

**NEUROPSYCHOLOGICAL EXECUTIVE
FUNCTIONING AND PSYCHOSOCIAL
WELL-BEING**

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M.A. (Clinical Psychology)**

**Thesis submitted for the degree Philosophiae Doctor
in Psychology at the North-West University**

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**May 2005
Potchefstroom Campus**

Acknowledgements

I wish to extend a sincere word of gratitude to the following individuals and institutions that, in some way or the other, assisted me in completing this project:

- The POWIRS team, especially Alta Schutte, as project leader, and Elsabè Botha for the gathering of the psychosocial data.
- To my promotor and mentor, Professor Marié Wissing, for stimulating conversations, meaningful input, immense encouragement and support, tea and tissues.
- To my parents, Bertus and Franci Marè, for your love, and your interest in and support of my academic career. I also deeply appreciate the opportunity you gave me to pursue tertiary education.
- To my husband, Bennie, for your love, never failing support, encouragement, assistance and dinner duties.
- I am sincerely grateful to my Heavenly Father, for the talents and opportunities He granted me, and his amazing love and support.

I hereby acknowledge the financial support provided by the South African National Research Foundation (NRF GUN number 2054068), Medical Research Council and Research Focus Area 9.1 of the North-West University (Potchefstroom Campus). The opinions expressed and the conclusions reached in this publication, are those of the author and do not represent that of any of the funders.

Contents

Acknowledgements	p. ii
Summary	iv
Opsomming	vii
Preface	x
Letter of permission	xi
Section 1: Introduction	p. 1
Section 2: Article 1: Neuropsychological executive functions and psychosocial well-being: A review	6
2.1 Manuscript: Neuropsychological executive functions and psychosocial well-being: A review	7
Section 3: Article 2: Attentional switching and psychosocial well-being	32
3.1 Guidelines for authors: <i>British Journal of Psychology</i>	33
3.2 Manuscript: Attentional switching and psychosocial well-being	36
Section 4: Article 3: The relationship between generativity as neuropsychological process and psychosocial well-being	69
4.1 Guidelines for authors: <i>Neuropsychology</i>	70
4.2 Manuscript: The relationship between generativity as neuropsychological process and psychosocial well-being	74
Section 5: Conclusions, implications and recommendations	109
Complete reference list	114

Summary

Neuropsychological executive functioning and psychosocial well-being

Key words: neuropsychology, executive functions, psychological well-being, social well-being, attentional switching, generativity

The aim of this study was to come to a better understanding of possible neuropsychological mechanisms underlying psychosocial well-being and therefore to determine whether a relationship between neuropsychological executive functions and psychosocial well-being does indeed exist. Research was conducted in the domains of neuropsychology and positive psychology. This thesis consists of three articles, namely 1) *Neuropsychological executive functions and psychosocial well-being: A review*, 2) *Attentional switching and psychosocial well-being*, and 3) *The relationship between generativity as neuropsychological process and psychosocial well-being*.

The first article argued the possibility of a relationship between neuropsychological and psychosocial aspects, with reference to a pluralistic ecosystems perspective, neuropsychological and other positive psychological theories, such as Miller's neuropsychodynamic model and Frederickson's broaden-and-build theory, as well as existing empirical studies. Numerous neuropsychological studies have indicated that the prefrontal cortex is involved in executive functions, with its main function to regulate both cognitive and affective functioning. Analyses of existing empirical studies indicated an established relationship between prefrontal lobe / executive / regulatory dysfunction and psychopathology, but also that the relationship between normal or optimal prefrontal executive functions and psychosocial well-being is still

unclear. The first article concluded that evidence correlating neuropsychological functioning with human flourishing, or indicating possible neuropsychological mechanisms involved in psychosocial well-being, is sparse, presenting a serious lacuna in scientific knowledge.

The following two articles focused on contributing to filling this lacuna. “*Attentional switching and psychosocial well-being*” and “*The relationship between generativity, as neuropsychological process and psychosocial well-being*” focused on attentional switching and generativity, as part of neuropsychological executive functions, as potential mechanisms associated with psychosocial well-being. These studies aimed to determine whether the capacity to switch attention, as measured by the *Color Trails Test (CTT)* and *Wisconsin Card Sorting Test (WCST)*, and the capacity to generate novelty, as measured by the *Controlled Verbal Fluency Task (CVFT)* (Benton, 1967) and *Uses of Objects Test (UOT)* (Getzels & Jackson, 1962), are related to the degree of psychosocial well-being experienced. As part of the interdisciplinary POWIRS (Profiles of Obese Women with Insulin Resistance Sndrome) project, black African women (article 2 n=66; article 3 n=72) completed the above mentioned neuropsychological measures, as well as indices of psychosocial well-being, in a cross-sectional design. The psychosocial measures included the Affectometer (AFM) 2 (Kammann & Flett, 1983); Constructive Thinking Inventory (CTI) abbreviated version (Epstein & Meier, 1989); Sense of Coherence Scale (SOC-29) (Antonovsky, 1987, 1993); The Fortitude Questionnaire (FORQ) (Pretorius, 1998); JAREL Spiritual Well-being Scale (SWS-H) (Hungelman et al., 1989); Psychological Well-being Scales (SPW-B) (Ryff & Singer, 1998); and the Cognitive Appraisal Questionnaire (CAQ) (Botha & Wissing, 2003).

The main findings of these studies were that the ease of attentional switching and generativity correlates statistically ($p < 0.5$) and practically significantly with higher levels of psychosocial well-being. From a micro-deterministic perspective it can be concluded that frontal lobe executive functions may play a role in the regulation higher-order adjusting psychosocial functions related to quality of life. From a macro-deterministic perspective it can be concluded that psychosocial well-being, while being influenced by executive functions, may also influence the continuous development of neuropsychological executive functions.

Opsomming

Neuropsigologiese uitvoerende funksionering en psigososiale welsyn

Sleutelwoorde: neuropsigologie, uitvoerende funksies, psigologiese welsyn, sosiale welsyn, aandagsverskuiwing, generatiewe

Die oogmerk met hierdie studie was om tot 'n beter begrip van moontlike neuropsigologiese meganismes onderliggend aan psigososiale welsyn te kom, en om dus te bepaal of daar wel 'n verwantskap tussen neuropsigologiese uitvoerende funksies en psigososiale welsyn bestaan. Navorsing is in die domeine van neuropsigologie en positiewe psigologie gedoen. Hierdie tesis bestaan uit drie artikels, naamlik 1) *Neuropsychological executive functions and psychosocial well-being: A review*, 2) *Attentional switching and psychosocial well-being*, en 3) *The relationship between generativity as neuropsychological process and psychosocial well-being*.

Die eerste artikel beredeneer die moontlikheid van 'n verwantskap tussen neuropsigologiese en psigososiale aspekte, met verwysing na 'n pluralistiese ekosistemiese perspektief, neuropsigologiese en ander positiewe psigologie-teorieë, soos Miller se neuropsigodinamiese model en Frederickson se "broaden-and-build" teorie, asook bestaande empiriese studies. Verskeie neuropsigologiese studies het aangedui dat die prefrontale korteks betrokke is by uitvoerende funksies, met die hoof funksie daarvan om beide kognitiewe en affektiewe funksionering te reguleer. 'n Ontleding van bestaande empiriese studies het 'n verband tussen prefrontale lob / uitvoerende / regulerende disfunksie en psigopatologie bevestig, maar ook aangedui dat die verband tussen normale of optimale prefrontale uitvoerende funksies en

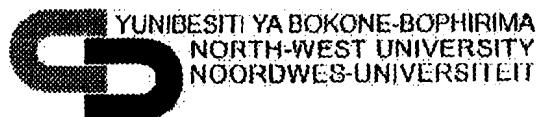
psigososiale welsyn nog onduidelik is. Die eerste artikel konkludeer dat bewyse wat neuropsigologiese funksionering met menslike welsyn korreleer, of potensiele neuropsigologiese meganismes betrokke by psigososiale welsyn aandui, baie min is, en dat daar 'n ernstige leemte in wetenskaplike kennis hieroor is.

Die volgende twee artikels het daarop gefokus om 'n bydrae te lewer om hierdie leemte te help vul. *Attentional switching and psychosocial well-being* en *The relationship between generativity, as neuropsychological process and psychosocial well-being* het gefokus op aandagsverskuiwing en generatieweit, as deel van neuropsigologiese uitvoerende funksies, en as potensiele meganismes geassosieer met psigososiale welsyn. Die doel van hierdie studies was om te bepaal of die kapasiteit vir aandagsverskuiwing, soos gemeet deur die *Color Trails Test (CTT)* en *Wisconsin Card Sorting Test (WCST)*, en die kapasiteit vir die generasie van nuwigheid, soos gemeet deur die *Controlled Verbal Fluency Task (CVFT)* (Benton, 1967) en *Uses of Objects Test (UOT)* (Getzels & Jackson, 1962), verband hou met die graad van psigososiale welsyn wat ervaar word. As deel van die interdisiplinêre POWIRS (Profiles of Obese Women with Insulin Resistance Sndrome) projek, het swart Afrika vroue (artikel 2 n=66; artikel 3 n=72) bostaande neuropsigologiese meetinstrumente voltooi, asook skale wat psigososiale welsyn meet, in 'n dwarsnitvraelys-navorsingsontwerp. Die psigososiale meetinstrumente het die *Affectometer (AFM) 2* (Kammann & Flett, 1983); *Constructive Thinking Inventory (CTI)* verkorte weergawe (Epstein & Meier, 1989); *Sense of Coherence Scale (SOC-29)* (Antonovsky, 1987, 1993); die *Fortitude Questionnaire (FORQ)* (Pretorius, 1998); *JAREL Spiritual Well-being Scale (SWS-H)* (Hungelman et al., 1989); *Psychological Well-being Scales (SPW-B)* (Ryff & Singer, 1998); en die *Cognitive Appraisal Questionnaire (CAQ)* (Botha & Wissing, 2003) ingesluit.

Die hoofbevindinge van hierdie studies was dat die gemak van aandagsverskuiwing en generatieweities statisties ($p < 0.5$) en prakties beduidend korreleer met hoër vlakke van psigososiale welsyn. Vanuit 'n mikro-deterministiese perspektief kan gekonkludeer word dat frontale lob uitvoerende funksies 'n rol speel in die regulering van lewenskwaliteitverwante hoër-orde aanpassende psigososiale funksies. Vanuit 'n makro-deterministiese perspektief kan gekonkludeer word dat psigososiale welsyn beïnvloed word deur uitvoerende funksies, maar dat dit ook die voortgaande ontwikkeling van neuropsigologiese uitvoerende funksies beïnvloed.

Preface

- This thesis was done in article format as indicated in rule A.14.4.2 of the year book of the North-West University.
- The three articles comprising this thesis were submitted for review to respectively the *Conference proceedings* of the Second European Conference on Positive Psychology, Verbania Pallanza, Italy; the *British Journal of Psychology* (impact factor: 1.277) and *Neuropsychology* (impact factor: 2.027). All articles are currently under review.
- All articles were formatted according to the style sheet of the American Psychological Association (APA). I have, however, included the guidelines for authors of the *British Journal of Psychology* and *Neuropsychology* for purposes of examination.
- For purposes of the thesis, these articles were page numbered consecutively. However, each individual article was numbered starting from page 1 for submission to the journals.
- Attached, please find the letter signed by the co-authors authorising me to use these articles for purposes of submission for a Ph.D. degree.



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12 May 2005

LETTER OF PERMISSION

Hereby permission is granted that the following manuscripts:

- 1) *Neuropsychological executive functions and psychosocial well-being: A review*
- 2) *Attentional switching and psychosocial well-being*
- 3) *The relationship between generativity as neuropsychological process and psychosocial well-being*

may be used by the first author, Elzabè Peters, for purposes of obtaining a Ph.D. degree.

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Section 1: Introduction

The current study focuses on the relationship between neuropsychological executive functions, as measured by particular neuropsychological tests, and facets of psychological- and social well-being, respectively forming part of two domains in psychology, namely neuropsychology and positive psychology or psychofortology. The motivation for such study is to come to an understanding of possible biological mechanisms underlying psychosocial well-being by bringing together information from different domains.

Neuropsychology entails the study of the relationship between brain functioning and behaviour (Lezak, 1995). The frontal lobes, and specifically the prefrontal areas, seem to be the anatomical basis of neuropsychological executive functions (Knight & Stuss, 2002; Lezak, 1995; Rains, 2002; Stuss & Benson, 1986; Stuss & Levine, 2002). Lezak (1995: 42) defines executive functions as “those capacities that enable a person to engage successfully in independent, purposive and self-serving behaviour”. She conceptualises four components of executive functioning, namely volition, planning, purposive action and effective performance. Stuss and Levine’s (2002: 407) definition of executive functions holds that they are mediated by the frontal lobes and are “high level cognitive functions that are involved in the control and direction of lower-level functions”. Rains (2002: 425) defines executive functions as “the capacity to guide and regulate behaviour on the basis of knowledge representations”. Executive functions may therefore be characterised as separable, but related functions, including attentional processes, mental flexibility, generativity, planning, inhibition and self-monitoring. The main purpose of these neuropsychological processes is to

mediate/regulate both cognitive and affective behaviour and guide in problem solving, especially when tasks are novel and nonautomatic (Hill, 2004; Lezak, 1995; Miyake, Friedman, Emerson, Witzki & Howerter, 2000; Rains, 2002; Stuss & Levine, 2002).

Psychological well-being refers to viewing one's life as manageable, meaningful and comprehensible (Antonovsky, 1987), satisfactory (Diener, Emmons, Larsen & Griffin, 1985) and purposeful (Ryff & Singer, 1998). It also refers to the tendency to make constructive cognitive appraisals in challenging situations (Epstein & Meier, 1989), to experience more positive than negative affect (Kammann & Flett, 1983) and a general absence of debilitating psychopathology. Social well-being refers to the ability to form and maintain positive, strong and meaningful interpersonal relationships, resulting in feelings of belonging and interdependence with others (Pretorius, 1997; Ryff & Singer, 1998).

Damage to the prefrontal areas usually results in adynamia (lack of initiative and spontaneity), diminished anxiety and concern for the future, mild euphoria, loss of divergent thinking, inability to think in abstract terms (conceptualise), inability to plan and follow through a course of action or take in account probable consequences of behaviour and ritualistic/rigid behaviour (Walsh & Darby, 1999; Kolb & Wishaw, 2000). Prefrontal dysfunction has been linked with schizophrenia (Rains, 2002; Heaton, et al., 1993; Tucker & Williamson, 1984), obsessive-compulsive disorder (OCD) (Rains, 2002, Miller, 1988), mania (Miller, 1988) and anti-social personality disorder (Rains, 2002; Miller, 1988). According to Tucker and Williamson (1984) this is the result when the self-regulation of neural activity occurs out of sync with ecological context. A correlation between prefrontal lobe / executive / regulatory dysfunction and pathology is thus clear, but the implications of normal or optimal

prefrontal lobe-, and specifically executive functions, regarding psycho-social well-being are still unclear.

Miller's (1988) neuropsychodynamic model hypothesised that the "ego-autonomous person's" functioning may depend on some optimum level of functioning in the frontal-interhemispheric axis. According to this model the prefrontal lobes synthesise exteroceptive and interoceptive information to regulate behaviour with the purpose of preserving personal equilibrium in ecological context, resulting in biopsychosocial health. It is thus assumed that the prefrontal lobes are responsible for both proximal (neuropsychological) and distal (behavioural) regulatory processes. This model forms the background for the current hypothesis that there is a relationship between neuropsychological executive functioning and level of psychosocial well-being.

A combination of tests converging to suggest the likelihood of deficits in prefrontal executive functions (Stuss & Levine, 2002; D'Elia, et al. 1996) were utilised to measure neuropsychological processes. As these tests have been developed to measure pathology, successful completion was taken as indication of at least normal prefrontal lobe executive functioning. The tests included were the Color Trails Test (CTT) (D'Elia, Satz, Uchiyama & White, 1996), Wisconsin Card Sorting Test (WCST) (Heaton, Chelune, Talley, Kay & Curtiss, 1993), Controlled Verbal Fluency Task (CVFT) (Benton, 1967), and the Uses of Objects Test (UOT) (Getzels & Jackson, 1962).

The psychosocial aspects were measured by means of the Affectometer (AFM) 2 (Kammann & Flett, 1983); Constructive Thinking Inventory (CTI) abbreviated version (Epstein & Meier, 1989); Sense of Coherence Scale (SOC-29) (Antonovsky,

1987, 1993); The Fortitude Questionnaire (FORQ) (Pretorius, 1998); JAREL Spiritual Well-being Scale (SWS-H) (Hungelman et al., 1989); Psychological Well-being Scales (SPW-B) (Ryff & Singer, 1998); and the Cognitive Appraisal Questionnaire (CAQ) (Botha & Wissing, 2003).

As this kind of research, relating well-being to neuropsychological processes, is only beginning to gain momentum, many questions are still unanswered. Therefore this study will aim at exploring this terrain further, looking for relationships between executive functioning, as operationalised with specific prefrontal lobe executive function tests, and psycho-social well-being. The value of such information would lie in a possible contribution to our understanding of mechanisms of well-being (Ryff & Singer, 1998). Once understood, this knowledge could be applied in developmental, preventative and psychotherapeutic contexts to enhance human well-being.

This thesis consists of three articles, namely 1) *Neuropsychological executive functions and psychosocial well-being: A review*, 2) *Attentional switching and psychosocial well-being*, and 3) *The relationship between generativity as neuropsychological process and psychosocial well-being*. These three articles will be presented consecutively together with the guidelines for authors for the respective journals they were submitted to.

The aim of the first article was to review relevant information in the field, with a focus on the empirical study and it was submitted to the *Conference proceedings* of the Second European Conference on Positive Psychology, Verbania Pallanza, Italy. The aim of the second article was to determine whether correlations between attentional switching, as measured by the CTT (part B) and WCST, and measures of psychosocial well-being do exist and it was submitted to the *British Journal of*

Psychology. The aim of the third article was to determine whether correlations between generativity, as measured by a verbal and ideational fluency task, and measures of psychosocial well-being do exist and it was submitted to

Neuropsychology. The results and implications of the study will be summarised and recommendations made in a concluding section.

Section 2: Article 1

Neuropsychological executive functions and psychosocial well-being: A review

submitted to the

***Conference proceedings* of the Second European Conference on
Positive Psychology, Verbania Pallanza, Italy**

Running head: EXECUTIVE FUNCTIONS AND WELL-BEING: A REVIEW

2.1 Manuscript

Neuropsychological executive functions and psychosocial well-being: A review

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Abstract

Searching to understand human flourishing and underlying mechanisms thereof, we need to study the biological correlates of well-being. Neuropsychology is suited to this search, being positioned on the interface between neurology and psychology. This review was conducted from an ecosystemic perspective. Theoretically a relationship between neuropsychological functioning and psychosocial well-being seems plausible, as supported by the neuropsychodynamic theory of Miller and Frederickson's broaden-and-build theory. Empirically, neuropsychological executive dysfunction relates to psychopathology. However, besides the contributions regarding left vs. right hemisphere processing of affect and the finding that positive affect facilitates cognitive processes and pro-social behaviour, data relating neuropsychological executive functioning to human flourishing is sparse. This literature review concludes that research is needed to fill this void in scientific knowledge.

Neuropsychological executive functions and psychosocial well-being: A review

Psychology, philosophy and history have shown long-standing interest in what it means to function optimally and recently, a whole new movement in science, of *well-being*, started developing. “Positive psychology” is the scientific study of human strengths and flourishing (Snyder & Lopez, 2002). Given the developments in this new field of study, Ryff and Singer (2002) stated that currently we need to understand the body during states of wellness, rather than only during illness. According to Smith (2002: 320) “neuroscientists usually study the brain in relation to disease, but perhaps they should begin paying more attention to the brain in relation to health”. The fundamental agenda for understanding the physiological substrates of human flourishing is to learn how “quality experiences in living keep the body well and how optimal biological functioning feeds back to quality of life” (Ryff & Singer, 2002: 10-11).

Neuropsychology entails the study of the relationship between brain functioning and behaviour (Lezak, 1995). As a discipline, it is positioned on the interface between neurology and psychology. Lezak (1995) defines three aspects of behaviour as investigated neuropsychologically, namely cognition, emotionality and executive functions. Neuropsychological executive functions seem to play an important role in the mediation/regulation of both human cognition and emotion (Stuss & Levine, 2002). However, the relationship between neuropsychological executive functions, as measured by specific neuropsychological tests and facets of psychological and social well-being has not, as far as could be ascertained, been explored. Knight and Stuss (2002: 573)

indicated this terrain as important to future understanding of prefrontal functioning by stating: "Given the vast expansion of prefrontal cortex (PFC) in humans, explication of the function of this brain region appears to be fundamental for a complete understanding of human cognition in both *health and disease*." This article will review the literature for support that grounds may exist to hypothesise a correlation between neuropsychological functioning and psychosocial well-being, aiming to give a state of the art review on this *biopsychosocial nexus*, (Ryff & Singer, 1998) in order to determine the meaningfulness of future empirical studies.

