

Taru Feldt

Sense of Coherence

Structure, Stability and Health Promoting Role
in Working Life



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Editors

Tapani Korhonen

Department of Psychology, University of Jyväskylä

Kaarina Nieminen

Publishing Unit, University Library of Jyväskylä

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ABSTRACT

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Four main questions based on Antonovsky's (1979, 1987a) sense of coherence theory were proposed in the present study. Firstly, the structure of the sense of coherence questionnaire (the 13-item Orientation to Life Questionnaire; Antonovsky, 1987a) was studied. Secondly, the stability of and mean changes in sense of coherence over time were investigated and, in addition, the relation of an individual's age and employment experiences to the changes in sense of coherence. Finally, sense of coherence was investigated as a mediator and as a moderator between the relationships of work characteristics and well-being. The study was based on five occupational samples: (1) technical designers ($N = 989$), (2) two age groups of technical designers ($N = 352$), (3) teachers ($N = 1012$), (4) managers ($N = 1035$) and, (5) employees in four organizations ($N = 219$). Samples 2 and 5 were longitudinal and the other three cross-sectional data designs. The results of confirmatory factor analysis showed that the 13-item Orientation to Life Questionnaire is not a unidimensional measure but the structures based on the item classification (meaningfulness, comprehensibility and manageability) characterized its structure fairly well. Sense of coherence was found to represent a moderately stable personality factor over 1-year and 5-year follow-up periods. Age did not play any role in stability of and mean changes in sense of coherence. Although the employment experiences were not related to the stability of sense of coherence, those subjects who had faced unemployment during the 5-year follow-up period had a weaker sense of coherence than those who had been in full-time employment throughout the follow-up. Sense of coherence showed a strong main effect on well-being: the stronger the subjects' sense of coherence was, the less they reported psychosomatic symptoms and emotional exhaustion at work. The mediator analyses of the study highlighted the major role of a good organizational climate as enhancing sense of coherence and consequently well-being. Sense of coherence moderated the work characteristics - well-being relationships in three ways: (1) subjects with a strong sense of coherence were better protected from the adverse work characteristics than subjects with a weak sense of coherence, (2) good social relations at the work place emphasized well-being among subjects with a very weak sense of coherence and, (3) high work demands had salutary effects on well-being when accompanied by a strong sense of coherence and pathogenic effects when accompanied by a weak sense of coherence.

Keywords: confirmatory factor analysis, Orientation to Life Questionnaire, psychosocial work characteristics, sense of coherence, well-being

Authors' address

Taru Feldt
Department of Psychology
University of Jyväskylä
P.O. Box 35 FIN-40351 Jyväskylä
FINLAND

email: tafe@psyka.jyu.fi

Supervisor group

Professor Isto Ruoppila (main supervisor)
Department of Psychology
University of Jyväskylä, Finland

Professor Ulla Kinnunen
Department of Psychology
University of Jyväskylä, Finland

Professor Esko Leskinen
Department of Statistics
University of Jyväskylä, Finland

Professor Juhani Kirjonen
Vocational Education Unit
University of Jyväskylä, Finland

Reviewers

Professor Raimo Rajala
Faculty of Education
University of Lapland, Finland

Docent Mika Kivimäki
Department of Psychology
University of Helsinki, Finland

Opponent

Professor Raimo Rajala
Faculty of Education
University of Lapland, Finland

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LIST OF ORIGINAL PUBLICATIONS

The thesis is based on the following articles, which are referred to in the text by their Roman numerals.

- I Feldt, T. & Rasku, A. (1998). The structure of Antonovsky's Orientation to Life Questionnaire. *Personality and Individual Differences*, 25, 505-516.
- II Feldt, T., Leskinen, E., Kinnunen, U. & Mauno, S. (2000). Longitudinal factor analysis models in the assessment of stability of sense of coherence. *Personality and Individual Differences*, 28, 239-257.
- III Feldt, T., Leskinen, E., Kinnunen, U. & Ruoppila, I. (1999). The effect of age and employment experiences on the stability of sense of coherence: A 5-year follow-up study. Manuscript submitted for publication.
- IV Feldt, T., Kinnunen, U. & Mauno, S. (in press). The mediational model of sense of coherence in the work context: A one-year follow-up study. *Journal of Organizational Behavior*.
- V Feldt, T. (1997). The role of sense of coherence in well-being at work: Analyses of main and moderator effects. *Work and Stress*, 11, 134-147.

Copies of the articles are included in the thesis.

1 INTRODUCTION

1.1 The salutogenic model of sense of coherence

The notion that personality attributes may play an important role in health and disease has attracted a lot of research effort. Studies have focused both on personality traits as pathogenic or risk factors (e.g., type A behavior pattern, hostility, aggression, depression, anxiety) and those assumed to protect from disease (e.g., extraversion, self-efficacy, hardiness) (see Cox & Ferguson, 1991; Kivimäki, 1996; Schaubroeck, & Ganster, 1991). In the latter line of research, Aaron Antonovsky's (1979, 1987a) sense of coherence construct has recently become a major issue. Sense of coherence, the core of a complex salutogenic model, refers to a global orientation to one's inner and outer environments which are hypothesized to be a significant determinant of location and movement on the health ease/dis-ease continuum. Antonovsky's (1987a,b) theory of sense of coherence also provides a theoretical model for the analysis of an individual's working conditions and well-being at work.

Despite the recent prolific research interest in sense of coherence, there remain a number of issues in the salutogenic model that require further empirical testing. One of the key issues concerns the measurement of sense of coherence. Up to the present time, thousands of people from more than twenty countries have filled in the Orientation to Life Questionnaire, an instrument that originally developed to operationalize sense of coherence. However, it appears that the factorial structure of the Orientation to Life Questionnaire, i.e., what the scale in fact measures, is still not resolved. The sense of coherence research carried out so far has also suffered from a lack of longitudinal research. Therefore, the hypothesized stable nature of sense of coherence in adulthood has remained open to debate. It is also unknown whether the radical changes in an individual's life, such as becoming unemployed, actually induce changes in sense of coherence, as assumed by the theory. Finally, it is notable that although the great majority of

existing sense of coherence studies have been carried out in life stress and clinical contexts, the construct has seldom been applied in the context of the workplace. For example, the mediator role of sense of coherence upon the relationship between psychosocial work characteristics and well-being is opaque. The moderator role of sense of coherence upon this relationship is also unclear.

These neglected issues in the sense of coherence literature inspired me to undertake the present study. In the search for answers to the questions about the structure of the Orientation to Life Questionnaire, the stability of sense of coherence as well as its possible mediator and moderator roles in working life, I used five Finnish occupational samples which were taken from both cross-sectional and longitudinal studies.

1.2 Sense of coherence as a key to successful coping

Antonovsky's (1979, 1987a) conceptual model of sense of coherence originated in observations of the health status of female concentration camp survivors. Antonovsky was struck by the surprisingly good health of these women despite their earlier harsh experiences. As a result, he developed a perspective that he labelled the "salutogenic" model. This model explained the conditions that predict well-being, as opposed to sickness, under conditions of adversity. The salutogenic model was the reverse of the traditional research approach which Antonovsky called the "pathogenic" model. He considered the pathogenic model to be inadequate in the sense that it unilaterally seeks to explain why people get sick, focusing on the way in which stressful life events predispose an individual to a variety of negative health outcomes.

In the salutogenic model, stressors, which Antonovsky defined as "demands to which there are no readily available or automatic adaptive responses" (Antonovsky, 1979, p. 72), may have damaging, neutral or salutary effects on health. Stressors generate a state of tension with which one must deal. How well one manages tension depends on the resources at one's disposal. The concept of "generalized resistance resources" encompasses such things as money, ego identity, cultural stability, religion, intelligence, social support, and anything else that is effective in a wide variety of stressors. Generalized resistance resources, in turn, facilitate sense of coherence by providing the individual with a set of life experiences which are meaningful and understandable, and in which tension is generally successfully managed. In the salutogenic model, sense of coherence is a key construct in dealing with stress. While sense of coherence is not a coping strategy in itself, individuals with a high sense of coherence may be more likely to flexibly adopt adaptive strategies that are appropriate to the needs of the specific situation (Antonovsky, 1979, 1987a, 1991, 1993).

Formally, Antonovsky defined sense of coherence as "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; (2) the resources are available to one to meet the demands posed by these stimuli; and (3) these demands are challenges, worthy of investment and engagement" (Antonovsky, 1987a, p. 19). In order to resolve or deal with the demands and conflicts posed by an individual, all these components termed as (1) comprehensibility, (2) manageability and (3) meaningfulness, are needed. To put it bluntly, one needs to know not only *what* to do about a certain source of stress and that one is *able to do* something about it, but also *why* one should do it. Hence, comprehensibility primarily represents the cognitive aspect, manageability the instrumental aspect and meaningfulness the motivational aspect of sense of coherence. Individuals who score highly on all of these three components, view the world as coherent, and in contrast, those who score low in all components view it as incoherent.

Sense of meaningfulness is, according to Antonovsky (1987a), the most central component of sense of coherence because of its motivational element. It can be seen, for example, in the case where a person is high on both comprehensibility and manageability components, i.e., knowing the rules of the game and believing that the requisite resources are at his/her disposal to deploy successfully. However, if his/her sense of meaningfulness is weak, understanding tends to loose ground and the command of resources is lost. By contrast, individuals who are low on comprehensibility and manageability but high on meaningfulness, are likely to show a profound spirit, deeply engaged in the search for understanding and resources.

In Antonovsky's (1979, 1987a) theory, health is conceptualized by the health ease/dis-ease continuum which refers to a multifacet state of the human organism. Operationally, Antonovsky suggested that at any one time a person can be described as having a particular profile on the health ease/ dis-ease continuum, which is a score of the four facets: pain, functional limitation, prognostic implication and action implication (Antonovsky, 1979). Antonovsky believed that a person with a strong sense of coherence maintains a more favorable position on this continuum than others.

According to the theory, sense of coherence can promote an individual's health status through three different channels (see Antonovsky, 1979, 1987a, 1990, 1992). First, it may have direct physiological health-maintaining consequences in such a way that the perception of the world of stimuli as comprehensible, manageable, and meaningful activates the brain to send messages to other bodily systems which maintain homeostasis. Second, sense of coherence can operate through the selection of health-promoting behaviours. The person with a strong sense of coherence is more likely to define stimuli as non-stressors and more likely to avoid stressors with which it will be difficult to cope successfully. Hence, such a person is more likely to avoid delay in seeking treatment, to comply with professional guidance, to seek information relevant to health, and to reject maladaptive behaviours.

The third, and the most important channel in Antonovsky's theory linking sense of coherence to health is the successful coping with stressors. This channel refers to an individual's coping process, following a slight modification of Lazarus' analysis of this process (see Lazarus, 1966; Lazarus & Folkman, 1984). If,

in *the first stage of appraisal*, a stimulus has been defined as a stressor, the person with a strong sense of coherence is more likely in *the second stage of appraisal* to define the stressor as benign or even as a welcome challenge, confident that it will be handled well. This arouses salutary emotions. *The third stage of appraisal* relates to the definition of the problem. The person with a strong sense of coherence is cognitively and emotionally capable of ordering the nature of the problem and willing to confront it. In this phase, the dual role of generalized resistance resources is emphasized. The generalized resistance resources provide life experiences that reinforce sense of coherence, but they are also to be regarded as potentials. The person with a strong sense of coherence is likely to have a greater variety of generalized resistance resources at his or her disposal. *The fourth stage is reappraisal*. In this stage, a person with a strong sense of coherence is open to feedback and the possibility of corrective action (Antonovsky, 1979, 1987a, 1990, 1992).

The other constructs that fit closely with Antonovsky's sense of coherence are Kobasa's (1979, 1982) hardiness, Rotter's (1966, 1975) locus of control and Bandura's (1977) self-efficacy. All these constructs can be, according to Antonovsky (1991), grouped under the rubric "salutogenic strength". They also represent generalized personality dispositions which have been studied in relation to successful coping and can be understood in transactional context. In addition, all four constructs share in whole or in part, the thesis that being high on these personality orientations facilitates successful coping and thus contributes to health.

1.3 The Orientation to Life Questionnaire - instrument for measuring sense of coherence

In 1987, Antonovsky published an instrument called "The Orientation to Life Questionnaire" to measure sense of coherence (see Antonovsky, 1987a). He developed the scale after intensive interviews with 51 persons (30 of them were men and 21 women) who were known to have undergone severe trauma with inescapable major consequences for their lives, and yet were perceived to be functioning remarkably well. In forming the scale, which was based on Guttman's facet approach (see Guttman, 1974), Antonovsky drew up a response profile from words and phrases used by respondents who were judged to have either a strong or weak sense of coherence. In the final phase of developing the scale, Antonovsky made a theoretically guided choice to have each item include one of the three components of sense of coherence (comprehensibility, manageability or meaningfulness). In addition, he designed the items to include the four other facets of stimulus. These were the modality of the stimulus (instrumental, cognitive or affective), its source (internal, external or both), the nature of the demand it posed (concrete, diffuse or abstract) and its time reference (past, present or future). Thus, each item in the Orientation to Life Questionnaire is in

the first place specified as comprehensibility, manageability or meaningfulness, but also shares elements with the other four facets of sense of coherence.

The Orientation to Life Questionnaire was designed to be a culture free instrument for measuring sense of coherence. Antonovsky (1987a, 1992, 1993) proposed that a high sense of coherence score can legitimately be obtained in any cultural setting. He suspected that to believe that stressors can be comprehended and managed and are worthy of engagement is always culturally acceptable. Therefore, to obtain a high score on the Orientation to Life Questionnaire, an individual is not required to assent to specific content-laden criteria to determine comprehensibility, ways of manageability, or reasons for meaningfulness.

The Orientation to Life Questionnaire (Antonovsky, 1987a) exists in two forms. The longer version consists of 29 items for each of which respondents are asked to select a response on a 7-point semantic differential scale with two anchoring phrases. It is made up of 8 meaningfulness, 11 comprehensibility, and 10 manageability items. A shorter, 13-item subset of the scale was proposed for use when time or space limitations prevented the use of the full scale. It contains 4 meaningfulness, 5 comprehensibility, and 4 manageability items.

Since the development of the scale, the construct of sense of coherence has received considerable research attention across a range of settings. On the whole the results of these studies support the reliability (Cronbach alpha) and validity of the scale and provide preliminary support concerning the usefulness of the underlying construct. Cronbach alphas of the 29-item version have ranged from 0.82 to 0.95 (see Antonovsky, 1993; Bishop, 1993; Callahan & Pincus, 1995; Cohen, 1997; Frenz, Carey & Jorgensen, 1993; Gallagher, Wagenfeld, Baro & Haepers, 1994; Langius & Björvell, 1993; Söderberg, Lundman & Nordberg, 1997). Cronbach alphas of the 13-item version have also emerged as high ranging from 0.74 to 0.91 (see Antonovsky, 1993; Brooks, 1998; George, 1996; Kivimäki, Kalimo & Toppinen, 1998; Klang, Björvell & Clyne, 1996; Korotkov, 1993; Langius & Björvell, 1993; Larson & Kallenberg, 1999; Shahani, Weiner & Streit, 1993; Steiner, Raube, Stuck, Aronow, Draper, Rubenstein & Beck, 1996).

