a defence-oriented coping response to task-oriented coping and begin to operate more like technocentred Eager Adopters

Conditioning variables

In the S-O-R model, conditioning variables are the intervening variables within the organism that condition the individual's response to the stressor. Such conditioning variables are mostly psychological (both cognitive and affective) and social in nature and are partially determined by cultural antecedents (Strümpfer, 1986:545). The psychological nature of these variables involves the individual's *skills and abilities* to deal with stressors, as well as his/her intelligence, required to understand stressful situations, to correctly appraise their implications, and to cope through problem solving (Strümpfer, 1986:546). In Figure 2 the various points of conditioning are indicated with broken-line arrows.

Considering the conditioning variables involved in technostress, the following *skills and abilities* have been identified:

Awareness of existing competence

This variable refers to the individual's ability to measure his/her technological competence by what he/she knows – not by what he/she does not know. It is accompanied by the cognition that there will always be more technology than there is time to learn. However, existing knowledge and achievements are valuable and important, and will remain so. Such knowledge and achievements provide the building blocks for future learning, and keep one at the forefront of computer technology (Rosen & Weil, 1999).

Curiosity

In modern organisations, those who love technology are usually called upon to teach others. However, since they understand so much, they tend to get excited, talk rapidly and use lots of jargon and shortcuts – thus scaring new users off. Although it is natural to be hesitant about or resistant to new computer technology, asking questions, no matter how simple, is important to obtain clarity and understanding amongst all the jargon and shortcuts of new technology (Rosen & Weil, 1999).

Analysis of new technology

Technology is best learned in small bytes. The impact of technostressors is lessened if the individual is able to dissect the new technology into small pieces, which are then mastered consecutively. This builds confidence and success (Rosen & Weil, 1999).

Prioritising and completing tasks

When using a computer, humans are drawn into multitasking activities, such as jumping from reading a document, to checking e-mail, to surfing the Web, and back to a document. Unfortunately, the more one multitasks, the more information the human brain is required to juggle – and the more the brain manages to hold, the less efficient one becomes on any one task (Rosen & Weil, 1999). The ability and skill to prioritise, to maintain focus on priorities, to focus on one single task and to allow time to complete each task before moving on counteract the possible negative effects of multitasking (Rosen & Weil, 1999).

Continual learning

There will always be more technology than there is time to learn. With the shelf life of hardware and software dropping to between 6 and 12 months, there is no way to master new technology fully before it needs to be upgraded or replaced. Thus learning and mastering new computer hardware and software is a continual process if one wants to manage one's job and stay close to the forefront of new technology (Rosen & Weil, 1999).

Technological segregation

Technology invades one's personal space and interrupts one's mental focus. Merely hearing the fax machine or the e-mail notification beeping on one's computer can have this effect. Seeing one's computer or phone reminds one of unfinished tasks, especially because all these technologies carry with them strong urges to perform. Taking time away from them can counteract their omnipresent power. Being unreachable on occasion, reconnecting with oneself and one's friends, family and loved ones can calm one. It makes one feel better about new, changing technology and enables one to work more productively (Rosen & Weil, 1999).

Technocoping

According to Strümpfer (1986), people cope with stress mainly in two distinct ways:

Regressive coping is based on the "you are inadequate" theory and its analogy, "stress is bad for you" – resulting in stress avoidance (Strümpfer, 1986:552). This correlates with Brod's (1984) observation of technoanxious behaviour. Technoanxious people perceive computer technology to be threatening. They are ambivalent about, reluctant towards and fearful of computers, and struggle to accept computer technologies (Brod, 1984:17).

Transformational coping takes place when an individual does not avoid or shrink from the situation initiated by a stressful event but confronts it head-on, transforming it into a productive, growth-promoting experience (Strümpfer, 1986:553). This corresponds with Brod's explanation of technocentred behaviour, which takes place when people perceive computer technology to be non-threatening and even over-identify with it. Such individuals are highly motivated and eager to adapt to new technologies, adopting a mindset that mirrors that of the computer itself (Brod, 1984:17).

Coping with technostress is a highly individual matter, since different people react to a situation in different ways. In a sense, all reactions to stress – from initiating a self-instruction program to hiding under one's desk – are forms of coping. Some, however, are more constructive, more appropriate to the workplace, and more likely to succeed than others (Kupersmith, 1992). The following are some specific constructive coping strategies that individuals who are faced with technostress may use.

Relaxation

The increased arousal of the individual is one component of the stress response. This arousal is apparent in physical changes in the heart rate, blood pressure, the central nervous system, the autonomic nervous system, and the endocrine system. It is also evident in the psychological (cognitive) changes experienced by the individual, especially involving an increased awareness of being "stressed". The opposite response of this arousal is the elicitation of the "relaxation response". The elicitation of the relaxation response in the presence of a stressor has been shown to be an effective treatment for stress (Hudiburg, 1996).