LINKS BETWEEN NEUROPSYCHOLOGICAL EXECUTIVE FUNCTIONING AND WELL-BEING

The question addressed in this review is whether a person's level of neuropsychological executive functioning will correlate with the level of psychosocial well-being experienced. The ontological point of departure for this review is a pluralistic systems philosophy, specifically an ecosystemic perspective (Bateson, 1972, 1979). This perspective integrates schools of thought, such as system theory (Von Bertalanffy, 1950, 1974), ecology and cybernetics (Von Foerster, 1981, in Moore, 2003). The focus is, therefore, on systems, with ecological and cybernetic principles as point of departure.

Living systems are self-regulating and self-propagating. According to general system theory (Von Bertalanffy, 1950, 1974), a system is a whole consisting of elements organised or structuralized in a particular way, forming part of a larger suprasystem with interactional patterns occurring within and between subsystems. The epistemological point of departure for this review is that of critical realism.

In this review, the focus is on the neuropsychological (especially executive functions), psychological and social subsystems of individual functioning. Of special concern for a study in correlations between different subsystems, is the principle of reciprocity between dynamically interrelated and interdependent parts and the assumption that these relationships can be examined. On this basis it can already be hypothesised that neuropsychological functioning will be interrelated with any other aspect of holistic human functioning.

The possible links between neuropsychological executive functioning and psychosocial well-being will be explicated against the backdrop of Madsen's (1988) conceptualisation of the structure of scientific theories. He identifies three strata or levels of discourse, being distinguished mainly by their degree of abstraction, namely the meta-stratum, hypothetical stratum and the data stratum.

Meta-stratum

Ontological assumptions

The ontological assumptions relevant for purposes of this review are assumptions regarding the nature of reality, man in particular, and assumptions regarding the body-mind relationship.

Conception of man

On a meta-theoretical level we take an ecosystemic perspective (Bateson, 1972, 1979), in which man is seen as a complex, living system within a hierarchy of larger

suprasystems, such as marriage, family and society. However, man as system also includes various subsystems, such as the biological and psychological. We also assume that man is constructing reality as he moves along via the process of language. Consequently human systems are viewed as autonomous, as their own meaning structures will determine their own actions. Although an autonomous system can be perturbed by another system, it will be possible only to the extent that the first system allows.

Psychophysical assumptions

Initially Luria (1966) referred to higher mental processes as “functional systems”. Intimately related to his conception of mental processes was the idea of the social origin and systemic organisation of higher mental functions in man, progressing through several stages during human development.

In explaining the relationship between “brain” and “mind”, Sperry (1987) referred to “psycho-neural interaction”, described as a mentalistic stance. This perspective recognises the existential reality of mental states and endows mental events with causative power to affect brain processing (macro-determinism) and to interact functionally with other mental events, while not denying the micro-determinist position that neuronal events also determine cognitive events. It claims to be a midway philosophic position that resolved the prior dualist-materialist dichotomy and claims to retain what is most valid from each side of the old dichotomy.

Nell (2000), in his work on cross-cultural neuropsychological assessment, agrees with this view. He states: “If mind, like brain, is one, and therefore unitary in all humans, then neuropsychological assessment founded on human universals will work equally well in

London, New York, or the subsistence farming villages of South Africa and Brazil. If mind is many, however, and the ways in which people think and solve problems are determined by the interaction of their genetic endowment and the material conditions of their culture, then identical tests may make geniuses of average people in one culture and imbeciles of equally average people in another “ (Nell, 2000: 13).

These mentalistic views are in contrast to that of Smith (2002) and Gray (1994). Smith (2002: 319) states: “ a complete knowledge of the workings of the brain can provide a complete knowledge of human behaviours, thoughts and feelings”. Gray (1994: 29) states: “all psychological processes, as well as the behaviour they underlie, are a product of activity in the brain”. These assumptions fall within the domain of neutral monism, viewing brain and consciousness as exactly the same entity, as viewed from different perspectives. It doesn't take into account the complexities arising from subsystems functioning within a suprasystem and the concomitant macro determinism, as set out by Sperry (1987).

In conclusion we assume that the micro-determinist position is still valid, but that the macro-determinist position has been added as another dimension in the conceptualisation of human functioning.

Epistemological assumptions

The epistemological assumptions regarding the relationship between knowledge and reality underlying the ecosystemic perspective are that of social constructionism (Dean & Rhodes, 1998), which is an expansion of constructivism (Efran & Lukens, 1985; Efran,

Lukens & Lukens, 1988). According to constructivism, people construct their own “reality” by the meaning they attach to the observed. One correct, objective reality is, therefore, denied, as it is impossible to know reality *exactly as it is*, because the observer forms part of the system it is observing (second order cybernetics) (Von Foerster, 1981, in Moore, 2003), and is therefore also influenced by the forces working in on the system. Social constructionism expands constructivist thinking by including the important role that social and cultural contexts play in the way meaning is created, therefore, acknowledging the role of macro determinism as set out by Sperry (1987).

We assume, as in an ecosystemic perspective, that reality cannot be known as it is and that human processes influence interpretations made. However, we do assume that a reality exists, which can be known by approximation. This position of critical realism differs from extreme relativism that may form part of a pure constructivist position.

In conclusion, the authors’ meta-assumptions guiding this review are that a human is a holistic system, functioning within a larger suprasystem, where both the processes of micro and macro-determinism play a role. It is further assumed that although an objective reality exists, it is not possible to *know* reality exactly as it is, but that approximations thereof can be established.

Hypothetical stratum

Theoretical constructs and models from which a relationship between neuropsychological functioning and psychosocial well-being can be predicted are explicated in this section.

Hypothetical constructs

The main constructs used in this review are “neuropsychological executive functions” and constructs related to well-being.

Neuropsychological executive functions

Numerous neuropsychological studies have indicated that the frontal lobes and specifically the prefrontal areas, mediate the “executive functions” (Knight & Stuss, 2002; Lezak, 1995; Rains, 2002; Stuss & Benson, 1986; Stuss & Levine, 2002). Lezak (1995) defines executive functions as “those capacities that enable a person to engage successfully in independent, purposive and self-serving behaviour” and conceptualises four components of executive functioning, namely, volition, planning, purposive action and effective performance. Stuss and Levine’s (2002: 407) definition of executive functions holds that they are mediated by the frontal lobes and are “high level cognitive functions that are involved in the control and direction of lower-level functions”. Rains (2002: 425) defines executive functions as “the capacity to guide and regulate behaviour on the basis of knowledge representations”. Common to all definitions given therefore, is the concept of mediation or regulation as primary purpose of executive functions. Impairment in executive functions tends to show up globally, affecting both cognitive and emotional aspects of behaviour (Lezak, 1995).

Well-being

Holistic well-being. Conceptualization of psychosocial well-being is linked to holistic models of well-being. Recent holistic wellness models include inter alia behavioural, biological, cognitive, psychological, social and spiritual dimensions of functioning (Adams, Bezner & Steinhardt, 1997; Cmich, 1984; Eberst, 1984; Crose, Nicholas, Gobble & Frank, 1992; Kumpfer, 1999; Seeman, 1989; Witmer & Sweeney, 1992). Travis and Ryan (1988) list six components or aspects of wellness, namely that wellness is a choice, a lifestyle, a process, an efficient channelling of energy, the integration of body, mind and spirit and the loving acceptance of yourself. Wellness/well-being is not only an end state within different dimensions, but also a continuous process, according to Archer, Probert and Gage (1987) and the National Wellness Association (1999). However, according to Jobson (2003), the question arises whether balanced wellness would refer to a kind of equilibrium between all the dimensions of one's being, or to the process where excesses in one dimension would compensate for deficiencies in another dimension?

Cognitive well-being. According to Seeman (1989: 1105), the cognitive subsystem is a "domain so powerful in its impact on health that it would be difficult to overstate its centrality". Seeman refers to "higher level intellectual resources" and defines cognitive health as the ability to establish an affirmative self-definition, as well as the experience of a sense of personal mastery and control over significant components of one's life. Eberst (1984) defines the "mental" domain of health as intelligence, perception of others, adaptability, decision-making ability, ability to cope, ability to relax, tolerance and

judgement. Cognitive resiliency competencies have been described by Kumpfer (1999) as, inter alia, intelligence, academic skills, the ability to delay gratification, moral reasoning, insight, planning ability and creativity.

It is clear that these definitions of cognitive well-being are extremely broad, trying to refer to (diverse) outcomes of processes happening within the brain. It is clear that some aspects of “cognitive health” as defined would neuropsychologically also be classified as “cognitive”, such as intelligence (as measured by conventional IQ tests), self-definition, perception and academic skills. Other conceptualisations, however, rather fit the definition of “executive functions” as defined in neuropsychology, such as planning, problem solving, decision-making and creativity.

It, therefore, seems possible that “cognitive health”, as defined in various holistic wellness models, may refer to both the cognitive and executive aspects of behaviour as neuropsychologically conceptualised, and a thorough explication of this aspect of well-being may be indicated in future research.

Psychosocial well-being. The interplay between the psychological and social subsystems of human functioning has been established as so pronounced and the concepts so difficult to distinguish, that the term psychosocial came into use as early as 1899 (OED, 2004).

Psychological well-being seems to be multi-dimensional regarding facets of self involved, namely affect, cognition, behaviour, self-concept, interpersonal relationships and absence of general symptoms of mental disorder. It also seems multi-dimensional

regarding domains of life in which it manifests, namely intra- and interpersonal, social and contextual and in love and work (Wissing & Van Eeden, 2002). Individual differences exist on these various dimensions of well-being related to a person's age, gender, socio-economic status and level of education (Ryff & Singer, 2002). Different theorists have proposed different micro-level constructs to define the essence of psychological well-being. It includes constructs such as *affect balance* (Kammann & Flett, 1983), *character strengths* (Peterson & Seligman, 2004), *constructive thinking* (Epstein & Meier, 1989), *flourishing* (Keyes & Haidt, 2003), *fortitude* (Pretorius, 1998), and *sense of coherence* (Antonovsky, 1987, 1993). In his review on salutogenesis, Smith (2002) also includes the concepts of hardiness (Kobasa, et al., 1979), coping (Folkman & Lazarus, 1980), social support, religion, happiness, humour and love, and selective perception as positively contributing to well-being. An overview of positive psychology can be found in Aspinwall and Staudinger (2003), Keyes & Haidt (2003), Peterson & Seligman (2004) and Snyder and Lopez (2002).

Social well-being refers to the level of social skills a person possesses, the level of comfort in social functioning, the ability to be part of a larger society and the extent of concern and respect for others (Eberst, 1984). Social well-being is also conceptualised as the ability to form and maintain positive, strong and meaningful interpersonal relationships, resulting in feelings of belonging and interdependence with others (Pretorius, 1997; Ryff & Singer, 1998). Kumpfer (1999) refers to social resiliency competencies, such as social skills, street smarts, communication skills, peer resistance skills, multi-cultural and bi-gender competencies and capacity for intimacy.

In summary, psychosocial well-being can be defined as a tendency towards optimal functioning on intra and interpersonal level.

Explanatory theories

Several holistic models on psychological well-being are built on a systems perspective, such as those by Cmich (1984) and Eberst (1984). According to the ecosystemic perspective, pathology results in a system lacking balance or complexity, caught up in a pattern of unhealthy, repetitive feedback loops. Optimal functioning is obtained when a dynamic, complex equilibrium or integration is established. In such equilibrium one entity, relationship, or pattern of relationships is not maximised at the cost of another entity, relationship or pattern of relationships (Moore, 2003).

According to Derryberry and Reed (1996), the construct of regulation provides an integrative framework for linking the behavioural, emotional and cognitive subsystems. A prominent function of the frontal lobes is regulation/mediation of both cognitive and affective operations (Stuss & Levine, 2002). It is, therefore, possible that the prefrontal cortex can be responsible for regulating a myriad of subsystems composing the human organism, in such a way contributing to holistic well-being.

Miller (1988) advanced to propose a “neuropsychodynamic model” for integrating the neuropsychological and psychosocial aspects. He hypothesised that the “ego-autonomous person’s” functioning may depend on some optimum level of functioning in the frontal-interhemispheric axis. With “ego-autonomous” he refers to Hartmann’s (1958) psycho-analytic conceptualisation of the ego’s ability to function autonomously by controlling in

it's life what is possible and adjusting to immutable adversity, to *maintain it's fundamental psychological stability*. According to this model, the prefrontal lobes synthesise exteroceptive and interoceptive information to regulate behaviour with the purpose of preserving personal equilibrium in ecological context, resulting in (holistic) health. It is, therefore, implied that the prefrontal lobes are responsible for both proximal (neuropsychological) and distal (behavioural) regulatory processes. Tucker and Williamson (1984: 203) proposed approximately the same idea by stating: "The same control systems that are called upon as the brain self-regulates it's level of activity may be called upon to self-regulate qualitative features of cognition".

More recently Frederickson (1998, 2001) postulated the broaden-and-build theory of positive emotions, postulating a reciprocal causal link between affect, physical health, cognition and social functioning. According to this theory, positive and negative emotions have distinct, but complementary adaptive functions, with concomitant cognitive and physiological effects. While negative emotions narrow the momentary thought-action repertoire, positive emotions broaden this repertoire, expanding the range of cognitions and behaviours that come to mind. These broadened mindsets, in turn, build physical, intellectual and social resources, again resulting in the experience of more positive emotions.

Regarding a possible neurological basis for manifested well-being, Smith (2002), through converse reasoning, hypothesises that since destruction of regions (such as the amygdala, frontal cortex, mediodorsal thalamus and ventral basal ganglia) can disrupt well-being, manifested in apathy, passivity, attention deficits, motor retardation and

dysphoria, it could be speculated that these structures might provide the neuroanatomical basis of well-being.

These conceptualisations and theories of humans as being pluralistic in facets, form the basis for hypothesising that a person's level of neuropsychological executive functioning may correlate with their level of psychosocial health. Once understood, this knowledge can be applied in health-related disciplines to enhance well-being in clients.

Data stratum

Neuroscientific research is usually conducted from a reductionist materialistic perspective. Most available data is, therefore, not taking the complexities, as explicated in an ecosystemic perspective, into account.

Evidence for a relationship between prefrontal *dysfunction* and *psychopathology* exists. Prigatano (1986) referred to the psychosocial consequences of cognitive dysfunction after brain injury. Stuss and Levine (2002) also support this relationship. They have subdivided the prefrontal area into a dorsolateral, ventrolateral and frontal pole region, based on functional distinctions. According to them, the dorsolateral prefrontal cortex (DLPFC) seems to be involved in control operations regarding *cognitive* functions, such as language activation and formulation, working memory, memory control and focusing of attention. The ventrolateral prefrontal cortex (VLPFC) seems concerned with control operations regarding *affective* functions, such as emotions, reinforcement, decision-making and behavioural regulation. The main function of the frontal lobes, therefore, seems to be control of both cognitive and affective functioning. The frontal

poles are possibly involved in aspects of *selfhood*, such as auto-noetic consciousness, self-awareness, humour, empathy and sympathy (Knight & Stuss, 2002).

Certain specific symptom clusters, due to damage to the pre-frontal areas, have been associated with the above-mentioned anatomical subdivisions. DLPFC lesions result in a lowering of general arousal, impaired attention, apathy, diminished drive, perseverative behaviour and an inability to plan and spontaneously initiate goal directed behaviour, thus *cognitive* dysregulation. Patients with VLPFC lesions exhibit a syndrome characterised by disinhibition of drives and release of behaviour from normal regulatory mechanisms, exhibited in impulsive responses, elevated mood, hyperactivity and disregard for conventions, thus *affective* dysregulation (Rains, 2002; Stuss & Levine, 2002; Miller, 1988). The former syndrome has such a devastating effect on executive function that it has been termed the “dysexecutive syndrome” (Rains, 2002) or frontal lobe inertia (Miller, 1988).

Prefrontal dysfunction has additionally been linked to schizophrenia (Rains, 2002; Heaton, Chelune, Talley, Kay & Curtiss, 1993; Tucker & Williamson, 1984), obsessive-compulsive disorder (Rains, 2002, Miller, 1988), mania (Miller, 1988) and anti-social personality disorder (Rains, 2002; Miller, 1988). These disorders usually accompany impairments in cognitive, affective and social aspects of functioning. It can, therefore, be said that prefrontal dysfunction has been linked to impairment in cognitive, affective and social aspects of functioning.

Although theories regarding a possible correlation between neuropsychological executive functions and psychosocial well-being exist, empirical evidence is sparse.

Ample evidence supports a relationship between psychological and social well-being. A strong relationship between psychosocial functioning and physical health has also been established (Barios-Choplin & McCraty, 1997; Carter, 1998; Damasio, 1990, 2003; Levenson, 1994; Servan-Schreiber, 2004). However, specific neuropsychological processes were left out of the equation.

Looking from a neuropsychological perspective, intelligence (broadly defined) has a long-standing reputation as a protective factor against the development of psychopathology (Kumpfer, 1999). Davidson (1999) indicated that individuals showing greater left as compared to right prefrontal neurological activation in response to emotional stimuli, were more likely to show positive affect and were less vulnerable to depression, thus experiencing higher levels of psychosocial well-being. Isen (2002) has established that positive affect (associated with psychosocial well-being) facilitates cognitive processes, especially flexibility. This is presumably due to the fact that frontal brain regions rich in dopamine receptors control both these processes. Positive affect and flexible cognitive processes in turn promote pro-social behaviour (Isen, 2002). These research findings corroborate with Frederickson's (1998, 2001) broaden-and-build model.

However, the available information regarding neuropsychological functioning and specific facets of psychosocial well-being is meagre compared to what is known regarding neuropsychological functioning and psychopathology, as well as regarding the interplay between biological, psychological and social systems. This lack of information represents a serious lacuna in scientific knowledge.

CONCLUSIONS

Recently a whole new movement in science, of *well-being*, started to develop. The current need from this perspective is to study the biological correlates of well-being in order to come to an understanding of possible mechanisms underlying psychosocial well-being. Neuropsychology as a discipline is suited for such study, as it is positioned on the interface of neurology and psychology. This review was conducted from a pluralistic ecosystemic perspective.

Numerous neuropsychological studies have indicated that the prefrontal cortex is involved with executive functions. The main function of these areas seems to be regulation/mediation of both cognitive and affective functioning. Pathology seems to originate when regulation occurs out of sync with the ecological context. The question, therefore, arises whether better neuropsychological regulation would be associated with better psychosocial functioning?

Different theories have been proposed that hypothesise a link between the neuropsychological and psychosocial subsystems, such as Miller's neuropsychodynamic model and Frederickson's broaden-and-build theory.

On an empirical level, the relationship between the psychological and social systems and between the psychosocial system and physical health are clear. A definite relationship has also been established between prefrontal dysfunction and psychopathology. However, data correlating neuropsychological functioning with human flourishing, or indicating possible neuropsychological mechanisms involved in psychosocial well-being, is sparse and presents a serious lacuna in scientific knowledge.

Research is needed to fill this void, as relevant information can contribute to improving or optimising human well-being.

References

- Adams, T. Bezner, J., & Steinhardt, M. (1997). The conceptualisation and measurement of perceived wellness: Integrating balance across and within dimensions. *American Journal of Health Promotion, 11*, 208-218.
- Antonovsky, A. (1987). *Unravelling the mystery of health: How people manage stress and stay well*. San Francisco: Jossey-Bass.
- Antonovsky, A. (1993). The structure and properties of the Sense of Coherence Scale. *Social Science and Medicine, 36*(6), 725-733.
- Archer, J., Probert, B.S., & Gage, L. (1987). College students' attitudes towards wellness. *Journal of College Student Personnel, 28*, 311-317.
- Aspinwall, L.G., & Staudinger, U.M. (2003). *A psychology of human strengths: Fundamental questions and future directions for a positive psychology*. Washington: APA.
- Barios-Choplin, R., & McCraty, R. (1997). An inner quality approach to reducing stress and improving physical and emotional well-being at work. *Stress Medicine, 13*, 193-201.
- Bateson, G. (1972). *Steps to an ecology of mind*. San Francisco: Chandler.
- Bateson, G. (1979). *Mind and nature: A necessary unity*. New York: Dutton.
- Carter, C.S. (1998). Neuroendocrine perspectives on social attachment and love. *Psychoneuroendocrinology, 23*, 779-818.