The validity of the 29-item Orientation to Life Questionnaire has been supported in several studies. In particular, these results have shown a strong link between scores on the Orientation to Life Questionnaire and various scales of *health and well-being* (Bowman, 1996; Carstens & Spangenberg, 1997; Coward, 1996; Fiorentino & Pomazal, 1998; Kaiser, Sattler, Bellack & Dersin, 1996; Langius & Björvell, 1993; Söderberg et al., 1997). These studies have consistently shown that the higher the score recorded on the Orientation to Life Questionnaire the higher have been the scores on the health and well-being scales. In addition, white-collar workers with high sense of coherence scores have found to be protected against coronary disease (Poppius, Tenkanen, Kalimo & Heinsalmi, 1999). The score of the 29-item scale has also been linked positively with the *perceived resources* (Fiorentino & Pomazal, 1998; Kalimo & Vuori, 1990, 1991; McSherry & Holm, 1994; Shiu, 1998), other constructs of generalized perception of self and environment, such as *locus of control*, *hardiness and self-esteem* (Kravetz, Drory & Florian, 1993; Petrie & Brook, 1992; Viviers, 1997; Williams, 1990) and the *health behaviors* (Gallagher et al., 1994; Lajunen & Summala, 1995; Vuori, 1994). A negative association has been observed between the score of the Orientation to

Life Questionnaire and the *perceived stressors* (Kalimo & Vuori, 1991; McSherry & Holm, 1994; Ryland & Greenfeld, 1991) and the *Type A behavior* (Söderberg et al., 1997).

The findings concerning the validity of the 13-item Orientation to Life Questionnaire have showed the same tendency. The score of this scale has positively correlated with the various aspects of *health and well-being* (see Antonovsky, 1993; Brooks, 1998; Coe, Romeis & Hall, 1998; Coward, 1996; Forsberg & Björvell, 1996; Forsberg, Björvell & Cedermark, 1996; Höfer & Straus, 1997; Kivimäki, Kalimo & Toppinen, 1998; Klang, Björvell & Clyne, 1996; Korotkov & Hannah, 1994; Mullen, Smith & Hill, 1993; Rasku, Feldt & Ruoppila, 1997; Steiner et al., 1996; Tolonen, 1997; Virokannas, Feldt & Ruoppila, 1998) and with the other constructs of generalized perception of self and environment like *self-esteem, self-transcendence and hardiness* (Coward, 1996; Korotkov & Hannah, 1994). The high score of the 13-item scale has also been shown to be negatively associated with the *perceived stressors* (George, 1996; Ingram, Corning & Schmidt, 1996; Kivimäki et al., 1998; Ryland & Greenfeld, 1991) and *poor coping strategies* (Klang, Björvell & Cronqvist, 1996)

Antonovsky (1987a, 1993) suggested that the Orientation to Life Questionnaire should be used as a unidimensional measure. This raises the question as to why Antonovsky recommended unidimensional use of the scale but troubled nonetheless to distinguish between the components of meaningfulness, comprehensibility and manageability and even to label the items of the scale according to these constructs. Antonovsky (1987a, 1993) himself defended the one-factor model of the Orientation to Life Questionnaire from a theoretical standpoint. He emphasized that the components of sense of coherence are interrelated and therefore should not be measured as distinct constructs. This argument has been supported by several studies where the three components of sense of coherence (measured by sum variables) have revealed high inter-correlations ($r = 0.50-0.78$) (e.g., Bishop, 1993; Flannery & Flannery, 1990; Hart, Hittner & Paras, 1991; Kravetz et al., 1993; Pasikowski, Sek & Scigala, 1994; Petrie & Brook, 1992; Sandell, Blomberg & Lazar, 1998). Antonovsky (1987a, 1993) also argued that there is no sense in measuring the three components of sense of coherence separately because they are all needed for successful coping.

Despite the vast popularity of the scale, only a few studies about the structural properties of the Orientation to Life Questionnaire have been published. Furthermore, most of these studies have been based mainly on exploratory factor analysis using the longer, 29-item scale (Callahan & Pincus, 1995; Flannery & Flannery, 1990; Frenz et al., 1993; Hawley, Wolfe & Cathey, 1992). According to these four studies and three nonpublished factor analytic studies referred to by Antonovsky (1993), the one-factor structure has seemed to provide the most appropriate solution for the Orientation to Life Questionnaire. Hence, the original three factors do not appear to be empirically distinct.

Although the classificatory item design of the Orientation to Life Questionnaire would enable employment of the confirmatory techniques in investigating the structure of the scale (see Jöreskog & Sörbom, 1996; Nummenmaa, Konttinen, Kuusinen & Leskinen, 1997), these studies are still scarce. To date, there exist only two published studies applying confirmatory

factor analysis to the Orientation to Life Questionnaire. In the first of these studies (see Sandell et al., 1998), confirmatory factor analysis supported neither the hypothesis of a single common factor measured by all 29 items of the scale, nor the three sense of coherence components in data of Swedish clinical and non-clinical samples. It is noteworthy that in the tested three-factor model, the factors describing meaningfulness, comprehensibility and manageability were not allowed to correlate. In the further exploratory factor analysis performed by the authors, the first two of the three obtained factors were basically equivalent to Antonovsky's meaningfulness and comprehensibility components. The second study (see Larson & Kallenberg, 1999) is the only study, or at least to my knowledge, which has investigated the structure of the 13-item version of the scale. In this study, the one-factor solution of the scale showed a better fit for the Swedish population data than the three-factor structure based on Antonovsky's item classification. Also in this study, the three factors in the tested three-factor model were not allowed to correlate.

In my opinion, the two alternative confirmatory factor analysis models still remain to be tested along with the recommended one-factor model. In the first place, given Antonovsky's theoretical considerations, his item classification of the Orientation to Life Questionnaire and his argument that the three components of sense of coherence are interrelated, there are good grounds for testing the correlated three-factor structure of the scale. Moreover, since the Orientation to Life Questionnaire is designed to measure a global orientation consisting of interrelated aspects of meaningfulness, comprehensibility and manageability, a structure whereby a second-order factor explains the correlations between the first-order meaningfulness, comprehensibility and manageability factors also calls to be tested (see Jöreskog & Sörbom, 1996). In other words, in this model, the Orientation to Life Questionnaire is assumed to measure a generalized expectancy factor, i.e., sense of coherence, whose influence is shared among the three first-order expectancy factors, i.e., meaningfulness, comprehensibility and manageability. It is notable that this second-order factor model is statistically equivalent to the correlated three-factor model. In the present study, these two confirmatory factor analysis models are tested along with the one-factor structure using the 13-item Orientation to Life Questionnaire.

1.4 The stability of sense of coherence

A crucial feature of the definition of sense of coherence is that it is hypothesized as a fairly stable dispositional orientation of personality (Antonovsky, 1987a,b, 1991, 1993; Antonovsky, Adler, Sagy & Visel, 1990; Sagy, Antonovsky & Adler, 1990). As early as in infancy and childhood, human beings attempt to achieve stability and predictability, as well as some meaning that can motivate further action. The sense of manageability begins to develop during the early years, as a result of parental response to the child's actions. During the years of childhood

and adolescence, consistency in life experiences enhances comprehensibility, load balance manageability and participation in socially-valued decision making meaningfulness. When entering young adulthood, the individual has acquired a tentative level of sense of coherence, a picture of the way the world is. After age 30, sense of coherence is expected to remain relatively stable, as the individual has already made major commitments in his or her life: marriage, the work on which most of one's waking hours will be spent, a style of life and a set of social roles. All these provide an individual with a stable set of life experiences which enable sense of coherence to become established (Antonovsky, 1979, 1987a).

Antonovsky (1979, 1987a) pointed out, however, that to say that sense of coherence is stable, enduring and pervasive in adulthood does not mean that it is immutable. He emphasized the dynamic nature of sense of coherence as well meaning that some modifications, "fluctuations around a mean level" as he called the variation in sense of coherence, may occur throughout the life course as a result of major changes in an individual's generalized resistance resources. For example, the death of a spouse or unemployment may cause considerable weakening in sense of coherence. On the other hand, abrupt positive and happy changes in an individual's life may strengthen sense of coherence. However, in later adulthood a person is inclined to return quite soon to his or her mean level of sense of coherence, whereas the change in sense of coherence may be long-lasting or even permanent among young adults with a less developed sense of coherence (Antonovsky, 1987a,b, 1991).

Curiously, a few longitudinal studies have so far attempted to answer the fundamental question about the stability of and mean changes in sense of coherence. Carmel and Bernstein (1990) conducted a 3-stage follow-up study dealing with changes in sense of coherence among medical students. They found that the mean level of sense of coherence weakened systematically over time as the work load in medical school increased during the first two years of study. However, because the inter-correlations of the sense of coherence scores between the baseline and follow-up measurements were not given, the amount of stability of sense of coherence over time and situations was left unknown. Additionally, the students investigated were all under 30 years of age, and thus it remained unclear whether their age, stressful life changes, or both together caused modifications in their sense of coherence. Frenz et al., (1993) reported high stability for sense of coherence (test-retest correlation 0.92) in a group of undergraduate students, but only using a one-week time span. Again, in a group of social service employees at intervals' of 7 to 30 days, a high test-retest reliability ($r = 0.90$) was observed (Frenz et al., 1993).

However, as indicated in a recent review on sense of coherence research (see Geyer, 1997), further investigations are needed to explore whether sense of coherence and its three components (comprehensibility, manageability, meaningfulness) represent a stable disposition. In particular, the factors which are hypothesized to affect the stability of and changes in sense of coherence, such as age and unemployment, merit closer attention. In my opinion, the statistical methods used in the assessment of the stability of sense of coherence are a matter for further attention, too. To my knowledge, there exist no studies that have employed Structural Equation Modeling in assessing the stability of and mean

changes in sense of coherence. This method is highly recommended in analyzing the stability of the constructs in longitudinal data (Jöreskog & Sörbom, 1996; Tisak & Meredith, 1990). The advantage of this method is that it allows the investigation of the constructs as latent variables and thus produces error-free stability coefficients for those constructs. In the present study, I employed this method in the assessment of the stability of sense of coherence and its relation to age and employment experiences in 1-year and 5-year follow-up data.

1.5 Roles of sense of coherence in the work context

1.5.1 Mediating role of sense of coherence in working life

Although the level of sense of coherence is largely shaped by the life experiences in childhood and adolescence, it may be modified in adulthood as well by the nature of the current working environment depending on the amount of generalized resistance resources afforded by the job (Antonovsky, 1987a,b, 1991). Generalized resistance resources at work refer to the provision of experiences that promote the development and maintenance of a strong sense of coherence whereas a generalized resistance deficit at work, in turn, produces experiences that vitiate one's sense of coherence. While sense of coherence is thought to be a major determinant of an individual's location on the health ease/dis-ease continuum (Antonovsky, 1979, 1987a) there is good reason to suspect that sense of coherence may operate as a mediator variable between psychosocial work characteristics and well-being at work (the mediator of a particular relationship is a variable which transmits the effect of one variable to the other; see Baron & Kenny, 1986; Cox & Ferguson, 1991). In other words, differences in psychosocial work characteristics may cause differences in sense of coherence, which, in turn, may affect the quality of health and well-being outcomes.

Influence at work, a good load-balance and good social relations in the workplace are the central work characteristics that Antonovsky (1987a,b) believed to serve as generalized resistance resources for an employee and consequently enhance one's sense of coherence. Influence at work is essential in particular to a sense of meaningfulness, a good load-balance to a sense of manageability and good social relations at work to a sense of comprehensibility. The effects of job security/insecurity as well as unemployment are also central to Antonovsky's theory. Job security is a work condition that Antonovsky assumed to be fundamental to an individual's sense of coherence, in particular to the sense of comprehensibility. It is defined as "the calm belief of the individual worker that, so long as one does not violate rules accepted as legitimate, one will not be fired" (Antonovsky, 1987a, p.115). Accordingly, job insecurity has a weakening effect on sense of coherence since it represents a generalized resistance deficit for an employee. Unemployment is one of the most destructive life situations for an individual's sense of coherence (Antonovsky, 1987a). When a person loses his/her

job s(he) loses the ability to predict the future, which has an adverse effect on sense of coherence. The unemployed person loses the social relations of the workplace and its group rituals, which are important in reinforcing the experience of consistency. In addition, the possibilities of participating in socially-valued decision-making are weakened, which decreases sense of meaningfulness.

The latter link in the proposed mediational model, i.e., the relations of sense of coherence on occupational well-being, has received an increasing amount of attention in recent years. The findings have been highly consistent, showing, in accordance with the theory, that the stronger employees' sense of coherence is, the better their occupational well-being. For example, a strong sense of coherence has found to be related to high job satisfaction (Feldt, 1995; Rasku et al., 1997; Strümpfer, Danana, Gouws & Viviers, 1998; Virokannas et al., 1998), whereas a weak sense of coherence has found to be related to anxiety and depression symptoms at work (Tolonen, 1997). A strong sense of coherence has also found to be negatively associated with burnout (Baker, North & Smith, 1997; Gilbar, 1998; Pålsson, Hallberg, Norberg & Björvell, 1996) which refers a stress syndrome that comprises emotional exhaustion, depersonalization and personal accomplishment (see Maslach, 1982; Maslach & Jackson, 1981; Schaufeli, Maslach & Marek, 1993). Of these three aspects of burnout a weak sense of coherence has showed the strongest connection with lowered personal accomplishment and high emotional exhaustion at work (Baker et al., 1997; Gilbar, 1998).

As the above references to the literature show, the appropriateness of mediational model in explaining the effects of psychosocial work characteristics on occupational well-being via sense of coherence has been closely argued on the theoretical level. However, as far as I know, this model continues to lack empirical confirmation. For this reason, I focused in this study on investigating whether sense of coherence mediates the effects of psychosocial work characteristics on well-being. The work characteristics I chose in the hypothesized mediational model represented those that Antonovsky (1987a,b) assumed to operate both as generalized resistance resources (good organizational climate, good leadership relations, influence at work) and as a generalized resistance deficit (job insecurity) for an individual. Thus, the former job characteristics are assumed to sustain sense of coherence and consequently well-being (i.e., low psychosomatic symptoms and low emotional exhaustion at work), whereas the latter characteristic of job is assumed to be related to weak sense of coherence and consequently well-being problems at work (i.e., high psychosomatic symptoms and high emotional exhaustion at work). In addition to the level of the variables in the proposed mediational model, I investigated whether changes in psychosocial work characteristics during a 1-year follow-up period cause changes in sense of coherence and consequently changes in well-being. An interesting question, for example, is whether an increase in an employee's generalized resistance resources at work strengthens that employee's sense of coherence and consequently enhances his or her well-being at work.

1.5.2 Moderating role of sense of coherence in working life

While sense of coherence can be considered as a mediator variable in the relationship between psychosocial work characteristics and well-being, its possible moderating role upon these relationships is not so clear in the theory (a moderator is a variable which alters the direction or strength of the relationship between two other variables; see Baron & Kenny, 1986; Parkes, 1994). On the one hand, Antonovsky (see Antonovsky, 1987a, Sagy & Antonovsky, 1990) rejected the moderator hypothesis because he emphasized that sense of coherence is not a buffer variable between stressor and disease but instead makes a direct contribution to health whereas the levels of stressors are of little importance in determining health and well-being outcomes. Although Antonovsky and Sagy (see Antonovsky & Sagy, 1986; Sagy & Antonovsky, 1990) found some support for seeing sense of coherence as a buffer between stressor and disease, they emphasized, however, that far more research is needed before it can be concluded that sense of coherence is of greater or lesser importance in affecting well-being depending on the structural context which generates different stressor levels.