Within the modern work environment it is easy to be drawn into the cerebral, precise, high-speed world of the computer. This can cause one to forget the intimate connection between body and mind, which may contribute to the

arousal of technostress (Kupersmith, 1992). Some of the most effective techniques for immediate relaxation work through the body – for example, breathing deeply and regularly, or alternately tensing and relaxing muscles. Other techniques free the mind from mechanical routine – for example, visualising oneself in an idyllic, peaceful setting (Kupersmith, 1992).

Good health

Good general health may be an individual's greatest ally in coping with technostress, as it is with other forms of stress. Taking care of oneself naturally includes getting proper nutrition, exercise and rest. The more intense the work environment, the more important it is to retain one's perspective and to make sure that one's private activities and interests are sufficient to provide both physical and mental variety (Kupersmith, 1992).

Positive attitude

Recognising that stress is natural, that ambivalent feelings towards technology are acceptable, and that many others in the workplace have the same problems, opens the way to a more relaxed and positive attitude (Kupersmith, 1992). This is achieved by positive "self-talk", the internal monologue of self-evaluating statements, replacing negative thoughts with positive affirmations, can be very effective in overcoming self-doubt and perfectionism (Kupersmith, 1992). Also, cultivating a sense of humour, and specifically the ability to laugh at one's own situation, may be the most important technique of all; it is certainly the best barometer of psychological health (Kupersmith, 1992).

Time management

Technostress can become a self-fulfilling prophecy. The perception that one is a victim can get in the way of constructive choices and actions. (Kupersmith, 1992). This situation can be countered by devoting some time each week to learning and exploration. Since there is never enough time, and since urgent everyday demands will always be competing for attention with long-range learning goals, this will probably require a conscious setting of priorities and some skilful time management. To reduce external interruptions and demands, set aside some personal space and time for learning, with the understanding that calls are to be returned later, visitors asked to come back at another time, and e-mail not monitored (Kupersmith, 1992).

Realistic goals

No one can be an expert at everything. To guide the learning process, the individual should pick an area where he/she can make a contribution and concentrate his/her efforts in that area. This personal territory should be approached with a spirit of exploration but also with tangible goals in mind, such as preparing for a demonstration to other staff. When a goal is attained, one should celebrate (Kupersmith, 1992) to internalise and establish the achievement.

Co-operation

While some people work and learn best on their own, many can benefit from the mutual support of a team setting. One useful technique for coping with technostress is to participate in a "mentor system" in which the novice is guided by a more experienced colleague – first watching some actual operations before "soloing" under the mentor's supervision (Kupersmith, 1992).

Hands-on practice

Developing and retaining computer skills requires application of the proverb "I hear and forget; I see and remember; I do and understand". Not surprisingly, researchers have found that experienced computer users perform better than novices in the workplace, and that even a brief acclimatisation can result in significantly enhanced results. While many companies take advantage of the online training provided by vendors and database producers, effective learning requires ongoing, hands-on practice (Kupersmith, 1992).

Prioritisation

Considering the modern trend of downsizing companies, operating a company with static or decreasing staff numbers and a smaller budget is a challenge that requires the explicit setting of priorities at the individual, departmental and corporate levels. The specification of low-level priorities as well as high-level priorities provides ways of operating a company effectively under such conditions. However, should this downsizing trend occur concomitant with an environment of "we do it all", the inability to set priorities may intensify stress among staff (Kupersmith, 1992).

Within the computerised office, the ability and skill to prioritise, to maintain focus on priorities, to focus on one single task and to allow time to complete each task before moving on, counteract the possible negative effects of multitasking as well as the resulting technostress (Rosen & Weil, 1999).

Self-education and training

The first and foremost way of coping with technostress is by education and training. Educating oneself about new developments is an ongoing, problem-focussed coping strategy. Part of the education process is accepting the fact that computer technology will always be changing, with some periods of change slower than others. It is important not to resist change, because resistance is more emotion-focussed and less effective in reducing the stressor. One of the problems with using training and education is the element of time, since there never seems to be enough of it. The training methods used for staff members might have to be individualised to overcome personal time constraints (Hudiburg, 1996).

CONCLUSION

Computer related technostress could thus theoretically be classified as a form of *psychological stress* due to the seemingly strong correlation that exists between these two

concepts. Furthermore, it seems advisable that CHI practitioners should consider stress components such as techno-*stressors*, -stress, -*strain* and -*coping* when designing and implementing new computer technologies thus ensuring the user's *psychological well being*. This in turn will assist in securing the organisation's *competitive edge*, enabling a *return on investment*.