- Cmich, D.E. (1984). Theoretical perspectives of holistic health. *Journal of School Health*, 54, 30-32.
- Cruse, R., Nicholas, D.R., Gobble, D.C., & Frank, B. (1992). Gender and wellness: A multidimensional systems model for counseling. *Journal of Counseling and Development*, 71, 149-156.
- Damasio, A. (1990). *The feeling of what happens*. San Diego: Harcourt.
- Damasio, A. (2003). *Looking for Spinoza: Joy, sorrow and the feeling brain*. San Diego: Harcourt.
- Davidson, R.J. (1999). Neuropsychological perspectives on affective styles and their cognitive consequences. In T. Dalgleish & M. Power (Eds), *Handbook of cognition and emotion*. New York: Wiley.
- Dean, R.G., & Rhodes, M.L. (1998). Social constructionism and ethics: What makes a 'better' story. *Families in Society: The Journal of Contemporary Human Services*, 79, 254-261.
- Derryberry, D., & Reed, M. A. (1996). Regulatory processes and the development of cognitive representations. *Development and Psychopathology*, 8, 215-234.
- Eberst, R.M. (1984). Defining health: A multidimensional model. *Journal of School Health*, 54, 99-104.
- Efran, J., & Lukens, M.D. (1985). The world according to Humberto Maturana. *The Family Therapy Networker*, 9, 23-28, 72-75.
- Efran, J., Lukens, R.J., & Lukens, M.D. (1988). Constructivism: What's in it for you? *The Family Therapy Networker*, 12, 27-35.

- Epstein, S., & Meier, P. (1989). Constructive thinking: A broad coping variable with specific components. *Journal of Personality and Social Psychology*, *57*, 332-350.
- Folkman, S., & Lazarus, R.S. (1980). An analysis of coping in a middle-aged community sample. *Journal of Health and Social Behaviour*, *21*, 219-239.
- Frederickson, B.L. (1998). What good are positive emotions? *Review of General Psychology: Special Issue: New Directions in Research on Emotion*, *2*, 300-319.
- Frederickson, B.L. (2001). The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions. *American Psychologist: Special Issue*, *56*, 218-226.
- Gray, J.A. (1994). Framework for a taxonomy of psychiatric disorder. In S.H.M. van Goozen, N.E. van de Poll & J.A. Sergeant (Eds.), *Emotions: Essays on emotion theory* (pp. 29-60). New Jersey: LEA.
- Hartmann, H. (1958). *Ego psychology and the problem of adaptation*. New York: International Universities Press.
- Heaton, R.K., Chelune, G.J., Talley, J.L., Kay, G.G., & Curtiss, G. (1993). *Wisconsin Card Sorting Test Manual: Revised and expanded*. Odessa: PAR.
- Isen, A.M. (2002). A role for neuropsychology in understanding the facilitating influence of positive affect on social behavior and cognitive processes. In C.R. Snyder & S.J. Lopez (Eds.), *Handbook of positive psychology* (pp. 528-540). Oxford: Oxford University Press.
- Jobson, R. (2003). Wellness in South Africa. *SA Family Practitioner*, *45*(3), 20-23.

- Kammann, R., & Flett, R. (1983). Affectometer 2: A Scale to measure current level of general happiness. *Australian Journal of Psychology*, 35, 259-265.
- Keyes, C.L.M., & Haidt, J. (2003). *Flourishing: Positive psychology and the life well-lived*. Washington: APA.
- Knight, R.T., & Stuss, D.T. (2002). Prefrontal cortex: The present and the future. In R.T. Knight & D.T. Stuss (Eds.), *Principles of frontal lobe function* (pp. 573-597). Oxford: Oxford University Press.
- Kobasa, S.C., Hilker, R.R., & Maddi, S.R. (1979). Who stays healthy under stress? *Journal of occupational medicine*, 21, 595-598.
- Kumpfer, K. (1999). Factors and processes contributing to resilience: The resilience framework. In M. Glantz & J. Johnson (Eds.), *Resilience and development: Positive life adaptations* (pp. 179-224). New York: Plenum Press.
- Levenson, R. (1990). The influence of age and gender on affect, physiology and their interrelations: A study of long-term marriages. *Journal of Personality and Social Psychology*, 67,
- Lezak, M.D. (1995). *Neuropsychological Assessment*. New York: Oxford University Press.
- Luria, A.R. (1966). *Higher cortical functions in man*. (B. Haigh, Trans.). London: Tavistock.
- Madsen, K.B. (1988). *A history of psychology in metascientific perspective*. Amsterdam: North Holland.

- Miller, L.M. (1988). Ego autonomy, creativity and cognitive style: A neuropsychodynamic approach. *Psychiatric Clinics of North America*, 11, 383-397.
- Moore, C. (2003). The ecosystemic approach. In W. Meyer, C. Moore & H. Viljoen (Eds.), *Personology: From individual to ecosystem* (pp. 462-498). Cape Town: Heinemann.
- National Wellness Association. (1999). *Definition of health*. Retrieved November 25, 2003, from <http://www.wellnessnwi.org/nwa/naweldef.htm>
- Nell, V. (2000). *Cross-cultural neuropsychological assessment: Theory and practice*. London: LEA.
- OED. (2004). *Oxford English Dictionary*. Retrieved March 23, 2004 from <http://www.oed.com/htm>
- Peterson, C., & Seligman, M.E.P. (2004). *Character strengths and virtues: A handbook and classification*. New York: Oxford University Press.
- Pretorius, T.B. (1998). *Fortitude as stress-resistance: Development and validation of the Fortitude Questionnaire (FORQ)*. University of the Western Cape: Bellville.
- Prigatano, G.P. (1986). *Neuropsychological rehabilitation after brain injury*. Baltimore: Hopkins Press.
- Rains, G.D. (2002). *Principles of human neuropsychology*. Boston: McGraw-Hill.
- Ryff, C.D., & Singer, B. (1998). The contours of positive human health. *Psychological Inquiry*, 9(1), 1-28.
-

- Ryff, C.D., & Singer, B. (2002). From social structure to biology: Integrative science in pursuit of human health and well-being. In C.R. Snyder & S.J. Lopez (Eds.), *Handbook of positive psychology* (pp. 541-555). Oxford: Oxford University Press.
- Seeman, J. (1989). Toward a model of positive health. *American Psychologist*, *44*, 1099-1109.
- Servan-Schreiber, D. (2004). *The instinct to heal: Curing stress, anxiety, and depression without drugs and without talk therapy*. USA: Rodale.
- Smith, D.F. (2002). Functional salutogenic mechanisms of the brain. *Perspectives in Biology and Medicine*, *45*, 319-328.
- Snyder, C.R., & Lopez, S.J. (2002). *Handbook of positive psychology*. Oxford: Oxford University Press.
- Sperry, R.W. (1987). Structure and significance of the consciousness revolution. *The journal of mind and behavior*, *8*, 37-66.
- Stuss, D.T., & Benson, D.F. (1986). *The frontal lobes*. New York: Raven Press.
- Stuss, D.T., & Levine, B. (2002). Adult clinical neuropsychology: Lessons from studies of the frontal lobes. *Annual Reviews of Psychology*, *53*, 401-433.
- Travis, J.W., & Ryan, R.S. (1988). *The wellness workbook*. Berkeley: Ten Speed.
- Tucker, D.M., & Williamson, P.A. (1984). Asymmetric neural control systems in human self-regulation. *Psychological review*, *91*, 185-215.
- Von Bertalanffy, L. (1950). The theory of open systems in physics and biology. *Science*, *3*, 23-29.
-

- Von Bertalanffy, L. (1974). General system theory and psychiatry. In G. Caplan (Ed.) *American handbook of psychiatry*. Vol. II. New York: Basic Books.
- Wissing, M.P., & Van Eeden, C. (2002). Empirical clarification of the nature of psychological well-being. *South African Journal of Psychology*, 32, 32-44.
- Witmer, J.M., & Sweeney, T.J. (1992). A holistic model for wellness and prevention over the life span. *Journal of Counseling and Development*, 71, 140-148.
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Section 3: Article 2

Attentional switching and psychosocial well-being

submitted to the

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Running head: ATTENTIONAL SWITCHING AND PSYCHOLOGICAL WELL-BEING

3.2 Manuscript

Attentional switching and psychosocial well-being

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Attentional switching and psychosocial well-being

Abstract

The aim of this paper was to determine whether the capacity to switch attention, as part of neuropsychological executive functions, is related to the degree of psychosocial well-being experienced. Sixty-six black African women completed the Color Trails Test (D'Elia et al, 1996), and Wisconsin Card Sorting Test (Heaton et al, 1993) as indications of flexibility in attentional switching. Psychosocial well-being was conceptualised and assessed in terms of various facets of holistic well-being, namely cognition, affect, behaviour, self-concept, interpersonal relationships and spiritual functioning. Statistically significant ($p < 0.05$) correlations indicate that flexibility in attentional switching is associated with psychosocial well-being. Implications of findings are indicated.

Key words: neuropsychology, attentional switching, psychosocial well-being

Attentional switching and psychosocial well-being

Psychology, philosophy and history have shown long-standing interest in what it means to function optimally and recently, a whole new science of well-being started to develop. One of the currently asked questions in this field is what the processes and mechanisms involved in mediating and moderating well-being are (Ryff & Singer, 2002). In a review on selective attention research Driver (2001) indicated the increasing research focus on the interplay between psychology and neuroscience. Additionally, Smith (2002: 320) stated that “neuroscientists usually study the brain in relation to disease, but perhaps they should begin paying more attention to the brain in relation to health”. This article links with these trends by focusing on a possible relationship between attentional switching (part of neuropsychological executive functions) and psychosocial well-being. It may be that neuropsychological processes (such as attentional mechanisms) can provide clues regarding possible mechanisms that mediate between brain functions and psychosocial well-being. The fundamental agenda for understanding the potential neuropsychological substrates of human flourishing is to learn how well-being can be improved based on knowledge regarding a possible reciprocal relationship between optimal neuropsychological functioning and psychosocial well-being.

The research question addressed in this article is whether attentional switching, as part of neuropsychological executive functions, correlates with psychosocial well-being. The point of departure is a pluralistic systems philosophy, more specifically an ecosystemic perspective (Bateson, 1972, 1979). According to general system theory (Von Bertalanffy,

1950, 1974), a system is a whole consisting of elements organised or structuralized in a particular way, forming part of a larger suprasystem, with interactional patterns occurring within and between systems. Of special concern for a study of correlations between different subsystems, is the principle of reciprocity between dynamically interrelated and interdependent parts. On this basis it can be hypothesised that neuropsychological functioning has to be interrelated with any other aspect of holistic human functioning.

A possible relationship between attentional switching as part of neuropsychological executive functions and facets of psychosocial well-being has not, as far as could be ascertained, been empirically investigated. Knight and Stuss (2002) suggest that explication of the function of the prefrontal cortex, the anatomical basis of executive functions, appears to be fundamental for a complete understanding of human cognition in both health and disease. Subsequently, the aim of this paper is to determine whether the capacity to switch attention, as measured by the *Color Trails Test* (CTT) (D'Elia, Satz, Uchiyama & White, 1996) (especially Part 2) and *Wisconsin Card Sorting Test* (WCST) (Heaton, Chelune, Talley, Kay & Curtiss, 1993) is related to the degree of psychosocial well-being experienced.

Attentional switching

Numerous neuropsychological studies have indicated that the frontal lobes and specifically the prefrontal areas, form the anatomical substrate of the so-called "executive functions" (Knight & Stuss, 2002; Lezak, 1995; Rains, 2002; Stuss & Benson, 1986; Stuss & Levine, 2002). Executive functions seem to mediate/regulate both cognitive and affective behaviour (Lezak, 1995; Rains, 2002; Stuss & Levine, 2002). The attentional

system forms part of executive functioning and consists of different components, with its main aim to orient the brain to novel input by regulating arousal levels (Tucker & Williamson, 1984).

Mirsky (1996) developed a neuropsychological model identifying the possible elements of attention and related these elements to neuropsychological measures and underlying neural systems. He proposed four elements of attention: focus-execute, shift, sustain and encode. Stuss and Levine (2002) in turn indicated that standard assessment is usually concerned with three aspects: attentional switching, selective attention and sustained attention. This model corresponds to that of Mirsky (1996), except for encoding.

Attentional switching, as one distinct aspect of the attentional system, is defined as the ability to move or change attentional focus in a flexible and adaptive manner. It is also known as task switching or attention shifting. Attentional switching has three characteristics: switching takes (1) time, but when (2) prepared, less time is needed to make a switch, however, a definite (3) cost still remains (Stuss, Shallice, Alexander & Picton, 1995). Therefore, so-called “attentional fatigue” may also influence the capacity to switch attention.

According to Derryberry and Reed (1996), the capacity to employ attention to regulate perceptual and conceptual processes is crucial. They postulate that the ability to shift attention is developed within contexts in which the child is incapable of physically changing the environment or stimuli associated with it. Individuals are thought to be able to regulate their attention better once the stimulus is consciously perceived (Williams,

1988). Evolutionary viewed, the capacity to switch attention seems related to survival, by promoting flexible coping. According to Derryberry and Reed (1996), in a threatening situation an individual must be able to attend to the threat itself, but also to the available sources for relief or safety. Attention switching capacity is, therefore, an important contributor to survival of the species and subsequently a worthy subject of study.

Mirsky (1996) indicates the Trail Making Test (TMT) as a measure indicative of focus-execute attention and the WCST as indicative of shifting attention. Stuss and Levine (2002) indicate both the TMT and WCST as indicative of the ability to shift attention. In this study the TMT and WCST were chosen to measure attentional switching capacity as proposed by Stuss and Levine (2002). However, given the population partaking in the study, the TMT was substituted with the CTT, developed as a standardised and culturally fair edition of the TMT (Mitrushina, Boone & D'Elia, 1999).

Psychosocial well-being

The interplay between the psychological and social subsystems of human functioning has been established as so pronounced, that the term *psychosocial* came into use as early as 1899 (OED, 2004).

Psychological well-being seems to be multi-dimensional regarding facets of self involved, namely affect, cognition, behaviour, self-concept, interpersonal relationships and absence of general symptoms of mental disorder. It also seems multi-dimensional regarding domains of life in which it manifests, namely intra and interpersonal, social and contextual and in love and work (Wissing & Van Eeden, 2002). Individual differences exist in these various dimensions of well-being related to a person's age, gender, socio-

economic status and level of education (Ryff & Singer, 2002). Different theorists have proposed different micro-level constructs to define the essence of psychological well-being. It includes constructs such as *affect balance* (Kammann & Flett, 1983), *constructive thinking* (Epstein & Meier, 1989), *explanatory style* (Buchanan & Seligman, 1995), *fortitude* (Pretorius, 1998), *sense of coherence* (Antonovsky, 1987, 1993) and *spirituality* (Hungelmann, Kenkel-Rossi, Klassen & Stollenwerk, 1989). An overview of important facets and constructs in positive psychology can be found in Aspinwall and Staudinger (2003), Keyes and Haid (2003), Peterson and Seligman (2004) and Snyder and Lopez (2002).

Social well-being refers to the level of social skills a person possesses, the level of comfort in social functioning, the ability to be part of a larger society and the extent of concern and respect for others (Eberst, 1984). Social well-being is also conceptualised as the ability to form and maintain positive, strong and meaningful interpersonal relationships, resulting in feelings of belonging and interdependence with others (Pretorius, 1998; Ryff & Singer, 1998). Kumpfer (1999) refers to social resiliency competencies such as social skills, street smarts, communication skills, peer resistance skills, multi-cultural and bi-gender competencies and capacity for intimacy.

In summary, psychosocial well-being refers to optimal functioning on intra and interpersonal level. In the current study, psychosocial well-being is conceptualised and measured in terms of facets of holistic models of well-being such as cognition, affect, behaviour, self-concept, interpersonal relationships and spiritual functioning.

Links between attentional switching and psychosocial well-being

Prefrontal executive dysfunction has been linked to schizophrenia (Rains, 2002; Heaton, et al., 1993; Tucker & Williamson, 1984), obsessive-compulsive disorder (OCD) (Rains, 2002, Miller, 1988), mania (Miller, 1988) and anti-social personality disorder (Rains, 2002; Miller, 1988). Impaired ability to switch attention, also known as cognitive or attentional bias, has been named as a cause of anxiety disorders (Mineka & Sutton, 1992) and manifests in Huntington's disease (Georgiou, Bradshaw, Phillips & Chiu, 1996). A correlation between executive (and specifically attentional) dysfunction and psychopathology is thus clear. However, the question arises whether normal or optimal executive functioning and specifically attentional switching, would correlate with indices of psychosocial well-being.

According to Derryberry and Reed (1996), attentional switching ability directly benefits psychosocial well-being by facilitating coping. When a person can remain in a threatening situation, but shift attention between the threat and possible coping options, the formation of more detailed conceptualisations is enabled which can facilitate coping in the future. Research in environmental psychology, on applications of Attentional Restoration Theory (ART), proposes that in case of attentional fatigue, beautiful, green environments contribute to attentional recovery, i.e. positive affective experiences and better cognitive functioning (Herzog, Black, Fountaine & Knotts, 1997; Taylor, Kuo & Sullivan, 2001). Therefore, a relationship between attentional processes and aspects of well-being has been established. Additional empirical evidence is sparse, but theories

linking neuropsychological executive functioning and psychosocial well-being point in the direction of a possible relationship.

During 1988 Miller proposed a “neuropsychodynamic model” for integrating the neuropsychological and psychosocial aspects. He hypothesised that the “ego-autonomous person’s” functioning may depend on some optimum level of functioning in the frontal-interhemispheric axis. With “ego-autonomous” he refers to Hartmann’s (1958) psychoanalytic conceptualisation of the ego’s ability to function autonomously by controlling in its life what is possible and adjusting to immutable adversity, to *maintain it’s fundamental psychological stability* (italics added). According to this model, the prefrontal lobes synthesise exteroceptive and interoceptive information to regulate behaviour with the purpose of preserving personal equilibrium in ecological context, resulting in (holistic) health. It is, therefore, implied that the prefrontal lobes are responsible for both proximal (neuropsychological) and distal (behavioural) regulatory processes.

More recently, Frederickson (1998, 2001) postulated the broaden-and-build theory of positive emotions, postulating a reciprocal causal link between affect, physical health, cognition and social functioning. According to this theory, positive and negative emotions have distinct, but complementary adaptive functions, with concomitant cognitive and physiological effects. While negative emotions narrow the momentary thought-action repertoire, positive emotions broaden this repertoire, expanding the range of cognitions and behaviours that come to mind. These broadened mindsets, in turn, build

physical, intellectual and social resources, again resulting in the experience of more positive emotions and higher levels of well-being.

It is, therefore, clear that the above mentioned theories rest on the assumption that reciprocity exists between dynamically interrelated and interdependent parts.

Method

Design

This study had a cross-sectional design and was part of the multi-disciplinary POWIRS project. (POWIRS = **P**rofiles of **O**bese **W**omen with **I**nsulin **R**esistance **S**yndrome) (Schutte, Kruger, Wissing, Underhay & Vorster, in press).

Participants

One hundred apparently healthy African women (aged 18-60 years) were recruited from governmental organisations in the North West Province of South Africa, based on their body mass index, for purposes of the POWIRS project. Exclusion criteria for the larger POWIRS study were pregnancy, lactation, any acute/chronic illness and use of chronic medication. Specific neuropsychological exclusion criteria included any history of head injury with loss of consciousness, prior neurological conditions or a history of epilepsy. Permission to utilise HIV/AIDS status as exclusion criteria was unfortunately denied by the participants' employer.

Due to the demands of the neuropsychological tests, a minimum educational level of Grade 11 was required for inclusion in this particular part of the study, which left 66 suitable participants, with a mean age of 26 years (range 19 - 52) and a mean educational level of 12 years (range 11 – 18). Informed consent was obtained from participants and

feedback was made available to them after testing. The ethical committee of the North-West University approved of this study and allocated the authorisation number 03M03.

Procedure

For a period of about three weeks, 10 participants per night stayed in the Metabolic Unit of the North-West University, Potchefstroom Campus. Data gathering took place at so-called “testing stations” of the different disciplines. Between 17:00 and 19:00 all participants were evaluated in groups at the anthropometrical measurements station, the dietary questionnaire station and the psychological questionnaire station. The next morning blood pressure measurements, blood samples and a glucose tolerance test were taken. After breakfast the neuropsychological tests were administered individually.

Measurements

Neuropsychological measures

Color Trails Test (CTT). The Color Trails Test (D’Elia, et al., 1996) is a paper and pencil test and a non-alphabetical parallel form of the Trail Making Test. For the purpose of this study, CTT Form A was used. The test consists of two parts, 1 and 2. Part 1 is primarily a test of motor speed and sustained visual attention, involving perceptual tracking and simple sequencing. As first part it is viewed as a strong indicator of performance anxiety (D’Elia, et al., 1996). Part 2 more directly assesses frontal systems functioning, due to the alternating sequence pattern requiring *divided or complex* attention and advanced sequencing skills, thus evaluating the simultaneous maintenance of two sequences. It, therefore, is the more sensitive indicator of attentional switching capacity.