On the other hand, the moderator hypothesis of sense of coherence is grounded in the theory by the fact that Antonovsky (see Antonovsky, 1979, 1987a; Sagy & Antonovsky, 1990) assumed that sense of coherence changes the direction of the relationship between stressor and health outcomes. According to Antonovsky, stressors may have damaging, neutral or even salutary effects on health, depending on the strength of a person's sense of coherence. The consequences of stressors on health are more likely to be salutary among people with a strong sense of coherence because they manage tension successfully and learn from their experiences. Conversely, pathogenic consequences of stressors on health are more likely among people with a weak sense of coherence because their tension management tends to be based on inflexible and situationally inappropriate coping strategies and in addition, their ability to mobilize potential resistance resources is poor.

Hitherto, little research effort has been made to shed further light on the possible moderating role of sense of coherence. In the work context, the results of these few studies have not succeeded in clarifying this issue: sense of coherence both has and has not operated as a moderator variable between psychosocial work characteristics and well-being. In the study by Kalimo, Olkkonen and Toppinen (1993), a strong sense of coherence buffered the pathogenic effects of poor leadership style, role indistinctness and poor co-operation on well-being among industrial managers. Klen (1998) also found a significant buffering effect for sense of coherence (measured by a 9-item scale), but the effects varied across the forestry occupations he studied. Klen observed, for example, that sense of coherence buffered the pathogenic effects of pressure of work on well-being among masters of forestry but among other forestry occupations this effect was not detected. In Feldt's (1995) study of technical designers, sense of coherence did not moderate the relationships between psychosocial work characteristics and job satisfaction. Nor did the findings by Kivimäki et al. (1998) support any moderated effects of sense of coherence in relationships between exposure to stress and perceived stressors at work and between stressors or perceived stressors and

symptoms of strain.

As the above review indicates, the issue concerning the possible moderator role of sense of coherence between psychosocial work characteristics and well-being requires further research. Therefore, I designed the last of the five studies included in this thesis to generate more information on this specific question. The seven psychosocial work characteristics studied in the investigated moderator effects model of sense of coherence were the quality of leadership relations, the quality of the organizational climate, pressure of time, work demands, influence at work, career rewards, and adverse physical factors in the working environment. Well-being at work was conceptualized by low psychosomatic symptoms and low emotional exhaustion at work.

1.6 The aims of this study

To sum up, my study aimed at investigating (1) the structure of the 13-item Orientation to Life Questionnaire, (2) the stability of sense of coherence and its relations to age and employment experiences and (3) the mediator and (4) the moderator roles of sense of coherence in the relationships between psychosocial work characteristics and well-being. The four specific research questions and the hypotheses derived from the sense of coherence theory were as follows:

- (1) *Does the 13-item Orientation to Life Questionnaire (Antonovsky, 1987a) measure sense of coherence as a unidimensional construct or as a three-dimensional construct consisting of the interrelated aspects of meaningfulness, comprehensibility and manageability? (Studies I, II, III).*

On the one hand, the one-factor model is defended by the fact that Antonovsky (1987a, 1993) recommended the use of the Orientation to Life Questionnaire as a unidimensional measure. On the other hand, the correlated three-factor model and its equivalent second-order factor model can be defended on the grounds that the sense of coherence construct, as well as the Orientation to Life Questionnaire, includes the three interrelated aspects of meaningfulness, comprehensibility and manageability (see Antonovsky, 1987a).

- (2) *How stable is sense of coherence and is age and employment experiences, such as unemployment and lay-off related to the stability of sense of coherence? (Studies II, III)*

Sense of coherence is assumed to be a fairly stable dispositional orientation of personality in adulthood (Antonovsky, 1979, 1987a,b, 1991, 1993; Antonovsky et al., 1990; Sagy et al., 1990). According to the theory, an individual's sense of coherence should be developed and highly stabilized around the age of 30 years. Accordingly, it can be assumed that sense of coherence among an older group of

individuals (over 30 years) will be more stable than among a younger group of individuals (under 30 years). Antonovsky (1979, 1987a,b, 1991) also postulated that unemployment weakens sense of coherence. Hence, it can be hypothesized that sense of coherence is more stable among subjects who have been in full-time employment than among those who have faced unemployment and/or lay-offs.

- (3) *Does sense of coherence have a mediating role in the relationships between psychosocial work characteristics and well-being at work? (Study IV)*

In the mediational model used in this study, good organizational climate, good leadership relations and influence at work are assumed to represent generalized resistance resources which, according to the theory, facilitate a strong sense of coherence (see Antonovsky, 1987a,b, 1991). A strong sense of coherence, in turn, is assumed to be related to high well-being at work (Antonovsky, 1987a,b). On the other hand, poor work characteristics, like job insecurity, represent a generalized resistance deficit for an employee which leads to a weak sense of coherence, and consequently impaired well-being at work. Similarly, it is hypothesized that when an employee encounters positive changes in his or her working environment (i.e., an improvement in organizational climate, leadership relations and influence at work, and a decrease in job insecurity), his or her sense of coherence strengthens, which, in turn, increases well-being, and, vice versa, when an employee experiences negative changes in his or her working environment (i.e., deterioration in organizational climate and leadership relations, decline in influence at work, increase in job insecurity), his or her sense of coherence weakens, which, in turn, reduces well-being.

- (4) *Does sense of coherence have a moderating role in the relationships between psychosocial work characteristics and well-being? (Study V)*

On the one hand, the moderator hypothesis can be rejected in the sense that Antonovsky did not consider sense of coherence as a buffer variable between stressor and disease but, on the contrary, assumed it to have a strong direct effect on health whereas the level of stressors matters little in determining health and well-being outcomes (Antonovsky, 1987a; Sagy & Antonovsky, 1990). On the other hand, the moderator hypothesis can be defended in that, according to Antonovsky (1979, 1987a), the consequences of stressors on health and well-being can be pathological, neutral or salutary contingent on the resolution of the tension caused by the stressor, i.e., on the strength of sense of coherence. Salutary consequences of stressors on health are more probable among people with a strong sense of coherence whereas pathogenic consequences of stressors on health are more probable among people with a weak sense of coherence.

2 METHODS

2.1 Participants and procedure

I sought to answer the research questions by using multiple samples which were all involved in study projects currently in progress at the Department of Psychology, University of Jyväskylä. Altogether, the study investigated five Finnish occupational samples which consisted of technical designers (samples 1 and 2), teachers (sample 3), managers (sample 4), and employees in different occupations in four organizations (sample 5). In the main samples 1 and 2 contained the same individuals as the technical designers were investigated both cross-sectionally and longitudinally.

2.1.1 Sample 1: a cross-sectional study among 989 technical designers (Studies I, V)

The sample of technical designers was drawn from membership registers of the Union of Technical Employees and the Union of Finnish Professional Engineers. At the time when the data were collected (March 1992) the Union of Technical Employees had a membership of 58 000; 20 - 25% of them were working in the field of design. Of the members of the Union of Professional Engineers (29 000), 30 - 35% worked in design. According to the job title criterion (the word "designer" in some form in the job title in the membership registers), 1203 subjects were randomly drawn from the members of the Union of Technical Employees and 1200 subjects from the Union of Finnish Professional Engineers. All 2403 questionnaires were sent to the subjects' home addresses and 1222 technical designers finally participated in the study. The response rate was 58.9% after removing those from the original sample who did not work in design (at the

researcher's request 232 subjects returned a blank questionnaire stating that they were not working in design occupations). In addition, 233 subjects were removed from the present sample because they were unemployed or laid-off at the time the questionnaire data were gathered. The data collection and the investigated subjects have been described in detail elsewhere (Feldt & Ruoppila, 1993).

Thus, the sample of technical designers comprised 989 engineers and technical employees having full-time jobs. The subjects were working in different fields of design, such as product and machine, automation, process and building design. Participants' mean age was 39 years (range 25 - 64 years). The great majority were men ($n = 931$, 94%). 50% of participants were engineers, 38% technicians, and 12% other technical employees (vocational school, short vocational courses or no vocational education).

2.1.2 Sample 2: a 5-year follow-up study among 352 technical designers (Study III)

The second sample was a 5-year follow-up study of the above-described group of technical designers who had participated in the study in March 1992 (see chapter 2.1.1.). A new data collection for the follow-up study was performed in April 1997. In this phase, the original sample of 1222 designers was divided into two groups on the basis of their age at the time of the first measurement: a younger group aged 25 - 29 years ($n = 210$) and an older group aged 35 - 40 years ($n = 285$). The new data collection was directed only at these two age groups, which consisted of 495 subjects (210 of them were members of the Union of Technical Employees and 285 members of the Union of Finnish Professional Engineers). Before sending out the new questionnaires, the validity of subjects' home addresses and membership were checked against the membership registers of both unions. The addresses of 76 subjects were not found in the registers (40 of them were members of the Union of Technical Employees and 36 members of the Union of the Finnish Professional Engineers) and, therefore, the follow-up questionnaires were sent to 419 subjects of which 352 (84%) participated in the study (for more detail, see Virokannas et al., 1998).

The longitudinal data ($N = 352$) consisted of 141 (40%) subjects in the younger age group (mean age 32 years in 1997) and 211 (60%) subjects in the older age group (mean age 43 years in 1997). The majority of the subjects were male (91%, $n = 320$). 61% of the participants were engineers and 39% technicians and other technical employees engaged primarily in design work. The subjects reported different experiences in relation to unemployment or lay-off during the follow-up period (1992-97). 181 (51%) had had no unemployment or lay-off experiences and 153 (44%) had had at least one unemployment or lay-off experience of at least two weeks' duration. 18 (5%) of the subjects had had under two weeks' experience of unemployment or lay-off. The participating technical designers were from different parts of Finland and were working in various fields, such as product and machine, process, building and electric design.

The rate of lacunae in the longitudinal data was 28.9%, as the data on 143

designers in the age groups under investigation ($n = 495$) were lost. 49% ($n = 70$) of these lost subjects were from the younger and 51% ($n = 73$) from the older age group. Thus, the missing data rate was slightly higher among the younger (33.3% from the 210 subjects) than older designers (25.6% from the 285 subjects). The lost subjects did not diverge by gender from the subjects who participated in the longitudinal study (92 % of the lost subjects were men and 91 % of the participants were men). Their sense of coherence scores were also similar. In 1992, the mean score of the Orientation to Life Questionnaire among the lost subjects was 61.9 ($SD = 12.01$) and among the participated subjects 61.1 ($SD = 12.03$) ($t(489) = -.70, p = 0.482$).

2.1.3 Sample 3: a cross-sectional study among 1012 teachers (Study I)

A sample of teachers was drawn from the members of the Teachers' Union according to two age criteria (45 - 49 and 55 - 59 years) and five subject and teaching levels (class teachers, physical education teachers, other subject teachers, special class teachers and vocational subject teachers). 1308 teachers met these criterions. The teachers' sample was a part of a research project concerning the well-being of aging teachers (Kinnunen & Parkatti, 1993; Kinnunen, Parkatti & Rasku, 1993, 1994; Kinnunen & Rasku, 1994; Rasku, 1993). A fuller description of the sample is given by Kinnunen et al. (1993, 1994).

The postal questionnaire data were collected in November-December 1991 and the response rate was 77%. Thus, the final sample consisted of 1012 teachers belonging to two age groups; 45 - 49 years old ($n = 573, 56.7%$) and 55 - 59 years old ($n = 439, 43.3%$). 58% ($n = 586$) of the teachers were female. Their teaching domains were as follows: 24% were subject teachers in grades 7 - 12, 22% class teachers in grades 1 - 6, 22% vocational subject teachers in vocational schools, 21% physical education teachers in grades 7 - 12 and 11% special class teachers in grades 1-9.

2.1.4 Sample 4: a cross-sectional study among 1035 managers (Study I)

The sample of managers was drawn from the membership registers of the Union of Technical Employees and the Union of Finnish Professional Engineers in spring 1996. The subjects were selected for the study from among those members who had the word "chief", "leader" or "manager" in some form in their job title in the union register. In this phase, members who were unemployed, laid-off or retired were omitted out from the study, leaving a total of 21 000 subjects in the membership register of the Union of Technical Employees (total membership in spring 1996 was 73 000) of whom 1000 were randomly selected for this study. After the same process, 5000 members were left in the register of the Union of Finnish Professional Engineers (total membership in 1996 was 34 000) of whom 1000 was randomly selected for this study. The postal questionnaires were sent to

these 2000 subjects' home addresses in April 1996. The response rate was 64.2% after omitting 389 subjects who did not meet the criteria of "working manager" (325 subjects returned an unfilled questionnaire with a mention that they did not work in management positions, 22 were retired, 42 were unemployed or laid-off). The data collection and the background of the investigated managers have been described in detail elsewhere (Rasku et al., 1997; Rasku, Ruoppila & Feldt, 1999).

The final sample consisted of 1035 managers ranging from shop floor supervisors to senior managers. The respondents were from different parts of Finland and their mean age was 44 years (range 20 - 65). The great majority were men (92%, $n = 951$). 52% of all the respondents were engineers, 29% technicians and 19% other technical employees (technicians, vocational school, short vocational courses or no vocational education). The respondents were working in management positions in different fields, most commonly in the metal, chemistry, building, paper and forestry industry.

2.1.5 Sample 5: a 1-year follow-up study among 219 employees (Studies II, IV)

The fifth sample was a part of a longitudinal research project "Job Insecurity and Well-being" conducted among four organizations in central Finland (see Happonen, Mauno, Kinnunen, Nätti & Koivunen, 1996; Kinnunen, Mauno, Nätti & Happonen, in press; Mauno, 1999; Mauno & Kinnunen, 1999). The study was conducted in two stages. In the first stage, in 1995, 636 employees working in a municipal social and health care department, a bank, factory or supermarket, answered a questionnaire (response rate 65%). Twelve months later, in 1996, 518 employees working in the same organizations participated in the study (response rate 53%). This study is based on the responses of those employees who participated in both stages of the study ($N = 219$).

The final sample was female dominated (73%, $n = 159$). The mean age of the subjects was 43 years (range 22 - 62 years, $SD = 7.8$ years). 45% of the subjects worked in municipal social and health care, 24% in a bank, 27% in a paper mill and 4% in a supermarket. 17% of the subjects had no vocational education, 39% had lower vocational education, 32% had higher vocational education and 12% had a university degree. There were some significant gender differences in the background variables; the majority of the men (63%) worked in the paper mill, whereas the majority of the women (56%) were employed in the social and health care department.

The data collection was performed in February 1995 and 1996 using a questionnaire distributed to each employee through inter-office mail. All the employees at the supermarket were asked to participate in the study. In the other organizations, a random sample of employees was selected from a list provided by the organization. Respondents returned their completed questionnaires in closed envelopes to a mailbox at the workplace. As names were not used in order to preserve anonymity, the panel data were formed by matching the data of those employees who participated in both phases of the study according to stable key variables concerning their background characteristics; gender, year of birth,

education, marital status, organization and position in the organization. The small number of subjects in the panel data was largely caused by the computer-based data matching process, in which those subjects who could not be differentiated from each other by the matching variables were discarded. Furthermore, to increase the reliability of the panel data, the information of the age of the youngest child and the years of employment in the organization were taken into consideration in matching process. If the values in these variables did not increase during the follow-up, the case was omitted.