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REFERENCES

1. BALDWIN, B.A. 1995. Unplug yourself from techno-stress. [Web:] http://nervm.nerdc.ufl.edu/update/U950310a.html
2. BARKER, R. 1997. Russel Barker paper on technostress. [Web:] http://www.cas.usf.edu/lis/lis5937/barker.html
3. BARLOW, D.H. & DURAND, V.M. 1995. Abnormal psychology: an integrative approach. New York : Brooks/Cole. 797 p.
4. BLAND, R.L. 1999. Diagnosis: technostress strategies to reducing and preventing technostress. University of South Florida – Health Sciences Centre Library. [Web:] http://www.med.usf.edu/~rbland/stress.htm
5. BROD, C. 1984. Techno stress: the human cost of the computer revolution. Reading, Mass. : Addison Wesley. 242 p.
6. CARSON, C.C. & BUTCHER, J.N. 1992. Abnormal psychology and modern life. New York : HarperCollins. 705 p.
7. FIGUEIREDO, J.R. 1994. An evaluation of people's attitudes toward technostress and techniques on how to overcome it. [Web:] http://www.soc.hawaii.edu/leonj/499s99/yamauchi/techno.htm
8. FISHER, J. 1999. Using perceived fun to reduce computer anxiety amongst new adult users. [Web:] http://cyberg.curtin.edu.au/members/papers/88.shtml
9. HUDIBURG, R.A. 1996. Assessing and managing technostress. [Web:] http://www2.una.edu/psychology/alatalk.htm .
10. KUNISHIGE, R. 1997. To fear or not to fear the computer. [Web:] http://www.soc.hawaii.edu/leonj/499s99/yamauchi/fear.htm
11. KUPERSMITH, J. 1992. Technostress and the reference librarian. [Web:] http://www.greatbasin.net/~jkup/tstr_ref.html
12. LONG, L. & LONG, N. 1986. Computers. Englewood Cliffs, N.J. : Prentice-Hall. 439 p.
13. LOUW, D.A. 1992. Suid-Afrikaanse handboek van abnormale gedrag. Halfweghuis : Southern Boekuitgewers. 736 p.
14. NAE (National Academy of Engineering). 2000. Greatest engineering achievements of the 20th century. [Web:] http://www.greatachievements.org/greatachievements/indexp.html
15. OLTMANNS, T.O. & EMERY, R.E. 1998. Abnormal psychology. Englewood Cliffs, N.J. : Prentice-Hall. 761 p.
16. PENDLEBURY, J., GROUARD, B. & MESTON, F. 1998. Successful change management. Chichester, N.Y. : Wiley. 299 p.
17. RAFTER, M.V. 1998. LIVEWIRE: technostress doesn't have to be fact of Internet life. [Web:] http://204.71.177.75/headlines/971224/entertainment/stories/online_livewire_1.html
18. ROSEN, L.D. & WEIL, M.M. 1992. Measuring technophobia: a manual for the administration and scoring of the Computer Anxiety Rating Scale (Form C), Computer Thoughts Survey (Form C) and the General Attitudes Toward Computers Scale (Form C). Dominguez Hills : California State University & Chapman University. 48 p.
19. ROSEN, L.D. & WEIL, M.M. 1997a. Technostress: coping with technology @ work @ home @ play. London : Wiley. 240 p.
20. ROSEN, L.D. & WEIL, M.M. 1997b. Technophobia. [Web:] http://www.pricecostco.com:80/webchat-1.9/webchat_docs/archive/t6297.html
21. ROSEN, L.D. & WEIL, M.M. 1998. A conversation with technostress authors Michelle M. Weil, Ph.D. and Larry D. Rosen, Ph.D. [Web:] http://www.technostress.com/tsconversation.html
22. ROSEN, L.D. & WEIL, M.M. 1999. Techno professionals: rules for thriving in the new millennium. [Web:] http://www.hds.com/hdsaware/columns/weil-rosen0199_1.htm
23. ROSEN, L.D. & WEIL, M.M. 2000a. Four-year study shows more technology @work and @home but more hesitancy about trying new technology. [Web:] http://www.technostress.com/busstudy2000.htm
24. ROSEN, L.D. & WEIL, M.M. 2000b. Results of our 49-month study of business attitudes show clerical/support staff, managers and executives using more technology at work and at home and becoming more hesitant toward new technology. [Web:] http://www.technostress.com/busstudy2000.htm
25. SELYE, H. 1976. The stress of life. New York : McGraw-Hill. 515 p.

26. STRÜMPFER, D. 1986. Executive stress. (In Barling, J., Fullagar, C. & Bluen, S. Behaviour in organisations: South African perspectives. Isando : McGraw-Hill. p. 533-559.)

27. VAN DER LINDE, I. 1999. Psigologiese kragte, coping en werktevredenheid van werknemers in ‘n finansiële instelling. Potchefstroom : PU vir CHO. (Verhandeling – M.A.). 198 p.

28. WEIL, M. 1997. Minds weren’t made for multitasking. [Web:] http://hotwired.lycos.com/synapse/hotseat/97/44/transcript2a.html

29. WHITE, S. 2000. A brief history of computing. [Web:] http://ox.compsoc.net/~swhite/history.html