Colour is used as the category for change in Part 2, which, as concept, transcends cultural distinctions. Research by Maj et al. (1993) suggested that CTT is a culturally fair test. Persons with colour blindness can distinguish the colours used. The test depends on reduced language demands and proved sensitive to subtle neurological alterations. Due to using colour as variable, this test also seems to be especially sensitive to right frontal lobe functioning (D'Elia, et al., 1996). In previous studies this test proved to be a reliable and valid measure of prefrontal cortex functions (D'Elia, et al., 1996). The test was scored by the time taken (in seconds) to complete each trial.

Wisconsin Card Sorting Test (WCST). The Wisconsin Card Sorting Test (Heaton et al., 1993) is used to assess abstract reasoning ability and the ability to shift cognitive strategies in response to changing environmental demands. As such, the WCST can be considered a measure of executive functioning, specifically attentional switching (Mirsky, 1995; Stuss & Levine, 2002). It requires the ability to develop and maintain an appropriate problem-solving strategy across changing stimulus conditions in order to achieve a future goal. Additionally, it requires maintenance of attention, strategic planning, organised searching, resistance to interference, utilising environmental feedback to switch between cognitive sets, directing behaviour toward achieving a goal and inhibiting impulsive/perseverative responding (Heaton et al., 1993).

The test consists of four stimulus cards and 128 response cards depicting figures of varying forms, colours and numbers of figures. Colour, form and number are universal symbols, placing limited demands on language production or knowledge. The client is instructed to match each consecutive card from the deck with one of the four stimulus

cards, but never told the correct sorting principle, only whether each card was sorted “right or wrong”. Once the client makes 10 correct matches, the sorting principle is changed without notice, requiring the client to use the examiner’s feedback, through a process of trial and error, to develop a new sorting strategy. The test proceeds in this way through a number of shifts among the three possible sorting categories (Heaton et al., 1993).

It appears from Milner’s work (1963) that the principal locus of this card-sorting effect is roughly around Broadmann’s area 9 in the left hemisphere. Lesions elsewhere in the left frontal lobe, and often in the right, will also produce a deficit on this task, although a somewhat attenuated one. However, posterior damage can also affect WCST performance (Anderson, Damasio, Jones & Tranel, 1991).

The score used in this study is *Percentage Conceptual Level Responses (%CLR)*. It indicates the percentage of trials in which a person exhibited insight into the correct sorting principle, indicating a person’s ability to shift attention between sorting principles. This test was scored using the computer programme devised by Harris (1988), according to the scoring criteria presented by Heaton et al. (1993).

Psychosocial measures

In the current study, psychosocial well-being is conceptualised in terms of holistic models of well-being and measured by particular indices to represent various facets of psychosocial well-being, namely cognition, affect, behaviour, self-concept, interpersonal relationships and spiritual functioning.

Cognitive: Cognitive Appraisal Questionnaire (CAQ). The CAQ (Botha & Wissing, 2003) is based on the explanatory style model of Buchanan and Seligman (1995). It measures globality, internality and stability of attribution across emotionally pleasant and unpleasant experiences. It is an eight item, five point Likert type scale, with a higher score indicating a more optimistic explanatory style and lower scores indicating a relatively pessimistic explanatory style. In this study, a Chronbach alpha reliability coefficient (referred to as ‘reliability’ in the remainder of the article) of 0.72 was obtained.

Affective: Affectometer 2 (AFM2) – Short form The AFM2 (Kammann & Flett, 1983) measures the overall level of well-being as full range dimension, conceptualised as the extent to which good feelings predominate over bad feelings, as reflected in the affect balance score. It is a three-minute self-report inventory consisting of twenty items measuring general happiness, scored on a five point scale. In this study, reliability of 0.78 and 0.82 were obtained for the positive and negative affect scales respectively.

Behavioural: Constructive Thinking Inventory (CTI) - abbreviated version. The CTI – abbreviated version (Epstein & Meier, 1989) measures non-intellective, habitual, automatic constructive thinking associated with the experiential system as conceptualised by Epstein (1973, 1994). The subscale Behavioural Coping (BC) is a 14-item five-point bipolar scale measuring ways of thinking that promote effective action. (Epstein & Meier, 1989). It also measures the maintenance of an optimistic approach to life, assisting in facing challenges and in rebounding from failures. People with high scores on BC are action orientated, optimistic and do not hold grudges, but refocus their attention on

planning and carrying out effective behaviour. In this study, a reliability of 0.61 was obtained for BC.

Self-concept: Fortitude Questionnaire (FORQ). The FORQ (Pretorius, 1998) measures the “strength to manage stress and stay well, as derived from an appraisal of the self, the family and support from others” (Pretorius, 1998:31). The selected subscale (FORQ-S) specifically refers to self-appraisal, which includes variables such as self-esteem, self-denigration, self-worth, personal competence, personal efficacy and perception of problem-solving skills. The questionnaire consists of twenty questions scored on a four-point semantic differential scale. A higher score indicates higher levels of fortitude. In this study, a reliability of 0.63 was obtained for FORQ-S.

Interpersonal relationships: Psychological well-being scales (SPWB). The PSWB (Ryff & Singer, 1998) measures the multidimensional structure of well-being according to Ryff and Keyes (1995). The subscale Positive Relations with Others (PSWB-PR) measures the extent of satisfying relationships with others. It is a 14-item subscale, scored on a six-point scale. The higher the score the higher the level of well-being experienced. In this study, a reliability of 0.71 was obtained for PSWB-PR.

Spirituality: Jarel spiritual well-being scale (SWS-H). The SWS-H (Hungelmann et al., 1989) indicates the extent to which a person experiences a “sense of harmonious interconnectedness between self, others, nature and the Ultimate Other, which exists throughout and beyond time and space“ (Hungelmann et al., 1989:394). This is achieved through a dynamic and integrative growth process leading to a realisation of the ultimate meaning and purpose of life. It consists of 21 questions scored on a six-point scale. A

higher score indicates higher levels of spiritual well-being. In this study, a reliability of 0.78 was obtained.

General psychological well-being: Antonovsky Orientation to Life Questionnaire (SOC-29). The SOC-29 (Antonovsky, 1987, 1993) measures a “global orientation that expresses the extent to which one has a pervasive, enduring though dynamic feeling of confidence that 1) the stimuli deriving from one’s internal and external environments in the course of living are structured, predictable and explicable (comprehensible); 2) the resources are available to one to meet the demands posed by these stimuli (manageable) and 3) these demands are challenges, worthy of investment and engagement (meaningful)” (Antonovsky, 1987:19). It was included in the study as indicator of general psychological well-being as it gives an indication of an underlying world view, partially determined by consistency of experience, whether positive or negative (Bowman, 1996) and has in previous research been linked to biological well-being (Antonovsky, 1987) and general psychosocial well-being (Wissing & Van Eeden, 2002). Antonovsky (1987) suggested that Sense of Coherence is a global orientation transcending cultural lines. The scale is a 29 item seven-point semantic differential questionnaire with two anchoring phrases. A high score on this scale indicates a strong sense of coherence. Reliability in this study was 0.81.

Results

The STATISTICA data analysis software system (StatSoft, Inc., 2003) was used for analyses. Firstly, the normality of the data for each variable was examined. Only age, Color Trails Test Trail 1 (CTT1) and Color Trails Test Trail 2 (CTT2) were not normally

distributed and due to their positive skewness, they were transformed by implementing logarithms (to base 10). Although CTT1 was administered as practice trail for CTT2, it was not included in further analyses due to the literature (D'Elia et al., 1996) indicating CTT1 as a stronger measure of emotional aspects, such as performance anxiety, than an indicator of the ease of attentional switching. The transformed CTT2 and Wisconsin Card sorting test – Percentage conceptual level responses (WCST-%CLR) were standardised by obtaining their z-scores. As CTT2 is a timed measure, a high score indicated a poor performance. Therefore, the CTT2 z-scores were multiplied by -1 to obtain the opposite of the scores, comparable to the interpretation of the WCST-%CLR scores.

The next step was to form an attentional switching factor. Manifest variables CTT2 and WCST-%CLR were used to obtain a latent variable “Attentional switching”, by means of a principal component (factor) analysis. The two manifest variables explained 65.34% of the variance of the attentional switching factor, with an eigenvalue of 1.31. The factor loadings of CTT2 and WCST-%CLR on “Attentional switching” were 0.81 and 0.81 respectively. This means that the latent variable “Attentional switching” could be obtained as the average of the two transformed standardised variables.

Following this step, partial correlations between the latent variable “Attentional switching” and the manifest psychosocial variables were determined, controlling for the effect of age on (especially) attentional switching. With the current sample size (assuming a random sample), correlations larger than roughly 0.2 in absolute value are statistically significant on a 5% level. However, such a correlation means that only 4% of the variance of the one variable is explained by the other. To be practically significant

with a medium effect (Cohen, 1988), the correlation ought to be approximately 0.3 and for a large effect it has to be 0.5. In this study a medium effect will be considered as indication of possible practical significance. Correlations between the psychosocial facets are also indicated in Table 1 in order to demonstrate the coherence between these facets.

As indicated in Table 1, all correlations between attentional switching and psychosocial well-being, except for Positive Relations with Others, are statistically significant. All the statistically significant correlations have a medium practical effect, except for Cognitive Appraisal. The many practically significant correlations among facets of psychosocial well-being attest to the high degree of coherence among them as components of holistic wellness.

[Table 1 approximately here]

Discussion and conclusions

The aim of this paper was to determine whether the capacity to switch attention, as measured by the Color Trails Test (CTT) (D'Elia et al., 1996) and Wisconsin Card Sorting Test (WCST) (Heaton et al., 1993), is related to the degree of psychosocial well-being experienced. Findings indicate that higher flexibility in attentional switching is associated with higher levels of psychosocial well-being. A practically significant correlation of 0.36 was found between attentional switching and Sense of Coherence, as indicator of general psychological well-being. Findings regarding the various facets of psychosocial well-being will be discussed separately.

Cognitive well-being

Ease of attentional switching correlates with a tendency to make global, internal and stable attributions regarding positive events and specific, external and changeable attributions regarding negative events, as measured by the CAQ. Brosschot (2002) states that attentional bias causes attributional bias, as the former leads to misattributions or over-interpretation of ambiguous information. Negative, internal attributions, causing guilt and shame, often result from attention focused on information such as heart rate or bodily sensations (Derryberry & Reed, 1996). It, therefore, seems as if the focus of attention can influence the type of attribution made. Ease of attentional switching may perhaps open up a wider array of possible attributions regarding a given situation and thereby facilitate better adjustment.

Affective well-being

Ease of attentional switching correlates with a higher level of positive as compared to negative affect, as measured by the AFM2. Attentional bias is believed to sustain or even cause anxiety disorders (Mineka & Sutton, 1992). However, negative affect, in turn, causes attentional bias (Brosschot, 2002), or “narrowing of the overall breadth of attention” (Frederickson, 2000). Persons high in anxiety are slow in shifting attention away from negative stimuli from either the environment (exteroceptive) or internal states (interoceptive) (Derryberry & Reed, 1996) A feedback loop, therefore, seems to exist between attentional and psychological functioning, attesting to human systemic functioning. Isen (2002) established that positive affect facilitates cognitive flexibility, presumably due to the fact that frontal brain regions rich in dopamine receptors control

both these processes. Another explanation is that the decision to attend involves integration of affective and cognitive information in deciding whether a particular task will confer benefits outweighing any perceived costs. This process seems to involve reward mechanisms, specifically dopamine systems (Wager, Jonides & Reading, 2004). Therefore, the ease of disengaging from negative stimuli and engaging positive stimuli seems associated with affective well-being.

Behavioural well-being

Behavioural coping (BC) correlates practically significantly with attentional switching. Attentional control is established as strong predictor of social skills, popularity and the ability to respond constructively in conflict situations in pre-schoolers (Derryberry & Reed, 1996). The reason seems to be that attentional switching is inversely related to the experience of anxiety, thus allowing a wider repertoire of behaviour to be utilised. Predominant attentional bias tends to trigger the most salient behavioural programmes, resulting in behavioural sensitisation (Brosschot, 2002). Behavioural sensitisation is defined as easily triggered behavioural patterns - probably neurally pre-activated motor programmes - coupled to the corresponding highly activated cognitive network. It often keeps people “stuck” in behavioural patterns that are counterproductive, while the ability to switch attention enables the utilization of a wider repertoire of behaviour. Focus on positive experiences may, however, also facilitate attentional flexibility by providing alternative behavioural patterns, thereby enhancing behavioural coping.

Positive self-appraisal

A practically significant correlation exists between attentional switching and self-concept. Attention to activated conceptual information can be biased, particularly evident in a complex domain such as the self-concept (Derryberry & Reed, 1996). Anxious children seem especially attentive to arousing interoceptive information. At conceptual level, these children only attend to negative components of the self. Such focus may strengthen the perception of the self as vulnerable and helpless, as opposed to efficient. Relaxation techniques develop more complex and resilient views of self (Frederickson, 2000). It may be effective partially due to switching attention from negative towards positive aspects and in the case of self-appraisal, to positive components of the self. Attentional switching seems to enable the refocusing of attention on the better rather than the worse. However, from a systems perspective, it is also possible that a strong self-concept may facilitate ease of attentional switching, as the secure individual need not focus attention on self-evaluation perpetually.

Interpersonal relationships

No significant correlation was found between Positive relations with Others and attentional switching. However, self-appraisal correlates with attentional switching and the self is construed within a social framework by attending to signs of acceptance and rejection from others (Leary, Tambor, Terdal and Downs, 1995). In this study, a correlation of $r = 0.48$ exists between self-appraisal and interpersonal relationships. Attentional switching, as neuropsychological function, therefore, seems associated with the intra-personal aspects of well-being, rather than the interpersonal aspects. However,

as intra-personal aspects in turn are associated with interpersonal aspects, it is possible that an indirect relationship, mediated by intra-personal aspects, may exist between attentional switching and interpersonal aspects.

Spiritual well-being

Spiritual well-being correlates practically significantly with ease of attentional switching. This could be due to spirituality requiring a shift in focus from the material to the spiritual realm, which would not be possible without the ability to switch attention. Spirituality increases the likelihood of finding positive meaning in life (Frederickson, 2000), which can happen via positive reappraisal, infusion of ordinary events with positive value and the pursuit of realistic goals. Therefore, spirituality could also facilitate attentional switching towards the positive by promoting skills such as “count your blessings”.

General discussion

The main finding of this study is that ease of attentional switching correlates positively with higher levels of psychosocial well-being. According to the ecosystemic perspective, this correlation should indicate reciprocal causality. This finding may point to one of the dynamics inherent in the processes of “psychological resiliency” (Kumpfer, 1999) and “flow” (Csikszentmihalyi, 1990), as conceptualisations of psychosocial well-being.

Psychological resiliency refers to effective coping and adaptation, although faced with loss, hardship or adversity. It is mediated by positive emotions and appraisals (Tugade & Frederickson, 2004), which can be cultivated by relaxation therapies and finding positive

meaning (Frederickson, 2000). Relaxation therapies might be successful due to their focus on contentment, by implication, refocusing attention away from the negative (stress) to the positive (contentment). Emphasising pleasant activities above unpleasant ones and implementing learned optimism could foster positive meaning. Distraction from everyday cares may foster positive emotions. “Green” environments restore attentional fatigue. It seems as if the ability to shift attention between different aspects is implied in these explanations of resiliency. We hypothesise that these shifts in focus made by resilient people could be attributed to well developed attentional switching abilities on a neuropsychological level.

Flow, in contrast, results from perseverance in an effort that can be sustained at the limit of a person’s capacities (Csikszentmihalyi, 1990). Considering this definition the question arises whether flow could be related to attention focused and sustained on a positive aspect.

The first implication of these findings, regarding a possible neuropsychological substrate of flourishing, is that we can better understand the mechanisms of well-being. Attentional processes may be a mediating mechanism between brain functioning and psychosocial well-being. The findings reported support the theory of Miller (1988) regarding the prominent role played by neuropsychological functions in psychosocial well-being. A second implication is that we can promote well-being by developing attentional switching skills through mental exercises. Adaptation on neurological level does not seem to require a great deal of time or practice, changes in prefrontal neural properties can be observed after relatively little experience (Duncan & Miller, 2002).

This suggests that psychosocial well-being could be more of a skill than a trait when developed and as such, opens up a new perspective on promoting well-being. It seems to be this skill that is implemented when, for example, utilising green environments for attentional restoration.

Future directions

The present reductionist attempt to link attentional switching, as one aspect of attentional functions, to psychosocial well-being, represents a first step towards a more comprehensive understanding of the role of executive functions in psychosocial well-being. A replication of the findings reported is necessary, as this study was conducted on a small mono-gender, mono-racial sample.

This study focused on what happens when attention can be flexibly shifted. However, extreme flexibility, resulting in distractibility, can impair performance. Stuss et al. (1995) indicate that the inability to inhibit strong, but inappropriate response tendencies is related to disorders, such as Attention Deficit Hyperactivity Disorder, memory disorders, manic episodes, Parkinson's disease and Gilles de la Tourette's syndrome (Georgiou et al., 1996). With a larger sample it would be interesting to see whether the relationship between attentional switching and psychosocial well-being could be polynomial rather than linear and to determine the boundaries between rigidity, flexibility and distractibility in attentional switching.

Acknowledgements

We thank the POWIRS team, especially Alta Schutte as project leader and Elsabè Botha for the gathering of the psychosocial data. We also thank the North-West University for financial support for this study.

References

- Anderson, S.W., Damasio, H., Jones, R.D., Tranel, D. (1991). Wisconsin Card Sorting Test performance as a measure of frontal lobe damage. *Journal of Clinical and Experimental Neuropsychology*, 13, 909-922.
- Antonovsky, A. (1987). *Unravelling the Mystery of Health. How people manage stress and stay well*. San Francisco: Jossey-Bass.
- Antonovsky, A. (1993). The structure and properties of the Sense of Coherence Scale. *Social Science and Medicine*, 36(6), 725-733.
- Aspinwall, L.G., & Staudinger, U.M. (2003). *A psychology of human strengths: Fundamental questions and future directions for a positive psychology*. Washington: APA.
- Bateson, G. (1972). *Steps to an ecology of mind*. San Francisco: Chandler.
- Bateson, G. (1979). *Mind and nature: A necessary unity*. New York: Dutton.
- Botha, E., & Wissing, M.P. (2003). *Cognitive Attribution Questionnaire*. Unpublished document, North-West University – Potchefstroom Campus, Potchefstroom.
- Bowman, B.J. (1996). Cross-cultural validation of Antonovsky's Sense of Coherence Scale. *Journal of Clinical Psychology*, 52, 547-549.
- Brosschot, J.F. (2002). Cognitive-emotional sensitisation and somatic health complaints. *Scandinavian Journal of Psychology*, 43, 113-121.
- Buchanan, G.M., & Seligman, M.E.P. (1995). *Explanatory style*. Hillsdale, NJ: Erlbaum.

- Cohen, Jacob. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: Erlbaum.
- Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. New York: Harper.
- D'Elia, L.F., Satz, P., Uchiyama, C.L., & White, T. (1996). *Color Trails Test: Professional manual*. Odessa: PAR.
- Derryberry, D., & Reed, M. A. (1996). Regulatory processes and the development of cognitive representations. *Development and Psychopathology*, 8, 215-234.
- Driver, J. (2001). A selective review of selective attention research from the past century. *British Journal of Psychology*, 92, 53-78.
- Duncan, J., & Miller, E.K. (2002). Cognitive focus through adaptive neural coding in the primate prefrontal cortex. In R.T. Knight & D.T. Stuss (Eds.), *Principles of frontal lobe function* (pp. 278-291). Oxford: Oxford University Press.
- Eberst, R.M. (1984). Defining health: A multidimensional model. *Journal of School Health*, 54, 99-104.
- Epstein, S. (1973). The self-concept revisited, or a theory of a theory. *American Psychologist*, 28, 404-416.
- Epstein, S. (1994). Integration of the cognitive and psychodynamic unconscious. *American Psychologist*, 49, 709-724.
- Epstein, S., & Meier, P. (1989). Constructive thinking: A broad coping variable with specific components. *Journal of Personality and Social Psychology*, 57, 332-350.