However, despite the small number of subjects in the longitudinal data ($N = 219$), the data represented relatively well the data gathered in the first study phase in 1995 ($N = 636$). The proportions of the men and women were identical in both data sets: 73% were women and 27% men. The respondents' mean age was also similar, i.e., in both data sets 43 years. In addition, the respondents represented the employed organization in the same proportion in both data sets. In the first study phase (in 1995), 43% of the respondents worked in the municipal social and health care sector (in the panel data 45%), 23% worked in the bank (in the panel data 24%), 26% worked in the paper mill (in the panel data 27%) and 8% worked in the supermarket (in the panel data 4%). Level of education was also quite similar in both data sets: 57% of the employees in the first study phase and 65% in the panel data had completed either vocational school or college education. Most of the respondents were white-collar workers (75% in the first study phase versus 81% in the panel data), and most job contracts were full-time (87% versus 84%) and permanent (97% versus 98%). In the first phase of the study, the mean score of the Orientation to Life Questionnaire among all the 636 participated employees was 63.3 ($SD = 9.9$). The corresponding score among the employees belonging to the panel data was 63.9 ($SD = 10.1$).

2.2 Measures

The central study variables can be divided into three groups: sense of coherence, well-being and work characteristics. These were measured in questionnaires as follows:

2.2.1 Sense of coherence

In all five studies the short-form (13-item) Orientation to Life Questionnaire (Antonovsky, 1987a) was used to assess sense of coherence. The scale is presented in Appendix I.

2.2.2 Well-being

Well-being indicators studied were psychosomatic symptoms which are conceptualized as potential consequences of negative experiences of work characteristics (see Kahn & Byosiere, 1992; Pearlin, 1989) and emotional exhaustion at work what is conceptualized as a negative outcome when an employee's emotional energies become drained at work (see Maslach & Jackson, 1981; Schaufeli, Maslach & Marek, 1993).

Psychosomatic symptoms were assessed by a 10-item scale (Study IV) (see Kinnunen & Nätti, 1994; Lehto, 1991; Mauno, 1999) and a 22-item scale (Study V) (see Aro, 1981; Heinälä & Ruoppila, 1988; Feldt & Ruoppila, 1993). Both of these covered a wide spectrum of somatic symptoms, disturbed affects and other psychological disturbances that are known to be common stress symptoms (e.g., abdominal pain, headache, lack of energy or depression, heartburn or acid problems). Respondents were requested to answer each item on the basis of their experiences over the last 12 months, using a 4-point scale ranging from 1 (not at all) to 4 (extremely).

Emotional exhaustion at work was measured by 6-item (Study IV) and 3-item (Study V) shortened versions of the Maslach and Jackson's (1981) Burnout Inventory. The items appeared in the form of statements and concerned the feelings of fatigue that develop as one's emotional energies become drained at work (e.g., "I feel emotionally drained from my work"). The statements were rated on a 6-point scale (1 = never, 6 = always).

2.2.3 Work characteristics

Altogether eight work characteristics variables were used in this study; leadership relations, organizational climate, pressure of time, work demands, influence at work, job insecurity, career rewards and, adverse physical factors in the working environment. The work characteristics chosen for the study were primarily those that Antonovsky (1987a,b) considered to be important in shaping employees' sense of coherence and well-being at work.

Leadership relations. Four- (Study IV) and 7-item (Study V) scales including the statements concerning, for example, feedback, support and frankness from the leadership were used to assess the relationship between the employee and leadership. Subjects responded on a 5-point scale (1 = totally agree, 5 = totally disagree). These questions were taken from the study "The Quality of Working Life in Finland" (Lehto, 1991).

Organizational climate. Four (Study IV) and seven (Study V) statements were used to assess the quality of organizational climate, particularly assistance from others, the general social climate and the conflicts between co-workers. Subjects responded on a 5-point scale (1 = totally agree, 5 = totally disagree). Also these questions were taken from the study "The Quality of Working Life in Finland" (Lehto, 1991).

Pressure of time was assessed by three items based on the study by Kalimo et

al. (1993) concerning the tiny time constraints at work (Study V). The respondents were asked to answer the questions by a 4-point scale (1 = never, 4 = extremely).

Work demands were assessed by five questions concerning the prevalence of work demands (Study V). The respondents evaluated the extent of their work demands by a scale from 1 (not at all) to 5 (very much). The questions were primarily taken from the study of Kalimo et al. (1993).

Influence at work was assessed by 3- (Study IV) and 8-item (Study V) measures concerning the latitude in decision making and relative power at work using a 5-point scale (1 = totally agree, 5 = totally disagree). The 3-item scale was primarily based on Ashford, Lee and Bobko's (1989) study and the 8-item scale on Kalimo et al.' (1993) study.

Job insecurity (Study IV) consisted of four items which assessed certainty and concern about job retention (see Mauno, 1999). The subjects responded on a 5-point scale (1 = totally agree, 5 = totally disagree). The scale was based on the studies of Greenhalgh (1982) and Hartley, Jacobson, Klandermans and van Vuuren (1991).

Career rewards (Study V) were measured by a question containing five items: "To what extent does the accumulation of experience in the job influence (a) salary, (b) an increase of responsibility at work, (c) the variety of working tasks performed, (d) increased appreciation, and (e) career advancement?". Subjects responded on a 4-point scale (1 = not at all, 4 = very much). The scale was formulated for the study by Feldt and Ruoppila (1993).

Adverse physical factors in the working environment (Study V) were measured by seven items concerning poor lighting, insufficient ventilation, crowded working space, dirt and dust, noise, restlessness and poor soundproofing. The responses were given on a 5-point scale (1 = not at all, 5 = very much). The scale was formulated on the basis of the studies of Heinälä and Ruoppila (1988), Kalimo et al., (1993) and Mäkinen (1982). In addition, the statement concerning the pleasant working environment was included in the study ("Does your job offer you a pleasant working environment?": 1 = totally disagree, 5 = totally agree) which was recoded in the total calculation.

2.3 Methods of data analysis

The primary method of data analysis was Structural Equation Modeling conducted via the LISREL program (Jöreskog & Sörbom, 1996). The method was chosen since it has been highly recommended in analyzing the latent structures of the study variables as well as the stability of the study variables over time in longitudinal data sets (see Jöreskog, 1979; Jöreskog & Sörbom, 1996; Tisak & Meredith, 1990). The structure of the 13-item Orientation to Life Questionnaire was investigated in Studies I, II and III by alternative confirmatory factor analysis models and the stability of and mean changes in sense of coherence in Studies II and III by longitudinal factor analysis models (see Tisak & Meredith, 1990).

Structural Equation Modeling is also recommended for analyzing indirect effects of the study variables (see Baron & Kenny, 1986) and, for this reason, the method was employed in Study IV where the mediator effects of sense of coherence in the work context were studied. In addition to these methods, the hierarchical regression analysis was used in analyzing the moderator effects of sense of coherence in the work context (Study V).

3 OVERVIEW OF THE RESULTS

3.1 The structure of the Orientation to Life Questionnaire (Studies I, II, III)

Studies I, II and III investigated the structure of the short-form (13-item) Orientation to Life Questionnaire (Antonovsky, 1987a). The confirmatory factor analysis was selected for the present study because the hypothesized factor analysis models were based on the priori information about the data structure both, in the form of knowledge derived from Antonovsky's (1979, 1987a) theory, and his classificatory item design (see Jöreskog & Sörbom, 1996; Nummenmaa et al., 1997).

Altogether three confirmatory factor analysis models (see Figure 1) were tested and compared by using the LISREL 8 program (Jöreskog & Sörbom, 1996). First, *a one-factor model* tested the adequacy of a single common factor in accounting for the underlying structure of the 13-item Orientation to Life Questionnaire. This model was derived from Antonovsky's (1987a, 1993) recommendations that the scale should be used as a unidimensional measure (see Studies I and II). Second, two statistically equivalent models, i.e., *a correlated three-factor model* and *a second-order factor model* tested the theoretically based interrelated three-component structure of the 13-item Orientation to Life Questionnaire (see Studies I, II and III). The correlated three-factor model included three first-order factors, the first of them consisting for the meaningfulness items, the second the comprehensibility items and the third the manageability items. The three factors were allowed to correlate because they are assumed to be interrelated in Antonovsky's (1987a) theory. In the second-order factor model, the correlations among the three first-order factors were explained by a second-order factor. Conceptually, the common variance attributable to the second-order factor was believed to represent a generalized, expectancy factor, i.e., sense of coherence, whose influence is shared among the three first-order

expectancy factors, i.e., meaningfulness, comprehensibility, manageability. These three models were tested using a multisample procedure (samples 1, 3 and 4 in Study I; sample 5 in Study II; sample 2 in Study III).

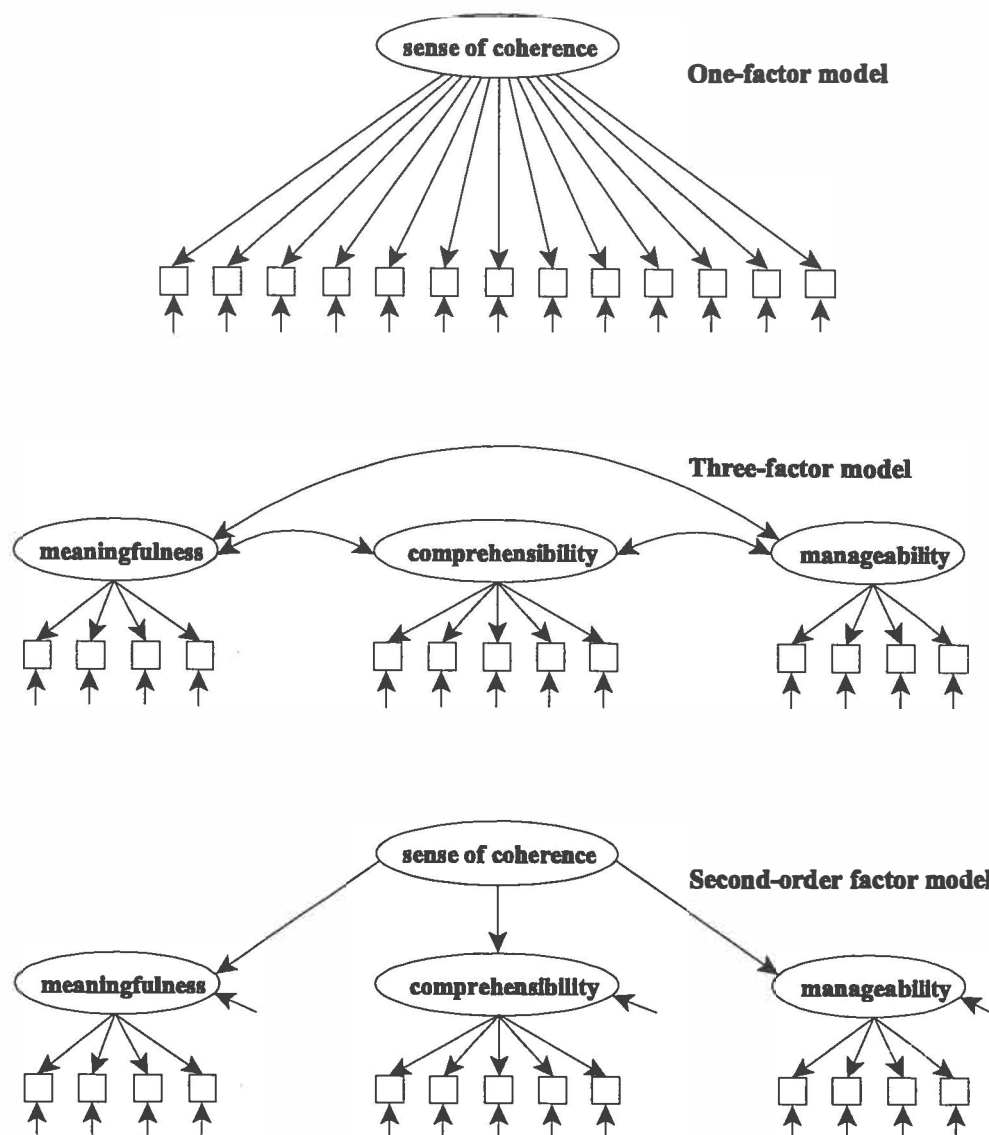


Figure 1. Three alternative confirmatory factor analysis models of the structure of the short-form (13-item) Orientation to Life Questionnaire (Antonovsky, 1987a) in constructing sense of coherence.

Studies I and II indicated that the correlated three-factor model and a second-order factor model were more adequate in characterizing the structure of the 13-item Orientation to Life Questionnaire than the one-factor model. Support for this conclusion came from the fit statistics as well as from the content interpretation of the alternative models. Firstly, Study I showed that the initial one-factor model (error covariances assumed to be zero), fitted the given multisample data poorly, whereas the corresponding correlated three-factor and second-order factor structures provided a better fit. Secondly, in Studies I and II, the one-factor model revealed several error covariances between the scale items. It is also notable, that these covariances varied across the studies (compare Studies I and II) and across the measurement occasions (Study II). In this sense, the models based on the item classification were better than the one-factor model because they revealed only one covariance in error terms.

The estimated factor analysis models also uncovered some structural weaknesses of the 13-item Orientation to Life Questionnaire. In all three alternative models, the comprehensibility item 5 and manageability item 6 were found to be problematic due to the strong mutual covariance in error terms. These items also showed low reliabilities on the factors in all three models tested in the study (Studies I, II and III).

3.2 The stability of and mean changes in sense of coherence (Studies II, III)

Studies II and III were designed to answer the second research question, i.e., the issue of the stability of and mean changes in sense of coherence. In Study II, the analyses were carried out using the 1-year follow-up data including 219 employees working in four organizations (sample 5). In Study III, the 5-year follow-up data including 352 technical designers (sample 2) were used to investigate the possible differences in stability of and mean changes in sense of coherence between the two age (subjects under 30 years vs. 35 - 40 years at the baseline measurement) and two employment groups (full-time employment vs. at least one unemployment and/or lay-off period of at least two weeks duration during the 5-year follow-up period).

Stability of sense of coherence. The stability analyses were based on the longitudinal factor analysis models (Jöreskog, 1979; Tisak & Meredith, 1990) using the LISREL 8 program (Jöreskog & Sörbom, 1996). *The longitudinal six-factor model* was designed to test the stability of the meaningfulness, comprehensibility and manageability components of sense of coherence. In this model, the cross-sectional correlated three-factor models (see chapter 3.1.) measured at two time points were connected together by structural equations posited between the factors. Based on the same methodology, the total sense of coherence construct was measured by *the longitudinal second-order factors model*. In both studies (Studies II and III), the invariance assumptions in the factors over time were found to be

supported. In addition, in Study III, the models met the hypothesis of invariance in factor loadings across the two age and two employment groups and thus, the models were estimated simultaneously for these groups with the loadings and structural parameters constrained to be equal both cross-sectionally and longitudinally.

Table 1 shows the estimated stability coefficients for the total sense of coherence construct and separately for its three components; meaningfulness, comprehensibility and manageability. Overall, the stability coefficients for the total sense of coherence construct were found to be moderately high in both studies. In 1-year follow-up time, sense of coherence was slightly more stable than in 5-year follow-up time. The opposite result was observed in the case of the three components of sense of coherence, the stability coefficients being slightly higher in 5-year follow-up time than in 1-year follow-up time. Study III showed that the stabilities of sense of coherence and its three components did not differ between the younger and the older group of technical designers, indicating the same degree of variation in these constructs in both age groups. Further, the stabilities did not differ between the two employment groups.

TABLE 1. The estimated stability coefficients for the total sense of coherence construct and for the meaningfulness, comprehensibility and manageability components of sense of coherence

Construct	Longitudinal factor analysis model	Study	Sample	Follow-up time	Stability coefficient
Sense of coherence	Second-order factors model	II	5	1 year	0.72
		III	2	5 years	0.67 ^a 0.66 ^b
Meaningfulness	Six-factor model	II	5	1 year	0.62
		III	2	5 years	0.73 ^a 0.72 ^b
Comprehensibility	Six-factor model	II	5	1 year	0.59
		III	2	5 years	0.64 ^a 0.61 ^b
Manageability	Six-factor model	II	5	1 year	0.65
		III	2	5 years	0.67 ^a 0.70 ^b

^a stability coefficient estimated for the two age groups investigated

^b stability coefficient estimated for the two employment groups investigated

Mean changes in sense of coherence and its three components. In Study II, the mean changes in the level of the meaningfulness, comprehensibility and manageability components of sense of coherence between the two time points were evaluated by using the longitudinal six-factor model. In this model, the means of the meaningfulness, comprehensibility and manageability factors at the

baseline measurement were fixed to zero and the means of these factors at the second measurement time were estimated (these estimates represented the mean changes in the factors over time). The results indicated that among 219 employees who worked in four organizations there were no mean changes in the meaningfulness, comprehensibility and manageability over the 1-year follow-up time (years 1995-96).

In Study III, the mean changes in the meaningfulness, comprehensibility and manageability over 5-year follow-up time (1992-97) were evaluated by the longitudinal six-factor model and the mean changes in the total sense of coherence by the longitudinal second-order factors model. In addition to mean change analyses, the mean differences of the constructs between the two age and two employment groups of technical designers were tested. The results can be summarized in three ways. *Firstly*, the effect of the measurement time on the level of sense of coherence was observed. The mean levels of technical designers' sense of coherence and its three components were higher in the second time of measurement (1997) than in the first time of measurement (1992). *Secondly*, age did not play any role in the level of and mean changes in sense of coherence. *Thirdly*, technical designers who had experienced unemployment and/or lay-offs during the follow-up time had on an average a weaker sense of coherence on both measurement occasions than full-time employed designers. This was seen also in each of the three components of sense of coherence. The positive changes in sense of coherence and its three components between these employment groups over a 5-year follow-up time were parallel.

3.3 Sense of coherence as a mediator between the relationships of work characteristics and well-being (Study IV)

The framework of Study IV was a mediational model linking four psychosocial work characteristics (organizational climate, job insecurity, leadership relations, influence at work) to two well-being indicators (psychosomatic symptoms, emotional exhaustion at work) via sense of coherence. The 1-year follow-up data (sample 5) allowed the investigation of the mediational relationships between the level of the study variables and, in addition, the changes in those variables. Structural Equation Modeling based on level and change variables (see Bast & Reitsma, 1997; Duncan, Duncan, Strycker, Li & Alpert, 1999; McArdle & Aber, 1990; Meredith & Tisak, 1990; Rovine & Molenaar, 1998) was used to estimate the proposed model.

The results highlighted the major role of a good organizational climate in enhancing sense of coherence and consequently well-being. Those employees who reported a good organizational climate had a strong sense of coherence, which was related to a low level of psychosomatic symptoms and emotional exhaustion at work. On the other hand, poor organizational climate was related to a weak sense of coherence and consequently high levels of psychosomatic symptoms and emotional exhaustion at work. The results also showed that the changes in

organizational climate were related to the changes in well-being indicators through changes in sense of coherence. In other words, when an employee appraised the organizational climate as having worsened during the year (1995-96), his or her sense of coherence weakened, which was also linked to reduced well-being.

Sense of coherence also mediated the job insecurity - well-being relationship. The employees who experienced high job insecurity were found to have a weaker sense of coherence and, consequently to suffer higher psychosomatic symptoms and emotional exhaustion than those employees who experienced low job insecurity. It was notable, however, that changes in job insecurity over a 1-year follow-up time were not related to changes in employees' sense of coherence and through it changes in well-being indicators.

Sense of coherence was not found to mediate the relationship between the level of leadership relations and well-being variables. However, a partially mediated link between changes in leadership relations and changes in well-being was found. For example, if the leadership relations improved during the year, the sense of coherence strengthened, which in turn was related to the lowered psychosomatic symptoms and emotional exhaustion at work. The changes in leadership relations were also directly related to changes in well-being. Sense of coherence had no mediating role in the influence at work and well-being relationship.

3.4 Sense of coherence as a moderator between the relationship of work characteristics and well-being (Study V)

Study V investigated cross-sectionally sense of coherence as a moderator in the relationship between seven psychosocial work characteristics (organizational climate, leadership relations, influence at work, work demands, pressure of time, career rewards, adverse physical factors) and well-being indicators (psychosomatic symptoms, emotional exhaustion at work) in a sample of Finnish technical designers (sample 1). The results were based on the hierarchical regression analysis where the main effects of the background variables (age, education, gender), sense of coherence and work characteristics on the well-being indicators were controlled throughout the moderator analyses.

The results indicated the strong main effect of sense of coherence on both well-being indicators studied: the stronger the sense of coherence, the lower the level of psychosomatic symptoms and emotional exhaustion at work. Sense of coherence explained 25.8 % of the variance of the psychosomatic symptoms and 14.5 % of the emotional exhaustion at work. Also, some support for a moderating role of sense of coherence on the relationship between work characteristics and well-being indicators was found although it is notable that these relationships explained only a small proportion of the variance of well-being indicators (0.7-1.5%).

The results concerning the moderating role of sense of coherence can be characterized in three ways. *Firstly*, the technical designers with a strong sense of coherence seemed to be better shielded from deleterious effects by adverse work characteristics on well-being. This was seen by the result that the stronger the sense of coherence, the weaker were the associations between the pressure of time and both well-being indicators. In addition, the subjects with the strongest sense of coherence showed the weakest association between the relationship of adverse factors in the work environment and emotional exhaustion at work.

Secondly, good social relations at work promoted well-being especially among technical designers with a very weak sense of coherence, whereas these relations were found to matter less in determining well-being outcomes in designers with a strong sense of coherence. On the other hand, poor social relations were most strongly connected with the well-being problems among designers with a weak sense of coherence. This moderating effect of sense of coherence was observed in the relationship between organizational climate and both well-being indicators, i.e., psychosomatic symptoms and emotional exhaustion at work. In addition, sense of coherence moderated the relationship between leadership relations and psychosomatic symptoms in such a way that among designers with the strongest sense of coherence, the association between the good leadership relations and low level of symptoms was strongest.

Thirdly, sense of coherence changed the direction of the relationships between some work characteristics and well-being indicators. This was observed in the relationship between work demands and emotional exhaustion at work in such a way that high work demands were related to high emotional exhaustion among the designers with a weak sense of coherence. In contrast, among the designers with a strong sense of coherence, high work demands were related to low emotional exhaustion. The results concerning career rewards also pointed to some degree in the same direction.

4 GENERAL DISCUSSION

4.1 Structure and stability of sense of coherence

This set of studies was designed to examine four crucial issues arising from Antonovsky's sense of coherence theory. Firstly, the structure of the sense of coherence scale, i.e., the 13-item Orientation to Life Questionnaire (Antonovsky, 1987a) was investigated (Studies I, II and III). Secondly, the stability of and mean changes in sense of coherence were investigated longitudinally (Studies II and III) and, in addition, the relations of an individual's age and employment experiences to the changes in sense of coherence (Study III). Thirdly, the mediator role of sense of coherence between the relationships of the psychosocial work characteristics and well-being was studied taking into account the level of these variables and, in addition, changes in these variables over a 1-year follow-up time (Study IV). Fourthly, the moderator role of sense of coherence between the relationships of the psychosocial work characteristics and well-being was studied (Study V). The obtained results led me to several conclusions which I discuss next in the light of Antonovsky's sense of coherence theory.

With regard to the first research issue, the results indicated that the correlated three-factor model and a second-order factor model formed on the basis of Antonovsky's (1987a) item classification, characterized the structure of the 13-item Orientation to Life Questionnaire better than the one-factor model (Studies I, II). The correlated three-factor model and second-order factor model were statistically equivalent models. They offered, however, two alternative ways to examine the structure of the 13-item Orientation to Life Questionnaire. A correlated three-factor model expressed that the scale measured three interrelated aspects of sense of coherence labelled as meaningfulness, comprehensibility and manageability. As expected on the basis of theory and prior research (see Antonovsky, 1987a; Bishop, 1993; Flannery & Flannery, 1990; Hart et al., 1991; Kravetz et al., 1993; Pasikowski et al., 1994; Petrie & Brook, 1992), these three

latent subconstructs of sense of coherence correlated strongly with each other. Therefore, it was meaningful to form a model where a second-order factor explained these high correlations between the three first-order factors. The formed second-order factor model was theoretically advantageous indicating that the Orientation to Life Questionnaire measured one general expectancy factor, i.e., sense of coherence, which consists of the three interrelated factors of meaningfulness, comprehensibility and manageability.

On the basis of the present results, I cannot conclude, however, that the correlated three-factor model and the second-order factor model would be absolutely superior models in characterizing the structure of the 13-item Orientation to Life Questionnaire. As noted in the results section, all the tested models suffered from the one covariance in error terms between the comprehensibility item 5 (*Has it happened in the past that you were surprised by the behaviour of people whom you thought you knew well?*) and manageability item 6 (*Has it happened that people you counted on disappointed you?*). This implied that these items shared something in common that the structures tested here could not explain. It is noteworthy that these two items have formed a unique factor in two previous exploratory factor analytic studies in which, the longer 29-item version of the Orientation to Life Questionnaire has been used (Frenz et al., 1993; Sandell et al., 1998). In analyzing the content of the items 5 and 6, I discovered these items measuring the same thing to a high degree. The aspect of interpersonal trust/mistrust is included in both items (see also Frenz et al., 1993; Sandell et al., 1998). In addition, when I followed Antonovsky's (1987a) five-facet item design, I found that these items have exactly the same four theoretical facets: the modality of the stimulus is instrumental, the source is external, the demand is diffuse and the time reference is past. Thus, the only deviating facet between these items is the component facet of sense of coherence, which, in this case, is not powerful enough to make a difference between these items.

The second research question concerned the stability of sense of coherence. Broadly speaking, the stability coefficients (0.66 - 0.72 for the total sense of coherence construct, 0.59 - 0.73 for the three components) revealed by the longitudinal factor analysis were found to be moderately high in the present samples of employees working in four organizations and technical designers (see Studies II and III). The stability coefficients were not, however, high enough to permit the conclusion that sense of coherence represents a stable disposition, as was also seen in the mean changes in the level of sense of coherence over time (see Study III).

Antonovsky's theory postulates that sense of coherence is more stable among people over 30 than among those under 30 years (see Antonovsky, 1987a,b, 1991, 1993; Antonovsky et al., 1990; Sagy et al., 1990). The present study, however, did not confirm this hypothesis (see Study III). In fact, age (i.e., subjects under 30 years vs. subjects 35-40 years at the baseline measurement) did not play any role in either the stability of or mean changes in technical designers' sense of coherence and in its three components over the 5-year follow-up period (1992-97). In addition, the second of Antonovsky's hypotheses did not gain support from the current study. The stability coefficients for sense of coherence and its three components were exactly the same in both the employment groups under

investigation. In other words, there was no more variation in sense of coherence among the designers who had faced unemployment and lay-offs during the 5-year follow-up than among those who had been in full-time employment throughout the follow-up.

One noticeable observation was, however, that those designers who had faced unemployment and/or lay-offs during the 5-year follow-up, had a weaker sense of coherence at both time points (1992 and 1997) than those who had been employed full-time throughout the follow-up (see Study III). Unfortunately, any explanations for this can remain only hypothetical as the data design employed throughout precludes the drawing of hard conclusions relative to the causal ordering of stability of sense of coherence and employment experiences. On the one hand, it can be supposed, in line with sense of coherence theory, that unemployment had weakened these subjects' sense of coherence. When an individual loses his or her job, the future predictions about life are made difficult, which in turn decreases an individual's sense of coherence (see Antonovsky, 1987a). On the other hand, it may be that the subjects with a weak sense of coherence had faced more frequent unemployment and lay-offs via the selection of ineffective or inflexible coping strategies than subjects with a strong sense of coherence. However, I am of the opinion that the latter explanation does not alone explain the level of differences in sense of coherence that were observed between the employment groups under investigation. The 5-year follow-up period of the study (1992-97) coincided with a deep economic recession of Finland, which bottomed out during the years 1992-95. The changes experienced in the various design fields during that time were so radical that I believe that a strong sense of coherence would not have spared subjects from unemployment when their work organizations were under redevelopment or went out of business.

A further interesting finding was that the measurement occasions were related to the level of the technical designers' sense of coherence (Study III). In both the age and employment groups investigated, sense of coherence was, on average, lower at the first time of measurement, in 1992, than at the second time of measurement, in 1997. One possible explanation for the positive changes in sense of coherence may be the upheaval in Finnish working life which occurred during the follow-up period. In 1992, unemployment and the threat of job loss became serious problems in Finland due to the deep recession in the national economy. At that critical juncture, future prospects for technical designers were very gloomy. For example, dismissals and layoffs increased rapidly in the design occupations (see Employment Outlook, 1996; Feldt & Ruoppila, 1993; The Statistics by the Employment Service of Ministry of Labour, 1998; Virokannas et al., 1997). This was also evident among the technical designers in this study. However, the situation had improved remarkably by 1997, the second time point, when an economic up-swing was underway and employment prospects among designers were better than they had been for years. Of course, many other explanations for the positive changes in sense of coherence could also be advanced. It is possible, especially given the relatively lengthy test-retest period, that the subjects had had one or more promotions and enjoyed higher salaries. This might explain their increased generalized resistance resources and consequent strengthening of sense of coherence.

It is notable that in Study II, which was performed among employees of different occupations in four organizations, no such increase in the mean level of sense of coherence was observed during a 1-year follow-up period (1995-96). These employees also faced various changes, such as a decrease in job insecurity (see Study IV; Mauno & Kinnunen, 1999; Mauno & Virolainen, 1996), but these were probably not powerful enough to induce mean changes in employees' sense of coherence within such a short period.

4.2 Roles of sense of coherence in the work characteristics - well-being relationship

The results obtained among 219 employees working in four organizations supported for the most part the proposed mediational model of sense of coherence (Study IV). First of all, the results highlighted the major significance of a good organizational climate in promoting sense of coherence and, consequently well-being. In addition, the results indicated that if the organizational climate improved during the year (1995-96), sense of coherence strengthened, which, in turn, was related to the lowered psychosomatic symptoms and emotional exhaustion. The changes in leadership relations showed the same direction although this mediational link was only partial. From a theoretical standpoint, it can be suspected that good social relations in the workplace served as generalized resistance resources for employees and thus sustained their sense of coherence. For example, social support at work is argued to be essential for an individual's sense of meaningfulness (Antonovsky, 1987b). Advice from colleagues and supervisors' enable an employee to manage his or her work tasks. In addition, comprehensibility at work is considerably strengthened when the organizational climate enables an employee to see the entire spectrum and his or her place in it and fosters confidence and feelings of security.

Also consistent with theoretical expectations, sense of coherence was found to mediate the job insecurity - well-being relationship in such a way that high insecurity was associated with low sense of coherence, which in turn, was related to high psychosomatic symptoms and emotional exhaustion at work. Thus, it is not only unemployment experiences that are destructive to an individual's sense of coherence but also uncertainty about one's job. In other words, job insecurity represents, using Antonovsky's (1979, 1987a) terminology, generalized resistance deficit for an individual.