- Fredrickson, B. L. (1998). What good are positive emotions? *Review of General Psychology*, 2, 300-319.
- Fredrickson, BL (2000). Cultivating positive emotions to optimize health and well-being. *Prevention & Treatment*, 3, Retrieved January 26, 2003, from <http://journals.apa.org/prevention/volume3/pre0030001a.html>
- Fredrickson, B.L. (2001). The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions. *American Psychologist*, 56, 218-226.
- Georgiou, N., Bradshaw, J.L., Phillips, J.G., & Chiu, E. (1996). The effect of Huntington's disease and Gilles de la Tourette's syndrome on the ability to hold and shift attention. *Neuropsychologia*, 34, 843-851.
- Harris, M.E. (1988). *Wisconsin Card Sorting Test: Scoring Program*. Odessa: PAR.
- Hartmann, H. (1958). *Ego psychology and the problem of adaptation*. New York: International Universities Press.
- Heaton, R.K., Chelune, G.J., Talley, J.L., Kay, G.G., & Curtiss, G. (1993). *Wisconsin Card Sorting Test Manual: Revised and expanded*. Odessa: PAR.
- Herzog, T.R., Black, A.M., Fountaine, K.A., & Knotts, D.J. (1997). Reflection and attentional recovery as distinctive benefits of restorative environments. *Journal of Environmental Psychology*, 17, 165-170.
- Hungelmann, J., Kenkel-Rossi, E., Klassen, L., & Stollenwerk, R.M. (1989). Development of the JAREL Spiritual Well-Being Scale. In R.M. Carroll-Johnson (Ed). *Classification of Nursing Diagnoses* (pp.393-398). Philadelphia: J.B. Lippincott Company.
-

- Isen, A.M. (2002). A role for neuropsychology in understanding the facilitating influence of positive affect on social behavior and cognitive processes. In C.R Snyder & S.J. Lopez (Eds.), *Handbook of positive psychology* (pp. 528-540). Oxford: Oxford University Press.
- Kammann, R. & Flett, R. (1983). Affectometer 2: A Scale to measure current level of general happiness. *Australian Journal of Psychology*, 35, 259-265.
- Keyes, C.L.M., & Haidt, J. (2003). *Flourishing: Positive psychology and the life well-lived*. Washington: APA.
- Knight, R.T. & Stuss, D.T. (2002). Prefrontal cortex: The present and the future. In R.T. Knight & D.T. Stuss (Eds.), *Principles of frontal lobe function* (pp. 573-597). Oxford: Oxford University Press.
- Kumpfer, K. (1999). Factors and processes contributing to resilience: The resilience framework. In M. Glantz & J. Johnson (Eds.), *Resilience and development: Positive life adaptations* (pp.179-224). New York: Plenum Press.
- Leary, M.R., Tambor, E.S., Terdal, S.K., & Downs, D.L. (1995). Self-esteem as an interpersonal monitor: The sociometer hypothesis. *Journal of Personality and Social Psychology*, 68, 518-530.
- Lezak, M.D. (1995). *Neuropsychological Assessment*. New York: Oxford University Press.
- Maj, M., D'Elia, L.F., Satz, P., Janssen, R., Zaudig, M., Uchiyama, C., et al. (1993). Evaluation of two new neuropsychological tests designed to minimize cultural bias in

- the assessment of HIV-1 seropositive persons: A WHO study. *Archives of Clinical Neuropsychology*, 8, 123-135.
- Miller, L.M. (1988). Ego autonomy, creativity and cognitive style: A neuropsychodynamic approach. *Psychiatric Clinics of North America*, 11(3), 383-397.
- Milner, B. (1963). Effects of different brain lesions on card sorting. *Archives of Neurology*, 9, 90-100.
- Mineka, S., & Sutton, S.K. (1992). Cognitive biases and the emotional disorders. *Psychological Science*, 3, 65-69.
- Mirsky, A.F. (1995). Perils and pitfalls on the path to normal potential: The role of impaired attention. Homage to Herbert G. Birch. *Journal of Clinical and Experimental Neuropsychology*, 17, 481-498.
- Mirsky, A.F. (1996). Disorders of attention: A neuropsychological perspective. In G.R. Lyon & N.A. Krasnegor, (Eds.), *Attention, memory and executive function* (pp.71-96). Baltimore: Brookes.
- Mitrushina, M.N., Boone, K.B., & D'Elia, L.F. (1999). *Handbook of normative data for neuropsychological assessment*. Oxford: Oxford University Press.
- OED. (2004). *Oxford English Dictionary*. Retrieved March 23, 2004 from <http://www.oed.com/htm>
- Peterson, C., & Seligman, M.E.P. (2004). *Character strengths and virtues: A handbook and classification*. New York: Oxford University Press.
- Pretorius, T.B. (1998). *Fortitude as stress-resistance: Development and validation of the Fortitude Questionnaire (FORQ)*. Bellville: University of the Western Cape.

- Rains, G.D. (2002). *Principles of human neuropsychology*. Boston: McGraw-Hill.
- Ryff, C.D., & Keyes, C.L.M. (1995). The structure of psychological well-being revisited. *Journal of Personality and Social Psychology*, 68, 719-727.
- Ryff, C.D., & Singer, B. (1998). The contours of positive human health. *Psychological Inquiry*, 9, 1-28.
- Ryff, C.D., & Singer, B. (2002). From social structure to biology: Integrative science in pursuit of human health and well-being. In C.R Snyder & S.J. Lopez (Eds.), *Handbook of positive psychology* (pp. 541-555). Oxford: Oxford University Press.
- Schutte, A.E., Kruger, H.S., Wissing, M.P., Underhay, C., & Vorster, H.H. (in press). The emergence of the metabolic syndrome in urban obese African women: the POWIRS study. *South African Journal of Science*.
- Smith, D.F. (2002). Functional salutogenic mechanisms of the brain. *Perspectives in Biology and Medicine*, 45, 319-328.
- Snyder, C.R., & Lopez, S.J. (2002). *Handbook of positive psychology*. Oxford: Oxford University Press.
- StatSoft, Inc. (2003). STATISTICA (Data analysis software system), version 6. www.statsoft.com.
- Stuss, D.T., & Benson, D.F. (1986). *The frontal lobes*. New York: Raven Press.
- Stuss, D.T., & Levine, B. (2002). Adult clinical neuropsychology: Lessons from studies of the frontal lobes. *Annual Reviews of Psychology*, 53, 401-433.

- Stuss, D.T., Shallice, T., Alexander, M.P., & Picton, T. (1995). A multidisciplinary approach to anterior attentional functions. *Annals of the New York Academy of Science*, 769, 191-212.
- Taylor, A.F., Kuo, F.E., & Sullivan, W.C. (2001). Coping with ADD: The surprising connection to green play settings. *Environment and Behaviour*, 33, 54-77.
- Tucker, D.M., & Williamson, P.A. (1984). Asymmetric neural control systems in human self-regulation. *Psychological review*, 91, 185-215.
- Tugade, M.M., & Frederickson, B.L. (2004). Resilient individuals use positive emotions to bounce back from negative emotional experiences. *Journal of Personality and Social Psychology*, 86, 320-333.
- Von Bertalanffy, L. (1950). The theory of open systems in physics and biology. *Science*, 3, 23-29.
- Von Bertalanffy, L. (1974). General system theory and psychiatry. In G. Caplan (Ed.) *American handbook of psychiatry*. Vol. II. New York: Basic Books.
- Wager, T.D., Jonides, J., & Reading, S. (2004). Neuroimaging studies of shifting attention: a meta-analysis. *NeuroImage*, 22, 1679-1693.
- Williams, M., Watts, F., MacLeod, C., & Mathews, A. (1988). *Cognitive psychology and emotional disorders*. New York: Wiley.
- Wissing, M.P., & Van Eeden, C. (2002). Empirical clarification of the nature of psychological well-being. *South African Journal of Psychology*, 32, 32-44.
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Table 1

Partial correlations between attentional switching and psychosocial measures, controlled for age

Psychosocial measures	Attentional switching	Cognitive appraisal	Affect balance	Behavioural coping	Self-appraisal	Positive relations	Spiritual well-being
Cognitive appraisal	0.26*	1.00					
Affect balance	0.33*+	0.51*++	1.00				
Behavioural coping	0.46*+	0.55*++	0.58*++	1.00			
Self-appraisal	0.41*+	0.45*+	0.66*++	0.60*++	1.00		
Positive relations	0.23	0.49*+	0.64*++	0.57*++	0.49*+	1.00	
Spiritual well-being	0.44*+	0.39*+	0.53*++	0.65*++	0.50*++	0.36*+	1.00
Sense of coherence	0.36*+	0.46*+	0.67*++	0.53*++	0.58*++	0.59*++	0.31*+

*Marked correlations are statistically significant at $p < 0.05$.

+Marked correlations are practically significant with a medium effect

++Marked correlations are practically significant with a large effect

Section 4: Article 3

**The relationship between generativity as
neuropsychological process and psychosocial well-being**

submitted to

Neuropsychology

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Neuropsychology ISSN: 0894-4105

Impakfaktor: 2.027

Geakkrediteerd by ISI

<http://www.apa.org/journals/neu/submission.html>

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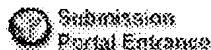
Editor: James T. Becker, PhD
Published Bimonthly, beginning in January

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 Jacoby, L. L. (1984). Incidental versus intentional retrieval: Remembering and awareness as separate issues. In L. R. Squire & N. Butters (Eds.), *Neuropsychology of memory* (pp. 145–156). New York: Guilford Press.

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Running head: GENERATIVITY AND PSYCHOSOCIAL WELL-BEING

4.2 Manuscript

The relationship between generativity as neuropsychological process and psychosocial well-being

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Abstract

This paper aimed to determine whether generativity, as neuropsychological executive function, and as measured by the *Controlled Verbal Fluency Task* (CVFT) (Benton, 1967) and *Uses of Objects Test* (UOT) (Getzels & Jackson, 1962), is related to psychosocial well-being. Psychosocial well-being was conceptualised and assessed in terms of various facets of holistic well-being, namely cognition, affect, behaviour, self-concept, interpersonal relationships and spiritual functioning. 72 African women participated in the study. Statistically ($p < 0.05$) and practically ($d =$ medium to large effect) significant correlations indicate that generativity is associated with psychosocial well-being. Implications of findings are that the frontal lobes may play a role in well-being, and that the latter could be possibly promoted by exercising neuropsychological skills.

Key words: neuropsychology, executive functions, generativity, fluency, psychosocial well-being

The relationship between generativity as neuropsychological process and psychosocial well-being

This article focuses on generativity, as part of neuropsychological executive functions, and the association thereof with psychosocial well-being. Generativity is the neuropsychological ability to generate novel ideas and spontaneous behaviours (Hill, 2004). The current exploration of a link between neuropsychological and psychosocial processes is in line with Smith's (2002: 320) remark that "neuroscientists should begin paying more attention to the brain in relation to health". Knight and Stuss (2002) also suggest that explication of the functions of the prefrontal cortex appears to be fundamental for a complete understanding of human cognition in both health and disease. The agenda for understanding the potential neuropsychological substrates of human flourishing is to bring together two domains of research that formed separate bodies of knowledge, namely neuropsychology and positive psychology (Seligman & Csikszentmihalyi, 2000), also called psychofortology (study of human strengths) (Wissing & Van Eeden, 1997, 2002). New domains and specialisations tend to emerge during the development of science, as specific facets of phenomena are differentiated and investigated (Staats, 1983). From an integration of findings from various domains and the exploration of relationships among facets or phenomena, new understandings, perspectives, theories and applications may develop.

The frontal lobes, and specifically the prefrontal areas, seem to be the anatomical basis of neuropsychological executive functions (Knight & Stuss, 2002; Lezak, 1995; Rains, 2002; Stuss & Benson, 1986; Stuss & Levine, 2002). Executive functions may be

characterised as separable but related functions, including mental flexibility, generativity, planning, inhibition and self-monitoring. The main purpose of these neuropsychological processes is to mediate/regulate both cognitive and affective behaviour and guide in problem solving, especially when tasks are novel and nonautomatic (Hill, 2004; Lezak, 1995; Miyake, Friedman, Emerson, Witzki & Howerter, 2000; Rains, 2002; Stuss & Levine, 2002). Generativity, which is the focus of this study, can be measured by tasks eliciting novel responses, such as verbal, ideational or design fluency tasks (Hill, 2004).

Fluency tasks tap the ability to generate multiple responses spontaneously following a single cue or instruction (Crowe, 1998; Lezak, 1995; Turner, 1999). Performance on verbal fluency tasks relies on efficient organisation of verbal retrieval and recall and involves short-term memory (in keeping track of words already said), ability to initiate and maintain word production set, cognitive flexibility and response inhibition capacity. These processes are viewed as aspects of executive functioning, and are generally considered to reflect left frontal function (Stuss & Levine, 2002). There is substantial evidence from neuroimaging studies to support the involvement of (left) prefrontal areas and the anterior cingulate in letter fluency performance (Baker, Frith & Dolan, 1997; Cantor-Graae, Warkentin, Franzen & Risberg, 1993; Cuenod, Bookheimer, Herz-Pannier, Zeffiro, Theodore & Le Bihan, 1995; Frith, Friston, Liddle & Frackowiak, 1991; Gourovitch, et al., 2000; Phelps, Hyder, Blamire & Shulman, 1997). It has long been recognised that patients with frontal lobe lesions exhibit a loss of spontaneous speech and difficulty in evoking appropriate words or phrases. Left frontal lesions result in, on

average, one third lower word production than right frontal lesions, with persons with bilateral lesions producing even fewer words (Miceli, Caltagirone & Gainotti, 1981).

Ideational fluency tasks are utilised to elicit divergent thinking. Divergent thought entails the capacity to generate many alternative responses, including alternatives of considerable variety and originality (Simonton, 1999a), that are needed mainly in unstructured problem situations (Cohen, 2001). Zangwill (1966) suggested that frontal lobe injury might interfere with these thought processes, as frontal lobe patients tend to embroider on the main or conventional use of the object, often failing to think of more creative uses. Verbal and ideational fluency are reduced due to impaired cognitive flexibility (Georgiou, Bradshaw, Phillips & Chiu, 1996). Ideational fluency tasks are rated as even more sensitive to frontal lobe functioning than less complex fluency tasks, such as verbal fluency tasks (Butler, Rorsman, Hill & Tuma, 1993; Carlsson, Wendt & Risberg, 2000).

This study focuses on linking information usually considered in the domain of neuropsychology with information from the domain of psychofortology. From a human systems theory perspective psychological well-being and social well-being are intricately linked (Bateson, 1972, 1979), hence the use of the term “psychosocial”. Psychological well-being has been conceptualised in various models (e.g. Adams, Bezner & Steinhardt, 1997; Eberst, 1984; Witmer & Sweeney, 1992) as a holistic phenomenon in which various dimensions, such as cognitive, affective, behavioural and spiritual, can be discerned. Psychological well-being has also been conceptualised and measured in terms of specific constructs, such as *affect balance* (Kammann & Flett, 1983), *constructive*

thinking (Epstein & Meier, 1989), *explanatory style* (Buchanan & Seligman, 1995), *fortitude* (Pretorius, 1998), *sense of coherence* (Antonovsky, 1987, 1993) and *spirituality* (Hungelmann, Kenkel-Rossi, Klassen & Stollenwerk, 1989). Individual differences exist in the various dimensions of well-being, related to a person's age, gender, socio-economic status and level of education (Ryff & Singer, 2002). An overview of important facets and constructs in positive psychology can be found in Aspinwall and Staudinger (2003), Keyes and Haid (2003), Peterson and Seligman (2004) and Snyder and Lopez (2002).

Social well-being refers to the level of diverse social skills a person possesses (Kumpfer, 1999); the level of comfort in social functioning, the ability to be part of a larger society, the extent of concern and respect for others (Eberst, 1984) and the ability to form and maintain positive, strong and meaningful interpersonal relationships, resulting in feelings of belonging and interdependence with others (Pretorius, 1998; Ryff & Singer, 1998). In summary, psychosocial well-being therefore refers to optimal functioning on intra- and interpersonal level.

Links between generativity, psychopathology and psychosocial well-being

The theoretical exploration of the hypothesis, namely that a relationship between neuropsychological and psychofortological facets may exist, was conducted along the line of thought presented by the pluralistic systems philosophy, specifically the ecosystemic perspective. (Bateson, 1972, 1979). According to this perspective subsystems within a suprasystem are in constant interaction. Such interaction will

inevitably result in interrelated influences and changes as manifested across the spectrum of the subsystems.

Empirically, prefrontal executive dysfunction has been linked to schizophrenia (Rains, 2002; Heaton, et al., 1993; Tucker & Williamson, 1984), obsessive-compulsive disorder (OCD) (Rains, 2002, Miller, 1988), mania (Miller, 1988) and anti-social personality disorder (Rains, 2002; Miller, 1988). A lack of generativity, as manifested in reduced fluency on both verbal and ideational fluency tasks, is linked to autism (Hill, 2004; Turner, 1999). Reduced cognitive flexibility in early Huntington's disease results in *inter alia* impaired verbal and ideational fluency (Georgiou, et al, 1996). Okada, Okamoto, Morinobu, Yamawaki & Yokota (2003) found that patients with major depression have lowered scores on fluency tasks and associated reduced blood flow and glucose metabolism in *inter alia* the left prefrontal cortex. Dysfunction of these areas, important in executive functions, parallels the impairment of spontaneous thought and action in depression, and may lead to the failure to generate and sustain mental activity seen in depressed patients. Patients with Parkinson's disease are impaired on ideational fluency (Wilson, Gilley, Tanner & Goetz, 1992). It is thus clear that executive dysfunction in general, and specifically disturbance in generativity, is linked to psychopathology.

However, can normal/optimal executive functions, and specifically generativity, be linked to psychosocial well-being, as pathology and well-being are not necessarily lying on a continuum? Besides the body of research generated by Alice Isen (e.g. Isen & Daubman, 1984; Isen, 1999; Isen, 2002) very little coherent information exists regarding

the role played by neuropsychological executive functions in different dimensions of psychosocial well-being.

Generativity, as viewed in neuropsychology, may however be linked to creativity, as described in the domain of psychofortology. Creativity is classified as a psychological strength by Peterson and Seligman (2004), as it is viewed as a highly successful adaptation mechanism, resulting in lifelong coping behaviour. Simonton (1999b) argues that creativity may have a biological evolutionary basis, which may manifest via generativity as neuropsychological process. If generativity is therefore associated with a psychological strength such as creativity, could it possibly also be associated with other psychological strengths?

The research question addressed in this article is therefore whether a person's level of neuropsychological executive functions, and specifically generativity, as measured by verbal and ideational fluency tasks, will correlate with the level of psychosocial well-being experienced.

Method and Material

Method

Design

This study was a cross-sectional study forming part of the multi-disciplinary POWIRS project (POWIRS = **P**rofiles of **O**beso **W**omen with **I**nsulin **R**esistance **S**ndrome) (Schutte, Kruger, Wissing, Underhay & Vorster, In press). Disciplines and sub-disciplines involved in the study included: anthropometrics, biochemistry, dietics, neuropsychology, physiology and psychofortology.

Participants

One hundred apparently healthy African women (aged 18-60 years) were recruited from governmental organisations in the North West Province of South Africa. Exclusion criteria for the larger POWIRS study were pregnancy, lactation, any acute/chronic illness and use of chronic medication. Specific neuropsychological exclusion criteria included any history of head injury with loss of consciousness, prior neurological conditions or a history of epilepsy. Permission to utilise HIV/AIDS status as exclusion criteria, was unfortunately denied by the participants' employer.

Due to the demands of the neuropsychological tests, a minimum educational level of grade 11 was required for inclusion in this particular part of the study, which left 72 suitable candidates, with a mean age of 28 years (range 19 - 52) and a mean educational level of 12 years (range 11 – 18). Assessment was conducted in English, the language of schooling and the work milieu the participants were from. Informed consent was obtained from participants, and feedback was made available to them after testing. The ethics committee of the North-West University approved of this study and allocated the authorisation number 03M03.

Procedure

For a period of about three weeks, 10 participants per night stayed in the Metabolic Unit of the North-West University, Potchefstroom Campus. Data gathering took place at so-called "testing stations" of the different disciplines. Between 17:00 and 19:00 all participants were evaluated in groups at the anthropometrical measurements station, the dietary questionnaire station and the psychological questionnaire station. The next

morning blood pressure measurements, blood samples and a glucose tolerance test were taken. After breakfast the neuropsychological tests were administered individually.

Measurements

Neuropsychological measures

Controlled Verbal Fluency Task (CVFT). The Controlled Verbal Fluency Task (Benton, 1967) is a phonemic task and consists of three English word-naming trails, with F, A and S employed as set of letters. The subject is asked to say as many different words as possible in 60 seconds, beginning with the given letter of the alphabet, excluding proper nouns, numbers and the same word with a different suffix. The task was scored for fluency, which is measured by the number of distinct responses generated. The score is the sum of all acceptable words produced in the three one-minute trails. Through converse reasoning, if bad performance indicates brain injury, good performance on this task was taken as indication of normal neuropsychological executive functioning. In this study a Chronbach alpha reliability coefficient (referred to as 'reliability' in the remainder of the article) of 0.79 was obtained for the sum of the three trails.

Uses of Objects Test (UOT). The Uses of Objects Test (Getzels & Jackson, 1962) is also known as the "Alternate Uses Test" or "Unusual Uses Test". It requires that a person write down as many uses as possible for five common objects: brick, pencil, paperclip, toothpick and sheet of paper. The time limit was 5 minutes for completion of all five objects. All participants easily finished within the designated time. The test was also scored for fluency, rather than quality of responses. Criteria employed for evaluating the total number of different suggested uses entailed discounting synonyms, distinctions

between singular and plural, and the addition of adverbs. For this study, only the sum of uses produced for brick, pencil and sheet of paper was included in the statistical analysis. It seemed as if the paperclip and toothpick were not in common use in the cultural group assessed, resulting in severely limited uses generated for these two objects. A reliability of 0.63 was obtained for the sum of the three objects.