One unexpected finding in the proposed mediational model emerged. Influence at work was the only one of the four investigated psychosocial work characteristics which was not related to sense of coherence at all but, on the contrary, was linked directly to well-being. This finding is in accordance with several occupational stress studies (e.g., Daniels & Guppy, 1994; Kalimo & Vuori, 1991; Karasek & Theorell, 1990; McKnight & Glass, 1995; Turnipseed, 1994) but somewhat surprising in the light of Antonovsky's (1987a,b) theory, which strongly stresses the importance of an individual's possibilities to have influence

over his or her work as a factor enhancing sense of coherence and consequently well-being. However, it is important to bear in mind that although sense of coherence did not mediate the relationship between influence at work and well-being, there were several indirect relationships due to the interrelated psychosocial work characteristics. For example, high influence at work correlated with good organizational climate and low job insecurity which were, in turn, associated with strong sense of coherence.

The tested mediational model of sense of coherence underlined the existence of a strong link between sense of coherence and both indicators of well-being in accordance with Antonovsky's theory and the large body of previous research (e.g., Antonovsky, 1987a; Baker et al., 1997; Gilbar, 1998; Kivimäki et al., 1998; Pålsson et al., 1996; Rasku et al., 1997; Tolonen, 1997; Virokannas et al., 1998). This finding was also confirmed in the last of the five studies (Study V) where sense of coherence emerged as the most powerful predictor of well-being among the technical designers: the stronger their sense of coherence, the less they reported psychosomatic symptoms and emotional exhaustion in their work. The main effect of sense of coherence explained a high proportion of the variance of the well-being indicators, 25.8 % of the psychosomatic symptoms and 14.5 % of emotional exhaustion.

In addition to this strong main effect of sense of coherence on well-being, I also found it to have a moderating effect on the relationships between psychosocial work characteristics and well-being at work. Undeniably, the detected moderator effects explained only a small proportion of the variance of the well-being indicators (0.7-1.5 %), but it has to be remembered that the detection of interaction in non-experimental field studies is difficult (see Champoux & Peters, 1987; Chaplin, 1991; Evans, 1985; McClelland & Judd, 1993). It has been argued, for example, that moderator effects are so difficult to identify that even those explaining only 1 % of the total variance should be considered important (Evans, 1985; McClelland & Judd, 1993). Contrary to Antonovsky's assertion (see Antonovsky, 1987a; Sagy & Antonovsky, 1990), the results indicated that a strong sense of coherence buffered the pathogenic effects of psychosocial work characteristics on well-being. For example, the stronger the designers' sense of coherence, the weaker was the connection between high pressure of time and problems of well-being. The same finding was also observed in the case of adverse factors in the working environment. The second notable finding was that good social relations at work were emphasized as factors enhancing well-being, especially among designers with a weak sense of coherence, whereas these relations mattered less in determining well-being outcomes among designers with a strong sense of coherence. Thus, supportive and encouraging social relations in the workplace seemed to compensate for weak personal coping resources. This is an important finding from the policy point of view.

The third and perhaps the most interesting moderator effect detected was that the strength of sense of coherence changed the direction of the relationship between work demands and emotional exhaustion at work. High work demands were found to have salutary effects on well-being when accompanied by a strong sense of coherence (decreased emotional exhaustion) and pathogenic effects when accompanied by a weak sense of coherence (increased exhaustion). This last

finding is in accordance with Antonovsky's (1979, 1987a) theory indicating that the effects of stressors on health outcomes may be salutary or pathogenic depending on how the tension is managed, i.e., the strength of sense of coherence.

4.3 Methodological evaluation

The major strengths of the present study rest in the multisample procedure used (five occupational samples of which four were independent), statistical methodology employed (Structural Equation Modeling) and, longitudinal data designs (1-year and 5-year follow-up studies). The use of a multisample procedure contributes to the generalization of the results. For example, the structure of the Orientation to Life Questionnaire was investigated by using all five samples and stability of sense of coherence by using two samples.

In the present study, for the first time, the structure of the 13-item Orientation to Life Questionnaire was investigated by using confirmatory factor analysis, a method that is highly recommended when analyzing scale structures that are based on a theory, classificatory item design or on a priori information derived from previous exploratory factor analytic studies. All these criteria were met in this study and confirmatory factor analysis proved to be a useful method in investigating the structure of the Orientation to Life Questionnaire (Studies I, II and III). Longitudinal factor analysis had a number of benefits in investigating stability of sense of coherence and its three components (Studies II and III). First, it produced the error-free stability coefficients for the latent constructs of sense of coherence. Second, it made it possible to test the invariance in the latent constructs of sense of coherence over time. As a result of this constraint, the findings concerning the structure of the scale gained additional reinforcement (the structure of the scale remained stable over time). Thirdly, by using mean structured longitudinal factor analysis models, it was possible to evaluate changes in the mean levels of the factors describing sense of coherence and its three components between the measurement occasions and, in addition, the mean differences of the factors between the groups. This third point raised the interesting possibility of studying the mean changes in the latent constructs of sense of coherence.

The present study also extended the sense of coherence literature by investigating for the first time the mediational model appropriate for explaining the effects of psychosocial work characteristics on well-being (psychosomatic symptoms, emotional exhaustion) via sense of coherence (Study IV). The major strength of this mediator study rests on its follow-up study setting and Structural Equation Modeling employed, which permitted the investigation of the relationships between the level of and changes in psychosocial work characteristics, sense of coherence and well-being indicators.

Before ending this discussion, the findings outlined here must be interpreted within the context of certain factors limiting the present results. I call attention to

these deficits so I may simultaneously suggest implications for future research. Regarding the structure of the 13-item Orientation to Life Questionnaire (Antonovsky, 1987a), I want to encourage caution in generalizing the results beyond the investigated occupational groups. Although the multisample procedure used here can be considered a major strength of this study, it does not guarantee however that the current findings would be directly valid for other populations. Because the investigated technical designers, teachers, managers and employees of four organizations represented solely Finnish people and primarily white-collar employees, replications with other samples, such as cross-cultural and blue-collar samples are needed to substantiate the generality of the results and the inferences reported here.

Obviously, the current results concerning the structure of the 13-item Orientation to Life Questionnaire cannot be generalized with regard to the longer, 29-item version of the scale. Therefore, an important task for future research is to investigate the same factor analysis models tested here by using the longer version of the Orientation to Life Questionnaire. The other properties of these two forms of the scale should also be compared. One thing that may limit, in my opinion, the comparability of these two forms of the scale is that there is seven items in the longer scale representing the future prediction of the stimulus but in the shorter scale there are none. Thus, the 13-item Orientation to Life Questionnaire measures the orientation to past and present life but not the future life.

A note of caution is also required before drawing any conclusive generalization from the current findings concerning the stability of and mean changes in sense of coherence. It is possible, for example, that the inability to detect an age effect on changes in the sense of coherence and its three components over time was explained by the choice of age cut-off point between the groups. If the younger group of technical designers had been, for example, 20-25 years of age at the first measurement time (1992), it is possible that the pattern of the results would have been different. Unfortunately, this was not possible in the present study, the youngest designers being age 25 in 1992. To gain a better understanding of the development and stability of sense of coherence future research could compare the stability of and mean changes in sense of coherence between groups differing more widely in age. Such an investigation would be important, especially given the fact that changes in individual's social networks may also play a role in relation to changes in sense of coherence (Antonovsky, 1987a).

One may also suspect whether the self-reported unemployment and lay-off experiences were reliable variables in investigating their relation to changes in sense of coherence. The critical question is how precisely the respondents remembered and reported their unemployment and lay-off periods on the postal questionnaire. By using the data based on the unemployment registers of the trade unions, this problem would have been avoided. However, I gave up the use of the unemployment registers because I wanted to guarantee the confidentiality and anonymity to the respondents.

It could only be hypothesized in this study that the strengthening in sense of coherence observed over the 5-year span among technical designers (1992-97)

was triggered primarily by the improvement in the Finnish economy, lowered job insecurity, higher salaries and possible promotions. In future studies, a more systematic investigation of such potential strengthening factors could yield important new insights into the nature and origin of changes in sense of coherence. One important starting point for such investigations would be to examine positive changes in the workplace as well as the other dimensions of unemployment such as duration and cause. The quality of family life is also assumed to be essential for an individual's sense of coherence (see Antonovsky, 1979, 1987a; McCubbin, Thompson, Thompson & Fromer, 1998). Therefore, it would be important to investigate in future studies to what extent changes in an individual's family life affect his or her sense of coherence.

The use of self-reported data can be considered a limitation of the present mediator and moderator studies (Studies IV and V). This might have the effect of artificially inflating relationships among the psychosocial work variables and sense of coherence and well-being indicators. In future extensions, a richer approach may utilise more objective psychosocial work variables in relation to sense of coherence. For instance, organizational change (e.g., plant re-location, or the introduction of new equipment or procedures) could provide a suitable basis for such studies, thereby providing for a stronger methodological approach than that allowed by self-report data on work environments. Naturally, for an approach to be genuinely experimental requires opportunities for study in organizational settings.

In assessing health and well-being outcomes, other indicators in addition to self-reported questionnaires are also needed. It is possible that more objective health indicators would yield different results in relation to sense of coherence. Although the large body of earlier research has showed a strong link between self-reported health measures and sense of coherence, it is notable that some previous studies that have used other types of health indicators have not confirmed this link. For example, sense of coherence has not been found to be connected to blood pressure (Fiorentino & Pomazal, 1998; Kalimo & Vuori, 1993). In addition, in the study by Kivimäki et al. (1997), sense of coherence did not predict sickness absences among male employees. Similarly, Poppius et al. (1999) found no connections between sense of coherence and coronary heart disease among blue-collar workers.

In the present mediator and moderator studies, the inability to detect causal inferences between the study variables can also be considered problematic because the tested models posited causal ordering between the psychosocial work characteristics, sense of coherence and well-being variables. For example, the possibility remains to be tested that an individual's health status affects sense of coherence. Following the reciprocity principle, the causality between sense of coherence and health could operate other way around. Health represents one of the sources that are responsible for the maintenance of the level of sense of coherence (Antonovsky, 1979, 1987a). Persistent serious health problems are assumed to shape a person's daily life in terms of the experiences of consistency, load-balance, and participation in socially-valued decision-making. These experiences, in turn, are thought to influence the development of sense of coherence. One approach to resolving causality between sense of coherence and

health is to apply a cross-lagged longitudinal design in which health and sense of coherence are measured at the baseline and again at the follow-up (see Kivimäki, Feldt, Vahtera & Nurmi, in press; Mauno & Kinnunen, 1999; Shingles, 1985; Zapf, Dormann & Frese, 1996). To my knowledge, there exists only one such study dealing with the causal ordering between sense of coherence and health (Kivimäki et al., in press). In this study, sense of coherence predicted health among women but not among men.

Finally, as to the generalizability of this research, I can only speculate as to the potential impact of those persons who chose not to respond to the surveys. The differences in the response rates of the samples may constitute a limitation to the internal validity of the study if the reasons for non-response are correlated with the dependent variables, a problem typical of survey research. To avoid this possibility, paying particular attention to response rates will be a feature of future research.

4.4 Conclusions and practical implications

Although the critical methodological comments discussed above call for further research, taken as a whole, the present findings extended the sense of coherence literature by providing new information about fundamental issues in the sense of coherence theory. I hope that the conclusions, summarized below, which I have drawn from the present findings will be of use to other researchers in their work in this field. I also put forward some recommendations in the hope that those who work with psychological welfare in the workplace could try them in practice.

The central methodological finding of this study was that sense of coherence is not a unitary phenomenon, at least as operationalized by the 13-item Orientation to Life Questionnaire. Therefore, with due respect, I do not agree with Antonovsky (1987a, 1993) that the scale is best used as a unidimensional measure. On the other hand, when constructing sense of coherence by the latent correlated three-factor or second-order factor variables, which I strongly encourage researchers to do, Antonovsky's theoretical arguments are not disputed. In fact, these models are theoretically advantageous because they specify the three components of sense of coherence while all three are simultaneously present in the model. Thus, Antonovsky's (1987a, 1993) view that all three components of sense of coherence, i.e., meaningfulness, comprehensibility and manageability, are needed in successful coping, is taken in earnest. Great caution must be exercised however in the case of two items in the 13-item Orientation to Life Questionnaire, i.e., comprehensibility item 5 and manageability item 6. If these items also reveal a strong error covariance in other studies, I suggest that they should be excluded from the subsequent scale measure.

While confirmatory factor analysis was very suitable for use in constructing sense of coherence, longitudinal factor analysis, in turn, proved to be an efficient way of analyzing the stability of and mean changes in sense of coherence. On the

basis of the findings arising out of this method, I feel confident in arguing that sense of coherence is also flexible in adulthood. In fact, I did not find any connections between changes in sense of coherence and individuals' age - a finding that calls in question Antonovsky's hypothesis that sense of coherence is more stable after young adulthood (after age 30) (see Antonovsky, 1987a,b, 1991, 1993; Antonovsky et al., 1990; Sagy et al., 1990). Personally, I was very delighted with this result because it showed that there is always "hope" in adult life; sense of coherence is not rigidly fixed and may in fact strengthen along with appropriate environmental factors. This fact must also be considered in work organizations, as is discussed next.

From a practical point of view, the present findings performed in the work context highlighted the fact that well-being in the workplace can be enhanced if there is an adequate understanding of the ways in which psychosocial work characteristics shape employees' sense of coherence, and thus their well-being at work. Those who are responsible for employees' psychological welfare in the workplaces (e.g., different levels of management, health and safety officers) should pay particular attention to ensuring good organizational climate, which, as the present results demonstrate, enhances employees' sense of coherence and, consequently, well-being. Those who have subordinates should remember that their style of leadership may shape their employees' sense of coherence and well-being at work. In particular, employees need social support, encouragement and advice at work as well as constructive feedback on their achievements.

Every effort should be made in the workplace to remove job insecurity, which I found to weaken sense of coherence and, consequently, well-being. People have to know what is going on in their organization. For example, when an organization is going through major changes, giving out information early and maintaining open lines of communication are key factors in reducing employees' uncertainty about their jobs. I also consider it important that leadership and managers pay particular attention to supporting the coping resources of employees who may recently have faced unemployment and lay-offs. Their sense of coherence (and thus their ability to cope with stressors at work) should be sustained by every possible means. For example, proper training and thorough initiation into job will help an employee to experience his or her work as meaningful, comprehensible and manageable.

Finally, I recommend that management and job designers take into consideration employees' own aspirations and their capacity to perform the tasks required of them. As the present study showed, high work demands can cause stress to employees with a weak sense of coherence while they may serve as promoters of well-being among employees with a strong sense of coherence.

YHTEENVETO

Koherenssin rakenne, pysyvyys ja terveyttä edistävä merkitys työelämässä

Väitöstutkimukseni taustateorianani oli Aaron Antonovskyn (1979, 1987a) salutogeeninen eli terveyttä ja stressinkäsittelyn voimavaroja korostava malli. Teorian keskeinen käsite on koherenssi, josta on käytetty myös suomenkielisiä nimityksiä elämänhallinta (Kalimo, 1988) ja elämänhallintakyky (Bäckman & Söderqvist, 1990). Koherenssi on yksilön kokonaisvaltainen, pysyvä, vaikkakin dynaaminen varmuuden tunne siitä, että sekä sisäinen ja ulkoinen ympäristö ovat ennustettavissa ja että asioiden sujuminen niin hyvin kuin voidaan järkevästi olettaa, on todennäköistä. Vahvan koherenssin omaavalla yksilöllä on taipumus tehdä sekä ympäristöstään että itsestään havaintoja ja tulkintoja joihin liittyy ymmärrettävyyden, hallittavuuden ja mielekkyyden tunteita. Teorian mukaan vahvan koherenssin omaavat ihmiset selviytyvät hyvin väistämättömistä stressitekijöistä, jonka vuoksi he pystyvät muita paremmin ylläpitämään ja parantamaan asemaansa terveys-sairaus jatkumolla (Antonovsky, 1979, 1987a).