Psychosocial measures

In the current study psychosocial well-being is conceptualised and measured in terms of facets of holistic models of well-being (Adams, Bezner & Steinhardt, 1997; Eberst, 1984; Witmer & Sweeney, 1992), such as cognition, affect, behaviour, self-concept, interpersonal relationships and spiritual functioning. All scales used had acceptable reliability and validity indices, according to their developers.

Cognitive: Cognitive Appraisal Questionnaire (CAQ). The CAQ (Botha & Wissing, 2003) is based on the explanatory style model of Buchannan and Seligman (1995) and measures globality, internality and stability in explanation of good and bad events. In this study a reliability of 0.72 was obtained.

Affective: Affectometer 2 (AFM2). The AFM2 (Kammann & Flett, 1983) measures the overall level of well-being, as reflected in the affect balance score (positive affect – negative affect). In this study reliability of 0.78 and 0.82 were obtained for the positive and negative affect scales respectively.

Behavioural: Constructive Thinking Inventory (CTI) - abbreviated version. The CTI – abbreviated version (Epstein & Meier, 1989) is a test measuring non-intellective, habitual, automatic constructive thinking associated with the experiential system as

conceptualised by Epstein (1973, 1994). The subscale Behavioural Coping (BC) measures ways of thinking that promote effective action (Epstein & Meier, 1989). In this study reliabilities of 0.74 and 0.61 were obtained for the full scale and the subscale BC respectively.

Self-concept: Fortitude Questionnaire (FORQ). The FORQ (Pretorius, 1998) measures the “strength to manage stress and stay well, as derived from an appraisal of the self, the family and support from others” (Pretorius, 1998:31). The selected subscale (FORQ-S) specifically refers to self-appraisal, which includes variables such as self-esteem, self-denigration, self-worth, personal competence, personal efficacy and perception of problem-solving skills. In this study a reliability of 0.88 was obtained for the full scale and 0.63 for the subscale FORQ-S.

Interpersonal relationships: Psychological well-being scales (PSWB). The PSWB (Ryff & Singer, 1998) measures the multidimensional structure of well-being according to Ryff and Keyes (1995). The subscale Positive Relations with Others (PSWB-PR) measures the extent of satisfying relationships with others. In this study a reliability of 0.71 was obtained for the subscale PSWB-PR.

Spirituality: JAREL spiritual well-being scale (SWS-H). The SWS-H (Hungelmann, et al., 1989) indicates the extent to which a person experiences a “sense of harmonious interconnectedness between self, others, nature and the Ultimate Other, which exists throughout and beyond time and space“ (Hungelmann, et al., 1989: 394). In this study a reliability of 0.78 was obtained for this scale.

General psychological well-being: Sense of Coherence Scale (SOC-29). The SOC-29 (Antonovsky, 1987, 1993) measures the “global orientation that expresses the extent to which one has a pervasive, enduring though dynamic feeling of confidence that 1) the stimuli deriving from one’s internal and external environments in the course of living are structured, predictable and explicable (comprehensible); 2) the resources are available to one to meet the demands posed by these stimuli (manageable); and 3) these demands are challenges, worthy of investment and engagement (meaningful)” (Antonovsky, 1987: 19). It was included in the study as general indicator of psychological well-being, as it gives an indication of an underlying world view, partially determined by consistency of experience, whether positive or negative (Bowman, 1996). Antonovsky (1987) suggested that the SOC measures a global orientation transcending cultural lines, which made it well-suited for this particular study. The reliability obtained for this study was 0.81.

Results

The STATISTICA data analysis software system (StatSoft, Inc., 2005) was used for the statistical analyses.

Firstly, the normality of the data for each variable was examined. Age was not normally distributed and was transformed by implementing a logarithm (to base 10). UOT scores were also not normally distributed, even after transformation, due to a few outliers. However, the information was correct and could not be excluded from the study. UOT scores were therefore entered in analysis as if they were normally distributed.

The next step was to form a “Generativity” factor. In the current study a correlation of 0.48 was found between manifest variables CVFT-sum and UOT-sum, indicating the extent to which they measure the same capacity. Previously a positive correlation of 0.53 between these two tasks was established (Carlson, et al., 2000). These two manifest variables were used to obtain a latent variable, Generativity, by means of a principal component (factor) analysis. The two manifest variables explained 76% of the variance of the generativity factor, with an eigenvalue of 1,52. The factor loadings of CVFT-sum and UOT-sum on Generativity were 0.87 and -0.87 respectively. Reliability of 0.67 was established for the Generativity factor by using equation M2 of Schepers (1993: 1) for the reliability of compound scores.

Following this step, Pearson correlations between the latent variable Generativity and the manifest psychosocial variables were determined, while controlling for the effect of age on generativity. After the initial correlations had been determined, attenuation corrections were done to correct for the influence of reliability on the correlations (Stanley, 1971). With the current sample size (assuming a random sample), correlations larger than roughly 0.2 in absolute value are statistically significant on a 5% level. However, such a correlation means that only 4% of the variance of the one variable is explained by the other. To be practically significant with a medium effect (Cohen, 1988), the correlation ought to be approximately 0.3 and for a large effect it has to be 0.5. In this study a medium effect will be considered as indication of possible practical significance. Correlations are indicated in Table 1.

[Table 1 approximately here]

Discussion and conclusions

The aim of this paper was to determine whether generativity, as neuropsychological process outcome, is related to the degree of psychosocial well-being experienced. Results indicated that generativity is significantly related to psychosocial well-being in this sample of participants. A correlation of 0.34 (0.45 attenuated) was found between generativity and sense of coherence as indicator of general psychological well-being. Therefore, generativity on a neuropsychological level, measured as the degree of verbal and ideational fluency, is practically significantly linked to the degree that a person experiences the world as comprehensible, manageable and meaningful. Wissing and Van Eeden (2002) indicated that the SOC is a strong indicator of general psychological well-being. Therefore, it can be concluded that generativity on neuropsychological level is associated with general psychological well-being. No causality can be deduced from this study. However, from a systems theory perspective it can be expected that causal influences are multi-lateral. The relationship between generativity and specific facets of psychosocial well-being will be discussed separately, but of course these facets hang together from the perspective of holistic models of well-being.

Cognitive well-being

Generativity correlates statistically and practically significantly with a tendency to make global, internal and stable attributions regarding positive events and specific, external and changeable attributions regarding negative events, as measured by the CAQ. This is in line with findings of Czerw (2004), who hypothesised a one-way relationship between divergent thinking, as measured by neuropsychological measures, and optimism,

indicating that divergent thinking influences optimism. However, from an ecosystemic perspective, it is also possible that optimism may influence divergent thinking, as the type of attribution made regarding a problem, could influence the generation of novel problem solving responses.

Affective well-being

A statistically and practically significant (medium effect) correlation was found between generativity and a preponderance of positive affect over negative affect, as measured by the AFM2. Positive affect has been previously associated with cognitive/mental flexibility, as measured by verbal and ideational fluency tasks, resulting in divergent thinking and flexible and effective coping skills (Isen, 1999). Positive affect has an established facilitative effect on generativity in general (Isen & Daubman, 1984), and on verbal (Isen, 2002) and ideational fluency (Vosburg & Kaufmann, 1999) specifically.

Negative affect has a detrimental effect on ideational fluency and creative problem solving as measured by neuropsychological divergent thinking tasks (Vosburg & Kaufmann, 1999), probably because original thought is prevented when an individual is in a state of high emotional arousal, such as that present during threatening circumstances (Cohen, 2001; Simonton, 1999a). Vosburg and Kaufmann (1999) found that suicide ideation was positively associated with problem generation fluency and negatively associated with problem solving flexibility, suggesting that people who showed strong negative mood tendencies were able to generate many problems but no adaptive solutions. A possible explanation for these findings can be that in situations with

increased demands for emotional control, capacity for neuropsychological problem solving processes is reduced (Phillips, Bull, Adams & Fraser, 2002).

Behavioural well-being

Generativity and ways of thinking that promote effective action, as measured by the subscale Behavioural Coping of the CTI, correlate statistically and practically significantly. The behavioural coping scale stresses the ability to self-generate adaptive responses to challenges or difficulties (Spirrison & Gordy, 1994) and fluency tasks are an indication of the ability to generate novel responses and behaviour (Hill, 2004).

Generativity thus may enable spontaneous behaviour and execution of routine behaviour where changed circumstances occur and alternatives are needed. A lack of this ability leads to high levels of repetitive behaviour in daily life (Turner, 1999).

Concerning a reverse relationship, Krampen (1997) found that systematic relaxation exercises, resting and listening to music improved verbal and ideational fluency and problem solving as measured with verbal and ideational fluency tasks, by probably creating preconditions for the optimal realisation of one's own generative abilities in a problem situation. In the same line, Russ (1999) found that imaginative play facilitate divergent thinking in preschoolers, as measured neuropsychologically. Play facilitates a number of different processes important in divergent thinking, such as combinatory imagination, which is the ability to combine elements of experience into new situations and new behaviours. Theoretically therefore, children who are good at generating a variety of ideas and who can flexibly solve problems during play should be able to apply these skills to everyday problem solving, resulting in better coping with life (Russ, 1999).

These findings support the current relationship found between generativity and behaviour.

Positive self-appraisal

A statistically and (attenuated) practically significant (medium effect) correlation was found between generativity and positive self-appraisal. Positive self-appraisal as measured, includes variables such as self-esteem, self-denigration, self-worth, personal competence, personal efficacy and perception of problem-solving skills. The current finding is in line with research by Jaquish and Ripple (1980), indicating that self-confidence is positively associated with divergent thinking as measured neuropsychologically. Confidence in one's own ideas seems necessary to facilitate divergent thinking. However, higher self-acceptance implies a divergence from more conventional thinking (Hurley, 2001), which indicates that positive self-appraisal could also be the result of divergent thinking.

The correlations found may be higher in a Western group, as participants in this study were from an African group, in which the individual-self is less important than the social-self, according to their traditional collectivistic value system (Allik & McCrae, 2004; Diener & Suh, 2000; Direko, 2002).

Interpersonal relationships

A statistically and practically significant correlation was found between generativity and satisfying relationships with others. Similar findings were made by Grattan and Eslinger (1989) who found a significant correlation between performance on the UOT and measures of empathy, which they explained as the result of cognitive flexibility.

Johnson (1976) found a relation between social fantasy play in children, as opposed to individual fantasy play, and divergent thinking as measured with the UOT, which he explained by stating that ideational fluency underlies the cognitive demands of both divergent thinking and social fantasy play.

Isen (2002) proposed that positive affect might play a role in the relationship between generativity and interpersonal relations. According to this view, positive affect, via cognitive flexibility/generativity, mediates the processes of generosity, helpfulness and responsibility, improving social behaviour. It therefore seems possible that cognitive flexibility and the ability to generate quantitatively more and qualitatively better options for behaviour, result in better adjustment on interpersonal level.

The current study was conducted with a group to whom English was a second language. It could be possible that they had a more flexible approach to the world than monolinguals, as they usually participate in activities involving two cultural groups. Such an explanation would be in line with the finding of De Souza Fleith, Renzulli and Westberg (2002) that bilingual people have higher performances on divergent thinking measures when compared to monolingual people.

Spiritual well-being

A statistically and practically significant correlation was found between generativity and a sense of harmonious interconnectedness between self, others, nature and the Ultimate Other, as measured by the SWS-H. Spiritual growth is linked to higher levels of cognitive development, and seen by most developmental theories as intertwined with

maturational processes and experiences. Spirituality is also linked to openness to new experiences (Dillon, Wink & Fay, 2003).

A possible explanation for this finding is that free association, conducive to generativity, does not take place in core consciousness. This means that the generation of divergent ideas often does not emerge from deliberate concentration, but rather occurs on the periphery of awareness, influenced by the “random intrusions of subliminal events” (Simonton, 2002: 228). This process reflects the freer floating of a mind in a less disciplined state, such as that occurring during spiritual activities such as prayer or meditation. Spiritual practices therefore may be conducive to divergent thinking, while the development of spirituality, which involves an expansion of meta-theoretical perspectives on the world, may depend on the maturation of divergent thinking capabilities.

General discussion

The main finding of this study is that higher levels of generativity, as measured by verbal and ideational fluency tasks, correlate positively with higher levels of psychosocial well-being in this group of participants. The present reductionist attempt to link generativity, as one aspect of neuropsychological executive functions, to psychosocial well-being, represents a first step toward a more comprehensive understanding of the role of executive functions in psychosocial well-being and *vice versa*.

To explain the relationship between generativity and psychosocial well-being, we link with Lezak's (1995) view that behaviour can be conceptualised in terms of three functional systems. Firstly, cognition, which refers to the information handling aspect of

behaviour, secondly emotionality, which concerns feelings and motivation, and finally executive functions, concerned with how behaviour is expressed. Executive functions thus seem to govern the expression of both cognition and emotion (Lezak, 1995; Stuss & Levine, 2002). Based on this tripartite distinction of behaviour, we hypothesise that cognition, emotion, or both may mediate the relationship between generativity and other dimensions of psychosocial well-being. Theoretically cognition and emotion may mediate different kinds of processes or be influential in different situations.

The cognitive mediation hypothesis proposes that cognition acts as mediator between executive functions and psychosocial well-being. Therefore the expression (executive functions) of how information is handled (cognition) could influence psychosocial well-being. However, as found empirically, a reverse relationship is also possible with psychosocial well-being, via its influence on cognitive processes, also influencing the expression of behaviour.

The emotional mediation hypothesis resonates with assumptions in Frederickson's (1998, 2001) broaden-and-build theory of positive emotions. According to her theory, positive and negative emotions have distinct, but complementary adaptive functions, with concomitant cognitive and physiological effects. While negative emotions narrow the momentary thought-action repertoire, positive emotions broaden this repertoire, expanding the range of cognitions and behaviours that come to mind. These broadened mindsets, in turn, build physical, intellectual and social resources, again resulting in the experience of more positive emotions. Our hypothesis proposes that feelings and

motivation (emotionality) could mediate between how behaviour is expressed (executive functions) and psychosocial well-being. Once again a bi-directional influence is expected.

Whatever the mechanisms may be for explaining the link between generativity and psychosocial well-being, the finding of significant correlations between neuropsychological and psychofortological measures aids in understanding the nature of psychosocial well-being. The frontal lobes and executive functions seem as important in healthy personality functioning as in psychopathology. Different dimensions of psychosocial well-being may share the characteristics of cognitive flexibility, divergent thinking and fluency, as manifested in generativity. It is, therefore, possible that psychosocial well-being could be enhanced by improving executive functioning, by means of simple neuropsychological exercises put forward as games.

The conclusions drawn from this study have bearing on both a micro- and a macro-deterministic level. In explaining the relationship between “brain” and “mind”, Sperry (1987) referred to “psycho-neural interaction”, described as a mentalistic stance. This perspective recognises the existential reality of mental states and endows mental events with causative power to affect brain processing (macro-determinism) and to interact functionally with other mental events, while not denying the micro-determinist position that neuronal events also determine cognitive events. It claims to be a midway philosophic position that resolved the prior dualist-materialist dichotomy and claims to retain what is most valid from each side of the old dichotomy.

From a micro-deterministic perspective it is suggested that the frontal lobe executive functions play a role in the regulation of life quality relevant higher-order adjusting

psychosocial functions. From a macro-deterministic perspective it is suggested that psychosocial well-being, while being influenced by executive functions, also influences the continuous development of neuropsychological executive functions.

Viewed evolutionally, executive functions seem to have evolved from overt to covert responses as a means of self-regulation (Barkley, 2001). That was necessary given the interpersonal competition that arose within a group-living species. The executive functions serve to shift the control of behaviour from the immediate context, social others, and the temporal now, to self-regulation by internal representations regarding the hypothetical social future (Barkley, 2001). The executive functions therefore seem to meet the requirements of a biological adaptation mechanism. Adaptation on neurological level does not seem to require a great deal of time or practise, as changes in prefrontal neural properties can be observed after relatively little experience (Duncan & Miller, 2002) providing an opportunity for interventions on this level.

A replication of the findings reported is necessary, as this study was conducted on a small mono-gender, mono-racial sample, from which no generalisations can be made. Detailed functional imaging studies of tasks of executive function, as well as detailed studies of brain structure, in persons with varying levels of psycho-social well-being, are needed to further understand the association of executive functions with psychosocial well-being.

Acknowledgements

We thank the POWIRS team, especially Alta Schutte as project leader and Elsabè Botha for the gathering of the psychosocial data. The authors are also grateful to those funding this project, namely the South African National Research Foundation (NRF GUN number 2054068), Medical Research Council and Research Focus Area 9.1 of the North-West University (Potchefstroom Campus).

References

- Adams, T. Bezner, J., & Steinhardt, M. (1997). The conceptualization and measurement of perceived wellness: Integrating balance across and within dimensions. *American Journal of Health Promotion, 11*, 208-218.
- Allik, J., & McCrae, R. R. (2004). Toward a geography of personality traits: Patterns of profiles across 36 cultures. *Journal of Cross-Cultural Psychology, 35*, 13-28.
- Antonovsky, A. (1987). *Unravelling the Mystery of Health*. San Francisco: Jossey-Bass.
- Antonovsky, A. (1993). The structure and properties of the Sense of Coherence Scale. *Social Science and Medicine, 36*(6), 725-733.
- Ashby, F.G., Isen, A.M., & Turken, A.U. (1998). A neuropsychological theory of positive affect and its influence on cognition. *Psychological Review, 106*, 529-550.
- Aspinwall, L.G., & Staudinger, U.M. (2003). *A psychology of human strengths: Fundamental questions and future directions for a positive psychology*. Washington: APA.
- Baker, S.C., Frith, C.D., & Dolan, R.J. (1997). The interaction between mood and cognitive function studied with PET. *Psychological Medicine, 27*, 565-578.
- Barkley, R.A. (2001). The executive functions and self-regulation: An evolutionary neuropsychological perspective. *Neuropsychological review, 11*, 1-29.
- Bateson, G. (1972). *Steps to an ecology of mind*. San Francisco: Chandler.
- Bateson, G. (1979). *Mind and nature: A necessary unity*. New York: Dutton.
- Benton, A.L. (1967). Problems of test construction in the field of aphasia. *Cortex, 3*, 32-58.

- Botha, E., & Wissing, M.P. (2003). *Cognitive Attribution Questionnaire*. Unpublished document, North-West University – Potchefstroom Campus, Potchefstroom.
- Bowman, B.J. (1996). Cross-cultural validation of Antonovsky's Sense of Coherence Scale. *Journal of Clinical Psychology, 52*, 547-549.
- Buchanan, G.M., & Seligman, M.E.P. (1995). *Explanatory style*. Hillsdale, NJ: Erlbaum.
- Butler, R.W., Rorsman, I., Hill, J.M., & Tuma, R. (1993). The effects of frontal brain impairment on fluency: Simple and complex paradigms. *Neuropsychology, 7*, 519-529.
- Cantor-Graae, E., Warkentin, S., Franzen, G., & Risberg, J. (1993). Frontal lobe challenge: A comparison of activation procedures during rCBF measures in normal subjects. *Neuropsychiatry, Neuropsychology and Behavioral Neurology, 6*, 83-92.
- Carlsson, I., Wendt, P.E., & Risberg, J. (2000). On the neurobiology of creativity: Differences in frontal activity between high and low creative subjects. *Neuropsychologia, 38*, 873-885.
- Cohen, Jacob. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: Erlbaum.
- Cohen, S.R. (2001). The relationship between convergent and divergent thinking in science as revealed in sixth and seventh graders. *The Journal of Educational Research, 68*, 327-330.

- Crowe, S.F. (1998). Decrease in performance on the verbal fluency test as a function of time: Evaluation in a young healthy sample. *Journal of Clinical and Experimental Neuropsychology*, 20, 391-401.
- Cuenod, C.A., Bookheimer, S.Y., Hertz-Pannier, L., Zeffiro, R.A., Theodore, W.H., & Le Bihan, D. (1995). Functional MRI during word generation, using conventional equipment: A potential tool for language localization in the clinical environment. *Neurology*, 45, 1821-1827.
- Czerw, A. (2004 July). *Relationship between optimism and creative thinking: Experimental Research*. Poster presented at the Second European Conference on Positive Psychology, Verbania Pallanza, Italy.
- De Souza Fleith, D., Renzulli, J.S., & Westberg, K.L. (2002). Effects of a creativity training program on divergent thinking abilities and self-concept in monolingual and bilingual classrooms. *Creativity Research Journal*, 14, 373-386.
- Diener, E., & Suh, E. M. (2000). Measuring subjective well-being to compare the quality of life of cultures. In E. Diener, & E. M Suh (Eds.), *Culture and subjective well-being* (pp 4-12). Cambridge, Massachusetts: The MIT Press.
- Dillon, M., Wink, P., & Fay, K. (2003). Is spirituality detrimental to generativity? *Journal for the Scientific Study of Religion*, 42, 427-442.
- Direko, L. P. (2002). *The Afrocentric world as compared to the Eurocentric worldview: Implications for Psychotherapy*. Unpublished manuscript, North-West University - Potchefstroom Campus, Potchefstroom.

- Duncan, J., & Miller, E.K. (2002). Cognitive focus through adaptive neural coding in the primate prefrontal cortex. In R.T. Knight & D.T. Stuss (Eds.), *Principles of frontal lobe function* (pp. 278-291). Oxford: Oxford University Press.
- Eberst, R.M. (1984). Defining health: A multidimensional model. *Journal of School Health, 54*, 99-104.
- Epstein, S. (1973). The self-concept revisited, or a theory of a theory. *American Psychologist, 28*, 404-416.
- Epstein, S. (1994). Integration of the cognitive and psychodynamic unconscious. *American Psychologist, 49*, 709-724.
- Epstein, S., & Meier, P. (1989). Constructive thinking: A broad coping variable with specific components. *Journal of Personality and Social Psychology, 57*, 332-350.
- Frederickson, B.L. (1998). What good are positive emotions? *Review of General Psychology: Special Issue: New Directions in Research on Emotion, 2*, 300-319.
- Frederickson, B.L. (2001). The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions. *American Psychologist: Special Issue, 56*, 218-226.
- Frith, C.D., Friston, K.J., Liddle, P.R., & Frackowiak, R.S.J. (1991). A PET study of word finding. *Neuropsychologia, 29*, 1137-1148.
- Georgiou, N., Bradshaw, J.L., Phillips, J.G., & Chiu, E. (1996). The effect of Huntington's disease and Gilles de la Tourette's syndrome on the ability to hold and shift attention. *Neuropsychologia, 34*, 843-851.
- Getzels, J.W., & Jackson, P.W. (1962). *Creativity and intelligence*. New York: Wiley.

- Gourovitch, M.L., Kirby, B.S., Goldberg, T.E., Weinberger, D.R., Gold, J.M., Esposito, G., et al. (2000). A comparison of rCBF patterns during letter and semantic fluency. *Neuropsychology, 14*, 353-360.
- Grattan, L.M., & Eslinger, P.J. (1989). Higher cognition and social behavior: Changes in cognitive flexibility and empathy after cerebral lesions. *Neuropsychology, 3*, 175-185.
- Heaton, R.K., Chelune, G.J., Talley, J.L., Kay, G.G., & Curtiss, G. (1993). *Wisconsin Card Sorting Test Manual: Revised and expanded*. Odessa: PAR.
- Hill, E.L. (2004). Evaluating the theory of executive dysfunction in autism. *Developmental Review, 24*, 189-233.
- Hungelmann, J., Kenkel-Rossi, E., Klassen, L., & Stollenwerk, R.M. (1989). Development of the JAREL Spiritual Well-Being Scale. In R.M. Carroll-Johnson (Ed). *Classification of Nursing Diagnoses* (pp.393-398). Philadelphia: J.B. Lippincott Company.
- Hurley, J.R. (2001). Constructive thinking and elevated ratings of self in interpersonal groups. *Journal of Psychology, 124*, 563-573.
- Isen, A.M. (1999). On the relationship between affect and creative problem solving. In S.W. Russ (Ed.), *Affect, creative experience and psychological adjustment* (pp. 3-17). Philadelphia: Taylor & Francis.
- Isen, A.M. (2002). A role for neuropsychology in understanding the facilitating influence of positive affect on social behavior and cognitive processes. In C.R Snyder & S.J. Lopez (Eds.), *Handbook of positive psychology* (pp. 528-540). Oxford: Oxford University Press.

- Isen, A.M., & Daubman, K.A. (1984). The influence of affect on categorization. *Journal of Personality and Social Psychology*, 47, 1206-1217.
- Jaquish, G.A., & Ripple, R.E. (1980). Divergent thinking and self-esteem in preadolescents and adolescents. *Journal of Youth and Adolescence*, 9, 143-152.
- Johnson, J.E. (1976). Relations of divergent thinking and intelligence test scores with social and nonsocial make-believe play of preschool children. *Child Development*, 47, 1200-1203.
- Kammann, R. & Flett, R. (1983). Affectometer 2: A Scale to measure current level of general happiness. *Australian Journal of Psychology*, 35, 259-265.
- Keyes, C.L.M., & Haidt, J. (2003). *Flourishing: Positive psychology and the life well-lived*. Washington: APA.
- Knight, R.T. & Stuss, D.T. (2002). Prefrontal cortex: The present and the future. In R.T. Knight & D.T. Stuss (Eds.), *Principles of frontal lobe function* (pp. 573-597). Oxford: Oxford University Press.
- Krampen, G. (1997). Promotion of creativity (divergent productions) and convergent productions by systematic-relaxation exercises: Empirical evidence from five experimental studies with children, young adults, and elderly. *European Journal of Personality*, 11, 83-99.
- Kumpfer, K. (1999). Factors and processes contributing to resilience: The resilience framework. In M. Glantz & J. Johnson (Eds.), *Resilience and development: Positive life adaptations* (pp. 179-224). New York: Plenum Press.

- Lezak, M.D. (1995). *Neuropsychological Assessment*. New York: Oxford University Press.
- Miceli, G., Caltagirone, C., & Gainotti, G. (1981). Neuropsychological correlates of localized cerebral lesions in nonaphasic brain-damaged patients. *Journal of Clinical Neuropsychology*, 3, 53-63.
- Miller, L.M. (1988). Ego autonomy, creativity and cognitive style: A neuropsychodynamic approach. *Psychiatric Clinics of North America*, 11, 383-397.
- Miyake, A., Friedman, N.P., Emerson, M.J., Witzki, A.H., & Howerter, A. (2000). The unity and diversity of executive functions and their contributions to complex "frontal lobe" tasks: A latent variable analysis. *Cognitive Psychology*, 41, 49-100.
- Okada, G., Okamoto, Y., Morinobu, S., Yamawaki, S., & Yokota, N. (2003). Attenuated left prefrontal activation during a verbal fluency task in patients with depression. *Neuropsychobiology*, 47, 21-26.
- Peterson, C., & Seligman, M.E.P. (2004). *Character strengths and virtues: A handbook and classification*. New York: Oxford University Press.
- Phelps, E.A., Hyder, F., Blamire, A.M., & Shulman, R.G. (1997). fMRI of the prefrontal cortex during overt verbal fluency. *NeuroReport*, 8, 561-565.
- Phillips, L.H., Bull, R., Adams, E., & Fraser, L. (2002). Positive mood and executive function: Evidence from Stroop and Fluency tasks. *Emotion*, 2, 12-22.
- Pretorius, T.B. (1998). *Fortitude as Stress-resistance: Development and Validation of the Fortitude Questionnaire (FORQ)*. Bellville: University of the Western Cape.
- Rains, G.D. (2002). *Principles of human neuropsychology*. Boston: McGraw-Hill.
-

- Russ, S.W. (1999). Play, affect and creativity: Theory and research. In S.W. Russ (Ed.), *Affect, creative experience and psychological adjustment* (pp. 57-75). Philadelphia: Taylor & Francis.
- Ryff, C.D., & Keyes, C.L.M. (1995). The structure of psychological well-being revisited. *Journal of Personality and Social Psychology, 68*, 719-727.
- Ryff, C.D., & Singer, B. (1998). The contours of positive human health. *Psychological Inquiry, 9*, 1-28.
- Ryff, C.D., & Singer, B. (2002). From social structure to biology: Integrative science in pursuit of human health and well-being. In C.R. Snyder & S.J. Lopez (Eds.), *Handbook of positive psychology* (pp. 541-555). Oxford: Oxford University Press.
- Schepers, J.M. (1993). Die betroubaarheid van saamgestelde tellings. (The reliability of compound scores). *Journal of Industrial Psychology, 19*, 1-5.
- Seligman, E.P., & Csikszentmihalyi, M. (2000). Positive psychology: An introduction. *American Psychologist, 55*, 5 – 14.
- Schutte, A.E., Kruger, H.S., Wissing, M.P., Underhay, C., & Vorster, H.H. (In press). The emergence of the metabolic syndrome in urban obese African women: the POWIRS study. *South African Journal of Science*.
- Simonton, D.K. (1999a). Creativity as blind variation and selective retention: Is the creative process Darwinian? *Psychological Inquiry, 10*, 309-328.
- Simonton, D.K. (1999b). *Origins of genius: Darwinian perspectives on creativity*. New York: Oxford University Press.
-

- Simonton, D.K. (2002). Blind variations, chance configurations, and creative genius. *Psychological Inquiry*, 4, 225-228.
- Smith, D.F. (2002). Functional salutogenic mechanisms of the brain. *Perspectives in Biology and Medicine*, 45, 319-328.
- Snyder, C.R., & Lopez, S.J. (2002). *Handbook of positive psychology*. Oxford: Oxford University Press.
- Sperry, R.W. (1987). Structure and significance of the consciousness revolution. *The journal of mind and behavior*, 8, 37-66.
- Spirrison, C.L., & Gordy, C.C. (1994). Nonintellective intelligence and personality: Variance shared by the Constructive Thinking Inventory and the Myers-Briggs Type Indicator. *Journal of Personality Assessment*, 62, 352-363.
- Staats, A.W. (1983). *Psychology's crisis of disunity: Philosophy and method for a unified science*. New York: Praeger.
- Stanley, J.C. (1971). Reliability. In R.L. Thorndike (Ed.), *Educational measurement* (pp.356-442). Washington: American Council of Education.
- StatSoft, Inc. (2005). STATISTICA (Data analysis software system), version 7. www.statsoft.com.
- Stuss, D.T., & Benson, D.F. (1986). *The frontal lobes*. New York: Raven Press.
- Stuss, D.T., & Levine, B. (2002). Adult clinical neuropsychology: Lessons from studies of the frontal lobes. *Annual Reviews of Psychology*, 53, 401-433.
- Tucker, D.M., & Williamson, P.A. (1984). Asymmetric neural control systems in human self-regulation. *Psychological review*, 91, 185-215.
-

- Turner, M. (1999). Generating novel ideas: Fluency performance in high-functioning and learning disabled individuals with autism. *Journal of Child Psychology and Psychiatry*, 40, 189-201.
- Vosburg, S., & Kaufmann, G. (1999). Mood and creativity research: A conceptual organising model. In S.W. Russ (Ed.), *Affect, creative experience and psychological adjustment* (pp. 18-39). Philadelphia: Taylor & Francis.
- Wilson, R.S., Gilley, D.W., Tanner, C.M., & Goetz, C.G. (1992). Ideational fluency in Parkinson's disease. *Brain and Cognition*, 20, 236-244.
- Wissing, M.P., & Van Eeden, C. (1997 September). *Psychological well-being: A fortigenic conceptualisation and empirical clarification*. Paper presented at the Third Annual Congress of the Psychological Society of South Africa, Durban, South Africa.
- Wissing, M.P., & Van Eeden, C. (2002). Empirical clarification of the nature of psychological well-being. *South African Journal of Psychology*, 32, 32-44.
- Witmer, J.M., & Sweeney, T.J. (1992). A holistic model for wellness and prevention over the life span. *Journal of Counselling and Development*, 71, 140-148.
- Zangwill, O.L. (1966). Psychological deficits associated with frontal lobe lesions. *International Journal of Neurology*, 5, 395-402.
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Table 1

Partial correlations between generativity and psychosocial measures, controlled for age

Psychosocial measures	Generativity	Generativity (Attenuated)
Cognitive appraisal	0.31**	0.45**
Affect balance	0.31**	0.42**
Behavioural coping	0.45**	0.71***
Self-appraisal	0.29*	0.44**
Positive relations	0.45**	0.64***
Spiritual well-being	0.36**	0.51***
Sense of coherence	0.34**	0.45**

*Marked correlations are statistically significant at $p < 0.05$.

** Marked correlations are practically significant with a medium effect.

*** Marked correlations are practically significant with a large effect.

Section 5: Conclusions, implications and recommendations

The aim of this study was to determine whether there is a relationship between neuropsychological executive functions and psychosocial well-being, respectively forming part of two domains in psychology, namely neuropsychology and positive psychology (Seligman & Csikszentmihalyi, 2000) or psychofortology (Wissing & Van Eeden, 1997, 2002). The motivation for such study is to come to an understanding of possible biological mechanisms underlying psychosocial well-being in bringing together information from different domains.

The first article focused on the possibility for such a relationship to exist, by looking at a possible interplay between neuropsychological and psychosocial aspects, from a pluralistic ecosystemic perspective (Bateson, 1972, 1979). Numerous neuropsychological studies have indicated that the prefrontal cortex is involved in executive functions (Knight & Stuss, 2002; Lezak, 1995; Rains, 2002; Stuss & Benson, 1986; Stuss & Levine, 2002). The main function of these areas seems to be regulation/mediation of both cognitive and affective functioning (Rains, 2002; Stuss & Levine, 2002). Pathology seems to originate when regulation occurs out of sync with the ecological context. The question, therefore, arises whether better neuropsychological regulation would be associated with better psychosocial functioning.

Different theories have been proposed that hypothesise a link between the neuropsychological and psychosocial subsystems, such as Miller's neuropsychodynamic model (Miller, 1988) and Frederickson's broaden-and-build

theory (Frederickson, 1998, 2001). On an empirical level a relationship has been established between prefrontal dysfunction and psychopathology. The first article concluded that evidence correlating neuropsychological functioning with human flourishing, or indicating possible neuropsychological mechanisms involved in psychosocial well-being, is sparse and that this situation presents a serious lacuna in scientific knowledge.

The following two articles focused on contributing to filling this particular lacuna. “Attentional switching and psychosocial well-being” and “The relationship between generativity, as neuropsychological process and psychosocial well-being” focused on attentional switching and generativity, as part of neuropsychological executive functions, as potential mechanisms associated with psychosocial well-being. The aims of these studies were to determine whether the capacity to switch attention, as measured by the *Color Trails Test* (CTT) and *Wisconsin Card Sorting Test* (WCST), and the capacity to generate novelty, as measured by the *Controlled Verbal Fluency Task* (CVFT) (Benton, 1967) and *Uses of Objects Test* (UOT) (Getzels & Jackson, 1962), are related to the degree of psychosocial well-being experienced. Attentional switching is defined as the ability to move or change attentional focus in a flexible and adaptive manner. Generativity is defined as the ability to generate novel ideas and spontaneous behaviours. Psychosocial well-being refers to optimal functioning on intra- and interpersonal level, and was conceptualised and measured in terms of facets of holistic models of well-being, including cognition, affect, behaviour, self-concept, interpersonal relationships and spiritual functioning.

Correlations between the latent variables “Attentional switching” and “Generativity” on the one hand and the manifest psychosocial variables on the other

hand were determined, while controlling for the effect of age on (especially) the neuropsychological measures. The main findings of these studies were that the ease of attentional switching and generativity correlates positively with higher levels of psychosocial well-being.

The present reductionist attempt to link aspects of executive functions, such as attentional switching and generativity, to psychosocial well-being, represents a first step toward a more comprehensive understanding of the role of executive functions in psychosocial well-being and *vice versa*. The information gleaned from this study seems to support Miller's (1988) neuropsychodynamic model, where he hypothesised that the ego-autonomous person's functioning may depend on some optimum level of functioning in the frontal-interhemispheric axis. Based on Lezak's (1995) tripartite distinction of behaviour, we have formed two more specific hypotheses, namely a cognitive mediation hypothesis and an affective mediation hypothesis, for the role played by executive functions in psychosocial well-being.

The cognitive mediation hypothesis proposes that cognition acts as mediator between executive functions and psychosocial well-being. The emotional mediation hypothesis correlates strongly with Frederickson's (1998, 2001) Broaden-and-Build theory and proposes that feelings and motivation (emotionality) could mediate between how behaviour is expressed (executive functions) and psychosocial well-being. Theoretically cognition and emotion may mediate different kinds of processes or be influential in different situations. In both hypotheses a bi-directional influence between executive functions and psychosocial well-being are expected. Future research needs to test which hypothesis is more valid.

Whatever the mechanisms may be for explaining the link between executive functions and psychosocial well-being, the finding of significant correlations between neuropsychological and psychofortological measures aids in understanding the nature of psychosocial well-being. A third hypothesis concerns the nature of psychosocial well-being. Communal factors found between dimensions of psychosocial well-being (cognitive, affective, interpersonal, etc) seems to be cognitive flexibility, ability to switch attention, divergent thinking and fluency. We can therefore conclude that psychosocial well-being, as manifestation of personality functioning, is specifically linked to neuropsychological executive functions, as processes of the frontal lobes, just as in the case of psychopathology.

The conclusions drawn from this study lies on both a micro- and macro-deterministic level (Sperry, 1987). From a micro-deterministic perspective it can be concluded that the frontal lobe executive functions play a role in the regulation of life quality relevant higher-order adjusting psychosocial functions. From a macro-deterministic perspective it can be concluded that psychosocial well-being, while being influenced by executive functions, also influences the continuous development of neuropsychological executive functions.

The knowledge gained from this study can be applied in theory formation, assessment and preventative and therapeutic interventions, to understand and promote human well-being. On a practical level it could, for example, be possible to deduce general psychological well-being from performance on a few simple neuropsychological tests, or to improve psychosocial well-being by means of neuropsychological exercises in game format. Adaptation and development on neurological level does not seem to require a great deal of time or practise and

changes in prefrontal neural properties can be observed after relatively little experience (Duncan & Miller, 2002). This, therefore, leaves a window of opportunity for interventions on this level.

A replication of the findings reported is, however, necessary, as this study was conducted on a small mono-gender, mono-racial sample. Detailed functional imaging studies of tasks of executive function, as well as detailed studies of brain structure, in persons with varying levels of psycho-social well-being, are needed to further understand the association of executive functions with psychosocial well-being.

Complete reference list

- Adams, T., Bezner, J., & Steinhardt, M. (1997). The conceptualization and measurement of perceived wellness: Integrating balance across and within dimensions. *American Journal of Health Promotion, 11*, 208-218.
- Allik, J., & McCrae, R. R. (2004). Toward a geography of personality traits: Patterns of profiles across 36 cultures. *Journal of Cross-Cultural Psychology, 35*, 13-28.
- Anderson, S.W., Damasio, H., Jones, R.D., Tranel, D. (1991). Wisconsin Card Sorting Test performance as a measure of frontal lobe damage. *Journal of Clinical and Experimental Neuropsychology, 13*, 909-922.
- Antonovsky, A. (1987). *Unravelling the Mystery of Health: How people manage stress and stay well*. San Francisco: Jossey-Bass.
- Antonovsky, A. (1993). The structure and properties of the Sense of Coherence Scale. *Social Science and Medicine, 36*(6), 725-733.
- Archer, J., Probert, B.S., & Gage, L. (1987). College students' attitudes towards wellness. *Journal of College Student Personnel, 28*, 311-317.
- Ashby, F.G., Isen, A.M., & Turken, A.U. (1998). A neuropsychological theory of positive affect and its influence on cognition. *Psychological Review, 106*, 529-550.
- Aspinwall, L.G., & Staudinger, U.M. (2003). *A psychology of human strengths: Fundamental questions and future directions for a positive psychology*. Washington: APA.
- Baker, S.C., Frith, C.D., & Dolan, R.J. (1997). The interaction between mood and cognitive function studied with PET. *Psychological Medicine, 27*, 565-578.

- Barios-Choplin, R., & McCraty, R. (1997). An inner quality approach to reducing stress and improving physical and emotional well-being at work. *Stress Medicine, 13*, 193-201.
- Barkley, R.A. (2001). The executive functions and self-regulation: An evolutionary neuropsychological perspective. *Neuropsychological review, 11*, 1-29.
- Bateson, G. (1972). *Steps to an ecology of mind*. San Francisco: Chandler.
- Bateson, G. (1979). *Mind and nature: A necessary unity*. New York: Dutton.
- Benton, A.L. (1967). Problems of test construction in the field of aphasia. *Cortex, 3*, 32-58.
- Botha, E., & Wissing, M.P. (2003). *Cognitive Attribution Questionnaire*. Unpublished document, North-West University – Potchefstroom Campus, Potchefstroom.
- Bowman, B.J. (1996). Cross-cultural validation of Antonovsky's Sense of Coherence Scale. *Journal of Clinical Psychology, 52*, 547-549.
- Brosschot, J.F. (2002). Cognitive-emotional sensitisation and somatic health complaints. *Scandinavian Journal of Psychology, 43*, 113-121.
- Buchanan, G.M., & Seligman, M.E.P. (1995). *Explanatory style*. Hillsdale, NJ: Erlbaum.
- Butler, R.W., Rorsman, I., Hill, J.M., & Tuma, R. (1993). The effects of frontal brain impairment on fluency: Simple and complex paradigms. *Neuropsychology, 7*, 519-529.
- Cantor-Graae, E., Warkentin, S., Franzen, G., & Risberg, J. (1993). Frontal lobe challenge: A comparison of activation procedures during rCBF measures in normal subjects. *Neuropsychiatry, Neuropsychology and Behavioral Neurology, 6*, 83-92.