Tutkimuksellani oli neljä pääasiallista tavoitetta. Ensimmäisenä tavoitteenani oli tutkia, onko 13-osioinen koherenssimittari (engl. The Orientation to Life Questionnaire; Antonovsky, 1987a) yksidimensioiden mittari, jollaisena Antonovsky (1987a, 1993) suosittelee sitä käytettävän, vai koherenssikäsitteen määrittelyn mukainen kolmidimensioiden mittari, joka sisältää kolme toisiinsa yhteydessä olevaa ymmärrettävyyden, hallittavuuden ja mielekkyyden osa-aluetta (tutkimukset I, II ja III).

Toisena tavoitteenani oli tutkia koherenssin pysyvyyttä sekä sitä, kuinka yksilön ikä sekä työttömyys- ja lomautuskokemukset ovat yhteydessä koherenssin muutoksiin (tutkimukset II ja III). Teorian mukaan koherenssi on pysyvämpää yli 30 vuotiailla kuin tätä nuoremmilla ihmisillä (Antonovsky, 1979, 1987a). Antonovsky (1987a,b) oletti myös työttömyyskokemusten heikentävän yksilön koherenssia ja näin ollen koherenssi olisi pysyvämpää täystyöllisillä kuin työttömyyttä kokeneilla ihmisillä.

Kolmas tutkimuskohteeni olisi selvittää, toimiiko koherenssimediaattorina eli välittäjänä psyykkissosiaalisten työn piirteiden ja hyvinvoinnin välisissä yhteyksissä (tutkimus IV). Oletuksena oli, että psyykkissosiaalisten työn piirteiden yhteydet hyvinvointiin kulkisivat koherenssin kautta. Antonovskyn (1979, 1987a,b, 1991) teoriasta löytyy perusteita mediaattori-hypoteesille, sillä hyvien työn piirteiden (kokemusten yhdenmukaisuus, optimaalinen kuormitus ja mahdollisuudet osallistua päätöksentekoon) oletetaan vahvistavan koherenssia, koska ne palvelevat yksilöä yleisinä kestokyvyn voimavaroina. Vahva koherenssi puolestaan ylläpitää yksilön terveyttä ja hyvinvointia työssä. Toisaalta epäedullisten työn piirteiden (yleisten kestokyvyn voimavarojen puute) oletetaan heikentävän koherenssia ja sitä kautta myös yksilön terveyttä ja hyvinvointia työssä.

Neljäntenä tavoitteenani oli tutkia koherenssin mahdollista moderoivaa eli muuntavaa vaikutusta psyykkissosiaalisten työn piirteiden ja hyvinvoinnin väli-

sissä yhteyksissä (tutkimus V). Koherenssin muuntavalle vaikutukselle ei löydy teoreettista tukea siinä mielessä, että Antonovsky (ks. Antonovsky, 1987a; Sagy & Antonovsky, 1990) ei pitänyt koherenssia puskuroivana tekijänä stressitekijöiden haitallisia terveysvaikutuksia vastaan. Puskurivaikutuksen sijasta hän korosti koherenssin suoraa vaikutusta terveyteen ja hyvinvointiin. Toisaalta koherenssilla voidaan olettaa olevan myös muuntavaa vaikutusta työn piirteiden ja hyvinvoinnin välisissä yhteyksissä, sillä Antonovskyn (1979, 1987a) mukaan stressitekijöillä voi olla patogeeniset (terveyttä heikentävät), neutraalit tai salutogeeniset (terveyttä edistävät) terveysvaikutukset riippuen yksilön koherenssin voimakkuudesta. Vahvan koherenssin omaavilla ihmisillä salutogeeniset terveysvaikutukset ovat todennäköisempiä kuin heikon koherenssin omaavilla ihmisillä. Heikko koherenssi sen sijaan altistaa stressitekijöiden patogeenisille terveysvaikutuksille.

Tutkimusongelmiini hain vastauksia käyttämällä viittä eri tutkimusaineistoa. Aineistot koostuivat kyselylomakkeisiin vastanneista suomalaisista eri ammattialojen edustajista, joita olivat 1) tekniset suunnittelijat (N = 989), 2) kaksi ikäryhmää teknisiä suunnittelijoita (N = 352), 3) opettajat (N = 1012), 4) esimiehet (N = 1035) ja 5) neljän eri organisaation työntekijät (N = 219). Aineistot 1, 3 ja 4 olivat poikkileikkausaineistoja, aineisto 2 oli viiden vuoden seuruuaineisto ja aineisto 5 oli vuoden seuruuaineisto.

Ensimmäistä tutkimusongelmaa, 13-osioiden koherenssimittarin rakennetta, selvitin konfirmatoristen faktorianalyysien avulla käyttäen LISREL-ohjelmaa. Hypoteesia mittarin yksidimensioisuudesta testasin muodostamalla yhden faktorin mallin, jossa kaikki mittarin 13 osiota asetettiin yhdelle faktorille. Koherenssiteoriaan perustuvaa oletusta koherenssin kolmesta toisiinsa yhteydessä olevasta komponentista (mielekkyyys, ymmärrettävyys, hallittavuus) testasin kahdella tilastollisesti ekvivalentilla faktorianalyysimallilla; kolmen faktorin ja toisen kertaluvun faktorin mallilla. Kolmen faktorin mallissa mielekkyyttä, ymmärrettävyyttä ja hallittavuutta kuvaavat osiot asetettiin omille faktoreilleen ja faktoreiden annettiin korreloida. Myös toisen kertaluvun mallissa mittarin osiot asetettiin omille faktoreilleen, mutta faktoreiden väliset korkeat korrelaatiot selitettiin toisen kertaluvun faktorilla. Näin ollen mallin rakenne kuvaa yhtä globaalia odotettua faktoria (koherenssi), joka koostuu kolmesta toisiinsa yhteydessä olevasta ensimmäisen kertaluvun faktorista (mielekkyyys, ymmärrettävyys, hallittavuus). Analyysit tehtiin käyttämällä sekä poikkileikkausaineistoja (aineistot 1, 3 ja 4 tutkimuksessa I) että seuruuaineistoja (aineisto 5 tutkimuksessa II, aineisto 2 tutkimuksessa III).

Tulokset osoittivat, että yhden faktorin malli ei ollut riittävä kuvaamaan 13-osioiden koherenssimittarin rakennetta, sillä malli tuotti useita virhetermien välisiä kovariansseja mittarin osioille. Kolmen faktorin ja toisen kertaluvun faktorin mallit olivat tässä suhteessa parempia, sillä niissä ilmeni ainoastaan yksi virhetermien välinen kovarianssi. Myös mallien tilastollisissa yhteensopivuustarkasteluissa käytetyt indeksit puolsivat enemmän kolmen faktorin ja toisen kertaluvun faktorin malleja kuin yhden faktorin mallia. Ongelmaksi kolmen faktorin mallissa jäi ymmärrettävyyttä ja hallittavuutta kuvaavien faktoreiden korkea keskinäinen korrelaatio (yli .90), minkä vuoksi niiden voidaan katsoa mittaavan hyvin pitkälle samaa asiaa. Kolmen faktorin ja toisen kertaluvun faktorin malleissa näyttäisi olevan myös yksi spesifi faktori (korkea virhetermien välinen kovarianssi yhden hallitta-

vuotta ja yhden ymmärrettävyyttä mittaavan osion välillä). Tämä spesifi faktori kuvaa luottamusta/epäluottamusta muihin ihmisiin.

Koherenssin pysyvyyttä tutkin LISREL-ohjelmalla tehtyjen pitkittäisfaktorimallien avulla. Aineistoina käytin vuoden (tutkimus II) ja viiden vuoden (tutkimus III) seuruuaineistoja. Pitkittäisfaktorimalleissa edellä kuvatut kolmen faktorin ja toisen kertaluvun faktorin mallit estimoitiin erikseen molemmille mittausajankohdille, jonka jälkeen ne yhdistettiin pitkittäisfaktorimalliksi faktoreiden rakenneyhtälöiden avulla. Koherenssin ja sen kolmen osa-alueen (ymmärrettävyys, hallittavuus, mielekkyys) pysyvyyttä arvioin faktorien välisten korrelaatioiden avulla. Koherenssin tasomuutoksia arvioin niinikään pitkittäisfaktorimallien avulla. Tulokset osoittivat koherenssille kohtuullista pysyvyyttä; vuoden seuruuaineistossa pysyvyysskerroin oli 0.72 ja viiden vuoden seuruuaineistossa hieman alhaisempi, 0.66-0.67. Koherenssin kolmen osa-alueen pysyvyys oli myös kohtuullinen (pysyvyysskerroimet 0.59-0.73), joskaan pysyvintä komponenttia ei voida tämän tutkimuksen perusteella osoittaa, sillä ne vaihtelivat kahdessa tutkimuksessa.

Viiden vuoden seuruuaineistoon perustuvat tulokset (tutkimus III) eivät antaneet tukea Antonovskyn (1979, 1987a) oletukselle, että koherenssi olisi pysyvämpää yli 30-vuotiailla kuin tätä nuoremmilla ihmisillä. Koherenssin pysyvyydessä ei ollut eroja myöskään työttömyyttä kokeneiden ja täystyöllisten suunnittelijoiden välillä, joten tältäkin osin Antonovskyn teoria jäi vaille vahvistusta. Huomattava tulos kuitenkin oli, että työttömyyskokemuksia omaavilla suunnittelijoilla oli alhaisempi koherenssin taso molempina mittausajankohtina (1992 ja 1997) verrattuna niihin suunnittelijoihin, jotka olivat saaneet pitää työpaikkansa koko seurantajakson ajan. Mielenkiintoinen havainto oli myös koherenssin keskimääräisen tason nousu vuodesta 1992 vuoteen 1997 molemmissa ikä- ja työllisyysryhmissä. Tätä tulosta selittänee osaltaan taloudellisen laman hellittäminen Suomessa seurantajakson aikana, minkä myötä työttömyysaste sekä työn epävarmuus ovat selvästi vähentyneet tutkittujen suunnittelijoiden edustamilla aloilla.

Koherenssin välittävää roolia psyykkissosiaalisten työn piirteiden (vaikutusmahdollisuudet, työn epävarmuus, organisaatioilmaston laatu, esimiessuhteiden laatu) ja hyvinvointi-indikaattoreiden (psykosomaattiset oireet, emotionaalinen uupumus) välisissä yhteyksissä tutkin rakenneyhtälömallin avulla LISREL-ohjelmalla (tutkimus IV). Mallissa otettiin huomioon muuttujien kahden mittauskerran taso ja muuttujissa tapahtunut muutos vuoden seuranta-ajalla. Tutkimukseen osallistui 219 työntekijää, jotka työskentelivät neljässä organisaatiossa. Tulokset osoittivat, että koherenssi välitti organisaatioilmaston ja molempien hyvinvointi-indikaattorien välisiä yhteyksiä: hyvä organisaatioilmasto oli yhteydessä vahvaan koherenssiin, joka edelleen oli yhteydessä vähäisiin psykosomaattisiin oireisiin ja alhaiseen emotionaaliseen uupumukseen. Lisäksi organisaatioilmastossa tapahtuvat muutokset olivat yhteydessä hyvinvoinninmuutoksiin koherenssin muutosten kautta. Toisin sanoen organisaatioilmaston parantuessa työntekijöiden koherenssi voimistui, mikä oli edelleen yhteydessä psykosomaattisten oireiden ja emotionaalisen uupumuksen vähenemiseen. Koherenssi välitti myös työn epävarmuuden ja molempien hyvinvointi-indikaattoreiden välisiä yhteyksiä; suuri työn epävarmuus oli yhteydessä heikkoon koherenssiin, joka oli edelleen yhteydessä psykosomaattisiin oireisiin ja emotionaaliseen uupumukseen työssä. Sen sijaan työn

epävarmuudessa tapahtuneet muutokset eivät olleet yhteydessä koherenssin muutoksiin, joten koherenssi ei välittänyt epävarmuuden ja hyvinvoinnin muutosten välistä yhteyttä.

Koherenssin muuntavaa vaikutusta työolotekijöiden ja hyvinvoinnin välisiin yhteyksiin tutkin hierarkkisen regressioanalyysin avulla, jossa iän, koulutuksen, sukupuolen sekä koherenssin ja työolotekijöiden omavaikutukset kontrolloitiin hyvinvointia kuvaavista muuttujista ennen koherenssin moderaattorivaikutusta (tutkimus V). Tutkimus perustui miesvaltaiseensuunnittelijoita koskevaan poikkeileikkausaineistoon. Työolotekijöitä kuvaavia muuttujia olivat organisaatioilmasto, esimiessuhteet, vaikutusmahdollisuudet, työn sisällöllinen vaativuus, aikapaineet, urapalkkiot ja fyysisen työympäristön laatu. Hyvinvointia kuvattiin psykosomaattisilla oireilla ja emotionaalisella uupumuksella. Tulokset osoittivat, että koherenssilla oli voimakas omavaikutus hyvinvoinnin indikaattoreihin: mitä voimakkaampi oli suunnittelijoiden koherenssi, sitä vähemmän heillä oli psykosomaattisia oireita (selitysaste 25.8 %) ja emotionaalista uupumusta (selitysaste 14.5 %). Koherenssilla oli myös muuntava vaikutus työolotekijöiden ja hyvinvointi-indikaattoreiden välisissä yhteyksissä. Nämähavainnot voidaan tiivistää kolmeksi vaikutusmalliksi. *Ensinnäkin*, vahvan koherenssin omaavilla suunnittelijoilla haitallisten työolotekijöiden (aikapaineet, fyysisen työympäristön haittatekijät) yhteys psykosomaattisiin oireisiin ja työuupumukseen oli heikempi kuin heikon koherenssin omaavilla suunnittelijoilla. Koherenssi siis puskuroi stressitekijöiden haitallisia terveysvaikutuksia, mikä on vastoin Antonovskyn näkemystä (ks. Antonovsky, 1987a, Sagy & Antonovsky, 1990). *Toiseksi*, heikon koherenssin omaavilla suunnittelijoilla työpaikan hyvät sosiaaliset suhteet korostuivat hyvinvointia lisäävinä tekijöinä, kun taas vahvan koherenssin omaavilla sosiaalisten suhteiden yhteys hyvinvointiin oli heikempi. *Kolmanneksi*, koherenssin voimistuessa eräiden työolotekijöiden ja hyvinvointi-indikaattoreiden välisten yhteyksien suunta muuttui. Esimerkiksi heikon koherenssin omaavilla työn sisällöllinen vaativuus oli stressitekijä, sillä heillä suuret vaatimukset olivat yhteydessä korkeaan työuupumukseen. Vastaavasti vahvan koherenssin omaavilla työn sisällöllinen vaativuus oli sitä vastoin voimavaratekijä työn vaativuuden ollessa yhteydessä vähäiseen työuupumukseen. Tämähavaintoantaatukea Antonovskyn (1979, 1987a) teorialle, jonka mukaan stressitekijöiden patogeeniset ja salutogeeniset terveysvaikutukset riippuvat koherenssin voimakkuudesta.