- Carlsson, I., Wendt, P.E., & Risberg, J. (2000). On the neurobiology of creativity: Differences in frontal activity between high and low creative subjects. *Neuropsychologia*, 38, 873-885.
- Carter, C.S. (1998). Neuroendocrine perspectives on social attachment and love. *Psychoneuroendocrinology*, 23, 779-818.
- Cmich, D.E. (1984). Theoretical perspectives of holistic health. *Journal of School Health*, 54, 30-32.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: Erlbaum.
- Cohen, S.R. (2001). The relationship between convergent and divergent thinking in science as revealed in sixth and seventh graders. *The Journal of Educational Research*, 68, 327-330.
- Cruse, R., Nicholas, D.R., Gobble, D.C., & Frank, B. (1992). Gender and wellness: A multidimensional systems model for counseling. *Journal of Counseling and Development*, 71, 149-156.
- Crowe, S.F. (1998). Decrease in performance on the verbal fluency test as a function of time: Evaluation in a young healthy sample. *Journal of Clinical and Experimental Neuropsychology*, 20, 391-401.
- Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. New York: Harper.
- Cuenod, C.A., Bookheimer, S.Y., Hertz-Pannier, L., Zeffiro, R.A., Theodore, W.H., & Le Bihan, D. (1995). Functional MRI during word generation, using conventional equipment: A potential tool for language localization in the clinical environment. *Neurology*, 45, 1821-1827.

- Czerw, A. (2004 July). *Relationship between optimism and creative thinking: Experimental Research*. Poster presented at the Second European Conference on Positive Psychology, Verbania Pallanza, Italy.
- Damasio, A. (1990). *The feeling of what happens*. San Diego: Harcourt.
- Damasio, A. (2003). *Looking for Spinoza: Joy, sorrow and the feeling brain*. San Diego: Harcourt.
- Davidson, R.J. (1999). Neuropsychological perspectives on affective styles and their cognitive consequences. In T. Dalgleish & M. Power (Eds), *Handbook of cognition and emotion* (pp. 103-123). New York: Wiley.
- Dean, R.G., & Rhodes, M.L. (1998). Social constructionism and ethics: What makes a 'better' story. *Families in Society: The Journal of Contemporary Human Services*, 79, 254-261.
- D'Elia, L.F., Satz, P., Uchiyama, C.L., & White, T. (1996). *Color Trails Test: Professional manual*. Odessa: PAR.
- De Souza Fleith, D., Renzulli, J.S., & Westberg, K.L. (2002). Effects of a creativity training program on divergent thinking abilities and self-concept in monolingual and bilingual classrooms. *Creativity Research Journal*, 14, 373-386.
- Derryberry, D., & Reed, M. A. (1996). Regulatory processes and the development of cognitive representations. *Development and Psychopathology*, 8, 215-234.
- Diener, E., Emmons, R.A., Larsen, R.J., & Griffin, S. (1985). The Satisfaction with Life Scale. *Journal of Personality Assessment*, 49, 71-75.
- Diener, E., & Suh, E. M. (2000). Measuring subjective well-being to compare the quality of life of cultures. In E. Diener, & E. M Suh (Eds.), *Culture and subjective well-being* (pp. 4-12). Cambridge, Massachusetts: The MIT Press.

- Dillon, M., Wink, P., & Fay, K. (2003). Is spirituality detrimental to generativity? *Journal for the Scientific Study of Religion*, 42, 427-442.
- Direko, L. P. (2002). *The Afrocentric world as compared to the Eurocentric worldview: Implications for Psychotherapy*. Unpublished manuscript, North-West University - Potchefstroom Campus, Potchefstroom.
- Driver, J. (2001). A selective review of selective attention research from the past century. *British Journal of Psychology*, 92, 53-78.
- Duncan, J., & Miller, E.K. (2002). Cognitive focus through adaptive neural coding in the primate prefrontal cortex. In R.T. Knight & D.T. Stuss (Eds.), *Principles of frontal lobe function* (pp. 278-291). Oxford: Oxford University Press.
- Eberst, R.M. (1984). Defining health: A multidimensional model. *Journal of School Health*, 54, 99-104.
- Efran, J., & Lukens, M.D. (1985). The world according to Humberto Maturana. *The Family Therapy Networker*, 9, 23-28, 72-75.
- Efran, J., Lukens, R.J., & Lukens, M.D. (1988). Constructivism: What's in it for you? *The Family Therapy Networker*, 12, 27-35.
- Epstein, S. (1973). The self-concept revisited, or a theory of a theory. *American Psychologist*, 28, 404-416.
- Epstein, S. (1994). Integration of the cognitive and psychodynamic unconscious. *American Psychologist*, 49, 709-724.
- Epstein, S., & Meier, P. (1989). Constructive thinking: A broad coping variable with specific components. *Journal of Personality and Social Psychology*, 57, 332-350.
- Folkman, S., & Lazarus, R.S. (1980). An analysis of coping in a middle-aged community sample. *Journal of Health and Social Behaviour*, 21, 219-239.
-

- Fredrickson, B. L. (1998). What good are positive emotions? *Review of General Psychology*, 2, 300-319.
- Fredrickson, BL (2000). Cultivating positive emotions to optimize health and well-being. *Prevention & Treatment*, 3, Retrieved January 26, 2003, from <http://journals.apa.org/prevention/volume3/pre0030001a.html>
- Fredrickson, B.L. (2001). The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions. *American Psychologist*, 56, 218-226.
- Frith, C.D., Friston, K.J., Liddle, P.R., & Frackowiak, R.S.J. (1991). A PET study of word finding. *Neuropsychologia*, 29, 1137-1148.
- Georgiou, N., Bradshaw, J.L., Phillips, J.G., & Chiu, E. (1996). The effect of Huntington's disease and Gilles de la Tourette's syndrome on the ability to hold and shift attention. *Neuropsychologia*, 34, 843-851.
- Getzels, J.W., & Jackson, P.W. (1962). *Creativity and intelligence*. New York: Wiley.
- Gourovitch, M.L., Kirby, B.S., Goldberg, T.E., Weinberger, D.R., Gold, J.M., Esposito, G., et al. (2000). A comparison of rCBF patterns during letter and semantic fluency. *Neuropsychology*, 14, 353-360.
- Grattan, L.M., & Eslinger, P.J. (1989). Higher cognition and social behavior: Changes in cognitive flexibility and empathy after cerebral lesions. *Neuropsychology*, 3, 175-185.
- Gray, J.A. (1994). Framework for a taxonomy of psychiatric disorder. In S.H.M. van Goozen, N.E. van de Poll & J.A. Sergeant (Eds.), *Emotions: Essays on emotion theory* (pp. 29-60). New Jersey: LEA.
- Harris, M.E. (1988). *Wisconsin Card Sorting Test: Scoring Program*. Odessa: PAR.

- Hartmann, H. (1958). *Ego psychology and the problem of adaptation*. New York: International Universities Press.
- Heaton, R.K., Chelune, G.J., Talley, J.L., Kay, G.G., & Curtiss, G. (1993). *Wisconsin Card Sorting Test Manual: Revised and expanded*. Odessa: PAR.
- Herzog, T.R., Black, A.M., Fountaine, K.A., & Knotts, D.J. (1997). Reflection and attentional recovery as distinctive benefits of restorative environments. *Journal of Environmental Psychology, 17*, 165-170.
- Hill, E.L. (2004). Evaluating the theory of executive dysfunction in autism. *Developmental Review, 24*, 189-233.
- Hungelmann, J., Kenkel-Rossi, E., Klassen, L., & Stollenwerk, R.M. (1989). Development of the JAREL Spiritual Well-Being Scale. In R.M. Carroll-Johnson (Ed.), *Classification of Nursing Diagnoses* (pp.393-398). Philadelphia: J.B. Lippincott Company.
- Hurley, J.R. (2001). Constructive thinking and elevated ratings of self in interpersonal groups. *Journal of Psychology, 124*, 563-573.
- Isen, A.M. (1999). On the relationship between affect and creative problem solving. In S.W. Russ (Ed.), *Affect, creative experience and psychological adjustment* (pp. 3-17). Philadelphia: Taylor & Francis.
- Isen, A.M. (2002). A role for neuropsychology in understanding the facilitating influence of positive affect on social behavior and cognitive processes. In C.R. Snyder & S.J. Lopez (Eds.), *Handbook of positive psychology* (pp. 528-540). Oxford: Oxford University Press.
- Isen, A.M., & Daubman, K.A. (1984). The influence of affect on categorization. *Journal of Personality and Social Psychology, 47*, 1206-1217.

- Jaquish, G.A., & Cornell, U. (1980). Divergent thinking and self-esteem in preadolescents and adolescents. *Journal of Youth and Adolescence*, 9, 143-152.
- Johnson, J.E. (1976). Relations of divergent thinking and intelligence test scores with social and nonsocial make-believe play of preschool children. *Child Development*, 47, 1200-1203.
- Jobson, R. (2003). Wellness in South Africa. *SA Family Practitioner*, 45(3), 20-23.
- Kammann, R. & Flett, R. (1983). Affectometer 2: A Scale to measure current level of general happiness. *Australian Journal of Psychology*, 35, 259-265.
- Keyes, C.L.M., & Haidt, J. (2003). *Flourishing: Positive psychology and the life well-lived*. Washington: APA.
- Knight, R.T. & Stuss, D.T. (2002). Prefrontal cortex: The present and the future. In R.T. Knight & D.T. Stuss (Eds.), *Principles of frontal lobe function* (pp. 573-597). Oxford: Oxford University Press.
- Kobasa, S.C., Hilker, R.R., & Maddi, S.R. (1979). Who stays healthy under stress? *Journal of occupational medicine*, 21, 595-598.
- Kolb, B., & Whishaw, I.Q. (1996). *Fundamentals of Human Neuropsychology*. USA: Freeman-Worth.
- Krampen, G. (1997). Promotion of creativity (divergent productions) and convergent productions by systematic-relaxation exercises: Empirical evidence from five experimental studies with children, young adults, and elderly. *European Journal of Personality*, 11, 83-99.
- Kumpfer, K. (1999). Factors and processes contributing to resilience: The resilience framework. In M. Glantz & J. Johnson (Eds.), *Resilience and development: Positive life adaptations* (pp. 179-224). New York: Plenum Press.
-

- Leary, M.R., Tambor, E.S., Terdal, S.K., & Downs, D.L. (1995). Self-esteem as an interpersonal monitor: The sociometer hypothesis. *Journal of Personality and Social Psychology*, 68, 518-530.
- Levenson, R. (1990). The influence of age and gender on affect, physiology and their interrelations: A study of long-term marriages. *Journal of Personality and Social Psychology*, 67,
- Lezak, M.D. (1995). *Neuropsychological Assessment*. New York: Oxford University Press.
- Luria, A.R. (1966). *Higher cortical functions in man*. (B. Haigh, Trans.). London: Tavistock.
- Madsen, K.B. (1988). *A history of psychology in metascientific perspective*. Amsterdam: North Holland.
- Maj, M., D'Elia, L.F., Satz, P., Janssen, R., Zaudig, M., Uchiyama, C., et al. (1993). Evaluation of two new neuropsychological tests designed to minimize cultural bias in the assessment of HIV-1 seropositive persons: A WHO study. *Archives of Clinical Neuropsychology*, 8, 123-135.
- Miceli, G., Caltagirone, C., & Gainotti, G. (1981). Neuropsychological correlates of localized cerebral lesions in nonaphasic brain-damaged patients. *Journal of Clinical Neuropsychology*, 3, 53-63.
- Miller, L.M. (1988). Ego autonomy, creativity and cognitive style: A neuropsychodynamic approach. *Psychiatric Clinics of North America*, 11, 383-397.
- Milner, B. (1963). Effects of different brain lesions on card sorting. *Archives of Neurology*, 9, 90-100.

- Mineka, S., & Sutton, S.K. (1992). Cognitive biases and the emotional disorders. *Psychological Science, 3*, 65-69.
- Mirsky, A.F. (1995). Perils and pitfalls on the path to normal potential: The role of impaired attention. Homage to Herbert G. Birch. *Journal of Clinical and Experimental Neuropsychology, 17*, 481-498.
- Mirsky, A.F. (1996). Disorders of attention: A neuropsychological perspective. In G.R. Lyon & N.A. Krasnegor, (Eds.), *Attention, memory and executive function* (pp.71-96). Baltimore: Brookes.
- Mitrushina, M.N., Boone, K.B., & D'Elia, L.F. (1999). *Handbook of normative data for neuropsychological assessment*. Oxford: Oxford University Press.
- Miyake, A., Friedman, N.P., Emerson, M.J., Witzki, A.H., & Howerter, A. (2000). The unity and diversity of executive functions and their contributions to complex "frontal lobe" tasks: A latent variable analysis. *Cognitive Psychology, 41*, 49-100.
- Moore, C. (2003). The ecosystemic approach. In W. Meyer, C. Moore & H. Viljoen (Eds.), *Personology: From individual to ecosystem* (pp. 462-498). Cape Town: Heinemann.
- National Wellness Association. (1999). *Definition of health*. Retrieved November 25, 2003, from <http://www.wellnessnwi.org/nwa/naweldef.htm>
- Nell, V. (2000). *Cross-cultural neuropsychological assessment: Theory and practice*. London: LEA.
- OED. (2004). *Oxford English Dictionary*. Retrieved March 23, 2004 from <http://www.oed.com/htm>
-

- Okada, G., Okamoto, Y., Morinobu, S., Yamawaki, S., & Yokota, N. (2003). Attenuated left prefrontal activation during a verbal fluency task in patients with depression. *Neuropsychobiology*, *47*, 21-26.
- Peterson, C., & Seligman, M.E.P. (2004). *Character strengths and virtues: A handbook and classification*. New York: Oxford University Press.
- Phelps, E.A., Hyder, F., Blamire, A.M., & Shulman, R.G. (1997). fMRI of the prefrontal cortex during overt verbal fluency. *NeuroReport*, *8*, 561-565.
- Phillips, L.H., Bull, R., Adams, E., & Fraser, L. (2002). Positive mood and executive function: Evidence from Stroop and Fluency tasks. *Emotion*, *2*, 12-22.
- Pretorius, T.B. (1998). *Fortitude as stress-resistance: Development and validation of the Fortitude Questionnaire (FORQ)*. Bellville: University of the Western Cape.
- Prigatano, G.P. (1986). *Neuropsychological rehabilitation after brain injury*. Baltimore: Hopkins Press.
- Rains, G.D. (2002). *Principles of human neuropsychology*. Boston: McGraw-Hill.
- Russ, S.W. (1999). Play, affect and creativity: Theory and research. In S.W. Russ (Ed.), *Affect, creative experience and psychological adjustment* (pp. 57-75). Philadelphia: Taylor & Francis.
- Ryff, C.D., & Keyes, C.L.M. (1995). The structure of psychological well-being revisited. *Journal of Personality and Social Psychology*, *68*, 719-727.
- Ryff, C.D., & Singer, B. (1998). The contours of positive human health. *Psychological Inquiry*, *9*, 1-28.
- Ryff, C.D., & Singer, B. (2002). From social structure to biology: Integrative science in pursuit of human health and well-being. In C.R. Snyder & S.J. Lopez (Eds.), *Handbook of positive psychology* (pp. 541-555). Oxford: Oxford University Press.

- Schepers, J.M. (1993). Die betroubaarheid van saamgestelde tellings. (The reliability of compound scores). *Journal of Industrial Psychology*, 19, 1-5.
- Schutte, A.E., Kruger, H.S., Wissing, M.P., Underhay, C., & Vorster, H.H. (in press). The emergence of the metabolic syndrome in urban obese African women: the POWIRS study. *South African Journal of Science*.
- Seeman, J. (1989). Toward a model of positive health. *American Psychologist*, 44, 1099-1109.
- Seligman, E.P., & Csikszentmihalyi, M. (2000). Positive psychology: An introduction. *American Psychologist*, 55, 5 – 14.
- Servan-Schreiber, D. (2004). *The instinct to heal: Curing stress, anxiety, and depression without drugs and without talk therapy*. USA: Rodale.
- Simonton, D.K. (1999a). Creativity as blind variation and selective retention: Is the creative process Darwinian? *Psychological Inquiry*, 10, 309-328.
- Simonton, D.K. (1999b). *Origins of genius: Darwinian perspectives on creativity*. New York: Oxford University Press.
- Simonton, D.K. (2002). Blind variations, chance configurations, and creative genius. *Psychological Inquiry*, 4, 225-228.
- Smith, D.F. (2002). Functional salutogenic mechanisms of the brain. *Perspectives in Biology and Medicine*, 45, 319-328.
- Snyder, C.R., & Lopez, S.J. (2002). *Handbook of positive psychology*. Oxford: Oxford University Press.
- Sperry, R.W. (1987). Structure and significance of the consciousness revolution. *The journal of mind and behavior*, 8, 37-66.

- Spirrison, C.L., & Gordy, C.C. (1994). Nonintellective intelligence and personality: Variance shared by the Constructive Thinking Inventory and the Myers-Briggs Type Indicator. *Journal of Personality Assessment*, 62, 352-363.
- Staats, A.W. (1983). *Psychology's crisis of disunity: Philosophy and method for a unified science*. New York: Praeger.
- Stanley, J.C. (1971). Reliability. In R.L. Thorndike (Ed.), *Educational measurement* (pp.356-442). Washington: American Council of Education.
- StatSoft, Inc. (2003). STATISTICA (Data analysis software system), version 6.
www.statsoft.com.
- StatSoft, Inc. (2005). STATISTICA (Data analysis software system), version 7.
www.statsoft.com.
- Stuss, D.T. & Benson, D.F. (1986). *The frontal lobes*. New York: Raven Press.
- Stuss, D.T. & Levine, B. (2002). Adult clinical neuropsychology: Lessons from studies of the frontal lobes. *Annual Reviews of Psychology*, 53, 401-433.
- Stuss, D.T., Shallice, T., Alexander, M.P., & Picton, T. (1995). A multidisciplinary approach to anterior attentional functions. *Annals of the New York Academy of Science*, 769, 191-212.
- Taylor, A.F., Kuo, F.E., & Sullivan, W.C. (2001). Coping with ADD: The surprising connection to green play settings. *Environment and Behaviour*, 33, 54-77.
- Travis, J.W., & Ryan, R.S. (1988). *The wellness workbook*. Berkeley: Ten Speed.
- Tucker, D.M., & Williamson, P.A. (1984). Asymmetric neural control systems in human self-regulation. *Psychological review*, 91, 185-215.
-

- Tugade, M.M., & Frederickson, B.L. (2004). Resilient individuals use positive emotions to bounce back from negative emotional experiences. *Journal of Personality and Social Psychology*, 86, 320-333.
- Turner, M. (1999). Generating novel ideas: Fluency performance in high-functioning and learning disabled individuals with autism. *Journal of Child Psychology and Psychiatry*, 40, 189-201.
- Von Bertalanffy, L. (1950). The theory of open systems in physics and biology. *Science*, 3, 23-29.
- Von Bertalanffy, L. (1974). General system theory and psychiatry. In G. Caplan (Ed.) *American handbook of psychiatry*. Vol. II. New York: Basic Books.
- Vosburg, S., & Kaufmann, G. (1999). Mood and creativity research: A conceptual organising model. In S.W. Russ (Ed.), *Affect, creative experience and psychological adjustment* (pp. 18-39). Philadelphia: Taylor & Francis.
- Wager, T.D., Jonides, J., & Reading, S. (2004). Neuroimaging studies of shifting attention: A meta-analysis. *NeuroImage*, 22, 1679-1693.
- Walsh, K., & Darby, D. (1999). *Neuropsychology: A Clinical Approach*. Edinburgh: Churchill-Livingstone.
- Williams, M., Watts, F., MacLeod, C., & Mathews, A. (1988). *Cognitive psychology and emotional disorders*. New York: Wiley.
- Wilson, R.S., Gilley, D.W., Tanner, C.M., & Goetz, C.G. (1992). Ideational fluency in Parkinson's disease. *Brain and Cognition*, 20, 236-244.
-

- Wissing, M.P., & Van Eeden, C. (1997 September). *Psychological well-being: A fortigenic conceptualisation and empirical clarification*. Paper presented at the Third Annual Congress of the Psychological Society of South Africa, Durban, South Africa.
- Wissing, M.P., & Van Eeden, C. (2002). Empirical clarification of the nature of psychological well-being. *South African Journal of Psychology*, 32, 32-44.
- Witmer, J.M., & Sweeney, T.J. (1992). A holistic model for wellness and prevention over the life span. *Journal of Counselling and Development*, 71, 140-148.
- Zangwill, O.L. (1966). Psychological deficits associated with frontal lobe lesions. *International Journal of Neurology*, 5, 395-402.