Metodologinen johtopäätökseni on, että 13-osiainen koherenssimittari (Antonovsky, 1987a) ei ole yksidimensioinen mittari. Tämän vuoksi suosittelen, että tutkijat käyttäisivät mittaria latenttina muuttujana, jossa on huomioitu osioluokittelu mielekkyyden, ymmärrettävyyden ja hallittavuuden käsitteiden mukaisesti. Näiden osioiden perusteella muodostetut kaksi tilastollisesti ekvivalenttia konfirmatorista faktorianalyysimallia, eli kolmen faktorin ja toisen kertaluvun faktorin mallit, ovat tilastollisesti yhteensopivia eivätkä ne riitele myöskään koherenssiteorian käsitteenmäärittelyn kanssa. Varovaisuutta tulee kuitenkin noudattaa mittarin kahden osion suhteen (osiot 5 ja 6), sillä ne näyttävät muodostavan keskenään mittarissa oman spesifi-faktorin. Mikäli kyseisten osioiden virhetermit korreloivat voimakkaasti myös muissa aineistoissa, suosittelennäiden osioiden poisjättämistä koherenssia kuvaavasta mittarista.

Pitkittäistutkimuksissani havaitsin koherenssin muovautuvan myös aikuisiällä, yli 30-vuotiaana. Tämä havainto on syytä huomioida psyykkisessä työsuojelussa työpaikoilla. Työntekijöiden koherenssia voidaan tukea kiinnittämällä huomiotaorganisaatioilmaston hyvään laatuun ja työn epävarmuuden vähentämiseen. Lisäksi työttömyys- ja lomautusjaksojen jälkeen työelämään palaavien työntekijöiden voimavarojen palauttamiseen pitää panostaa voimakkaasti, jotta heidän koherenssiaan ja hyvinvointiaan työssä voitaisiin ylläpitää ja parantaa. Lisäksi suosittelen, että työpaikoilla otettaisiin huomioon työntekijöiden yksilölliset toiveet, tavoitteet ja kyvyt toimenkuvia ja työtehtäviä suunniteltaessa. Se mikä sopii yhdelle, ei sovi toiselle. Esimerkiksi heikon koherenssin omaavalle vaativat työtehtävät voivat aiheuttaa stressiä, kun taas vahvan koherenssin omaavalle työn vaativuus voi olla hyvinvointia lisäävä voimavaratekijä.

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Appendix 1. The 13-item Orientation to Life Questionnaire. (Note: The items are numbered according to their item numbers as presented in Antonovsky's (1987a) 29-item version of the Orientation to Life Questionnaire. ME=meaningfulness item, CO=comprehensibility item, MA=manageability item).

Here is a series of questions relating to various aspects of our lives. Each question has seven possible answers. Please mark the number which expresses your answer, with numbers 1 and 7 being the extreme answers. If the words under 1 are right for you, circle 1; if the words under 7 are right for you, circle 7. If you feel differently, circle the number which best expresses your feeling. Please give only one answer to each question.

- 4ME: Do you have the feeling that you don't really care about what goes on around you?
(1=very seldom or never, ... 7=very often)
- 5CO: Has it happened in the past that you were surprised by the behaviour of people whom you thought you knew well?
(1=never happened, ... 7=always happened)
- 6MA: Has it happened that people whom you counted on disappointed you?
(1=never happened, ... 7=always happened)
- 8ME: Until now your life has had:
(1=no clear goals or purpose at all, ... 7=very clear goals and purpose)
- 9MA: Do you have the feeling that you're being treated unfairly?
(1=very often, ... 7=very seldom or never)
- 12CO: Do you have the feeling that you are in an unfamiliar situation and don't know what to do?
(1=very often, ... 7=very seldom or never)
- 16ME: Doing the things you do every day is:
(1=a source of deep pleasure and satisfaction, ... 7=a source of pain and boredom)
- 19CO: Do you have very mixed-up feelings and ideas?
(1=very often, ... 7=very seldom or never)
- 21CO: Does it happen that you have feelings inside you would rather not feel?
(1=very often, ... 7=very seldom or never)
- 25MA: Many people - even those with a strong character - sometimes feel like sad sacks (losers) in certain situations. How often have you felt this way in the past?
(1=never, ... 7=very often)
- 26CO: When something happened, have you generally found that:
(1=you overestimated or underestimated its importance, ... 7=you saw things in the right proportion)
- 28ME: How often do you have the feeling that there's little meaning in the things you do in your daily life?
(1=very often, ... 7=very seldom or never)
- 29MA: How often do you have feelings that you're not sure you can keep under control?
(1=very often, ... 7=very seldom or never)

I
**The structure of Antonovsky's Orientation to Life
Questionnaire**

by

Taru Feldt and Anne Rasku

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The structure of Antonovsky's Orientation to Life Questionnaire

Taru Feldt*, Anne Rasku

Department of Psychology, University of Jyväskylä, P.O. Box 35, FIN-40351 Jyväskylä, Finland

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Abstract

The present study investigated the structure of Antonovsky's (1987) short-form (13-item) Orientation to Life Questionnaire (OLQ). The OLQ was developed to measure sense of coherence, which consists of three interrelated components: meaningfulness, comprehensibility and manageability. Confirmatory factor analyses were carried out using data on three occupational groups (technical designers $n = 989$, teachers $n = 1012$, managers $n = 1035$). The factor analysis models were specified and compared in the study: (1) a first-order one-factor model; (2) a first-order correlated-three-factor model; and (3) a second-order model with three first-order factors. The results suggested that the first-order correlated-three-factor structure and the second-order structure fitted the data better than the one-factor structure. The second-order model in particular proved to be theoretically advantageous. It indicated that the short-form OLQ could be conceptualized as a single general expectancy factor, sense of coherence, consisting of three interrelated first-order factors, i.e. meaningfulness, comprehensibility and manageability. © 1998 Elsevier Science Ltd. All rights reserved.

Key words: Sense of coherence; Comprehensibility; Manageability; Meaningfulness; Orientation to Life Questionnaire; Confirmatory factor analysis

1. Introduction

Since Aaron Antonovsky (1979) presented his sense of coherence construct, which expresses an individual's global orientation to life, his theory has been widely adopted in health and well-being research. The Orientation to Life Questionnaire (OLQ), developed to measure sense of coherence, has been translated into at least 14 languages (see Antonovsky, 1993). The scale exists in two forms, the original 29-item scale, and the shortened, 13-item version (Antonovsky, 1987), both of

*Corresponding author. Tel.: +358-14-601211; Fax: +358-14-602841; E-mail: tafe@psyka.jyu.fi

which have been found to be highly reliable measures (see Antonovsky, 1993). The criterion validity of the OLQ has also received support, the score of the scale showing a high correlation with the scores of other constructs of generalized perception of self and environment, such as locus of control and hardiness (e.g. Korotkov and Hannah, 1994; Kravetz, Drory and Florian, 1993; Williams, 1990), perceived resources and stressors (e.g. Kalimo and Vuori, 1991; McSherry and Holm, 1994; Ryland and Greenfeld, 1991), health and well-being (e.g. Coward, 1996; Feldt, 1997; Langius and Björvel, 1993) and health behaviors (e.g. Gallagher, Wagenfeld, Baro and Haepers, 1994; Lajunen and Summala, 1995; Vuori, 1994).

However, the structural properties of the OLQ, and especially of the shorter version, have received only minor attention. This is a research area that Antonovsky (1987, 1993) himself has mentioned as in need of further investigation. The aim of the present paper is to investigate the structure of the short-form OLQ using data on three occupational groups: technical designers, teachers and managers.

1.1. Sense of coherence and its three interrelated components

According to Antonovsky (1979, 1987), an individual's sense of coherence predicts and explains his or her movement along the health-disease continuum. Formally, sense of coherence is defined as "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; (2) the resources are available to one to meet the demands posed by these stimuli; and (3) these demands are challenges, worthy of investment and engagement" (Antonovsky, 1987, p. 19). The first of these interrelated aspects of sense of coherence is termed comprehensibility (the cognitive component), the second manageability (the instrumental component) and the third meaningfulness (the motivational component).

Antonovsky (1987) has argued that these three components of sense of coherence are dynamically interrelated. Individuals who score highly on comprehensibility, manageability and meaningfulness view the world as highly coherent, and on the contrary, those who score low on all components view it as incoherent. Sense of meaningfulness is the most central component of sense of coherence because of its motivational element. It can be seen, for example, in cases where a person is high on both the comprehensibility and manageability components (he or she knows the rules of the game and believes that the requisite resources are at his/her disposal to deploy successfully) but if his or her sense of meaningfulness is weak, understanding tends to lose ground and the command of resources is lost.

1.2. Theoretically based structure of the OLQ

Antonovsky (1987) designed the OLQ to be a culture-free instrument for measuring sense of coherence (see also Bowman, 1996; 1997). He developed the scale after extensive interviews with individuals who were known to have undergone severe trauma with inescapable major consequences for their lives, and yet were perceived to be functioning remarkably well. In forming the scale, which was based on Gutmann's facet approach, Antonovsky drew up a response profile

from words and phrases used by respondents who were judged to have either a strong or weak sense of coherence.

In the final phase of developing the scale, Antonovsky made a theoretically guided choice to have each item include one of the three components of sense of coherence (comprehensibility, manageability or meaningfulness). In addition, he designed the items to include the four other facets of stimulus, which were the modality of the stimulus (instrumental, cognitive or affective), its source (internal, external or both), the nature of the demand it posed (concrete, diffuse or abstract) and its time reference (past, present or future). Thus, each item in the OLQ is in the first place specified as comprehensibility, manageability or meaningfulness, but also shares elements with the other four facets of sense of coherence (modality, source, demand, time).

The OLQ (Antonovsky, 1987) exists in two forms. The longer version consists of 29 items for each of which respondents are asked to select a response on a seven-point semantic differential scale with two anchoring phrases. It is made up of eight meaningfulness, eleven comprehensibility, and ten manageability items. The abridged 13-item scale contains four meaningfulness, five comprehensibility, and four manageability items (Antonovsky, 1987). Antonovsky (1987, 1993) has stressed that the three components should not be measured as distinct constructs because the scale was developed to measure a global orientation, sense of coherence, consisting of three interrelated components of meaningfulness, comprehensibility and manageability. The high intercorrelations between the three components have also been found in several previous studies (e.g. Bishop, 1993; Flannery and Flannery, 1990; Hart, Hittner and Paras, 1991; Kravetz, et al., 1993; Pasikowski, Sek and Scigala, 1994; Petrie and Brook, 1992).

1.3. Previous exploratory factor analyses

Only a few factor analytic studies using the OLQ have been reported to date. However, all of them have relied solely on exploratory techniques. The majority of these factor analyses has yielded a one-factor solution for the 29-item OLQ. For example, Antonovsky (1993) has referred to three unpublished studies all of which have shown the OLQ to be a unidimensional instrument for measuring sense of coherence. The one-factor solution is also found in three published studies (based on principal component analysis with varimax rotation), which have been employed in a sample of 828 patients with rheumatoid arthritis (Callahan and Pincus, 1995), 374 patients and non patients (Frenz, Carey and Jorgensen, 1993), and 95 evening college students (Flannery and Flannery, 1990). Moreover, Hawley, Wolfe and Cathey (1992), on the basis of the factor analysis they performed in a sample of 1333 patients with rheumatic disorders, concluded that the OLQ is best used as unidimensional. Although they found some trends toward heavier loadings of meaningfulness and manageability items on the first factor, and comprehensibility items loading on the third factor, there was considerable overlap, and several items had a factor loading of at least 0.4 on more than one factor.

1.4. Present study

According to Antonovsky (1987), the OLQ is an instrument measuring a single global construct, i.e. sense of coherence, which consists of three interrelated subconstructs: meaningfulness, comprehensibility and manageability. This interrelated three-component structure of the OLQ has not

been tested to our knowledge by confirmatory techniques, but previous exploratory factor analytic studies have shown the scale to have a single factor structure. The major aim of the present study is to clarify whether the one-factor structure or the theoretically based intercorrelated three-component structure is a more appropriate way to characterize the short-form (13-item) OLQ. The present approach relies on confirmatory factor analysis because the hypothesized models are based on a priori information about the data structure both in the form of knowledge derived from previous exploratory factor analyses and in the form of Antonovsky's (1987) theory.

Altogether three factor analysis models are specified and compared in this study. First, a *first-order one-factor model* is performed to test whether the one-factor model is sufficient to describe the structure of the short-form OLQ as might be expected on the basis of the previous exploratory factor analytic work (see Antonovsky, 1993; Callahan and Pincus, 1995; Flannery and Flannery, 1990; Frenz et al., 1993). Second, a factor analysis is carried out on a *first-order correlated-three-factor model* designed to characterize the interrelated three-component structure of sense of coherence on the basis of Antonovsky's (1987) theoretical considerations and his classificatory design for the OLQ items. Finally, a *second-order model with three first-order factors* is specified. Conceptually, the common variance attributable to the second-order latent variable is believed to represent a generalized, expectancy factor (sense of coherence) whose influence is shared among the three first-order expectancy factors (meaningfulness, comprehensibility and manageability).

2. Method

2.1. Subjects and procedure

The material for this study was obtained from three projects currently in progress at the University of Jyväskylä concerning the work-related well-being of technical designers (Feldt, 1997), aging teachers (Kinnunen, Parkatti and Rasku, 1994), and managers (Rasku, Feldt and Ruoppila, 1997).

2.1.1. Technical designers (n = 989)

The sample of technical designers was drawn from the members of two Finnish trade unions: the Union of Technical Employees and the Union of Professional Engineers in Finland. The data were collected by postal questionnaires which were sent to the subjects' home addresses in spring 1992. The respondents' mean age was 39.4 years (range 25–64) and 94% (n = 931) of them were male. All the subjects were in full-time employment, came from different parts of Finland and represented different fields of design, such as product and machine, automation, process and building. 50% of these designers were engineers and 50% technical employees.

2.1.2. Teachers (n = 1012)

A sample of teachers for the postal questionnaire sent to the subjects' home addresses was drawn from the members of the Teachers' Union according to two age criteria (45–49 and 55–59 years) in autumn 1991. 58% (n = 586) of the respondents were female. Fifty-eight percent of the teachers were 45–49 years old and 43% 55–59 years old. Their teaching domains were as follows: 24% were specialist subject teachers in grades 7–12, 22% general class teachers in grades 1–6, 22% vocational

subject teachers, 21% physical education teachers in grades 7–12 and 11% special class teachers in grades 1–9.

2.1.3. Managers (n = 1035)

The sample of managers was also drawn from the Union of Technical Employees and the Union of Professional Engineers in Finland. The questionnaires were sent to the subjects' home addresses in spring 1996. The respondents were from different parts of Finland and their mean age was 44 years (range 20–65). The great majority of them were men (92%, $n = 951$). Fifty-two percent of all the respondents were engineers and 48% other technical employees. They were all employed in management positions (ranging from shop floor supervisors to senior managers) in different fields of industry, most commonly the metal, paper and forestry industries.

The comparison of gender between the three occupational groups showed that females were dominant among the teachers whereas males were dominant among the managers and technical designers ($\chi^2(2) = 973.4$, $P < 0.001$). In addition, the nonparametric Kruskal-Wallis test showed that the teachers were on average older than technical designers and managers ($\chi^2(2) = 1241.03$, $P < 0.001$).

2.2. Measurement

In addition to questions collected for other research purposes, the technical designers, teachers and managers completed the 13-item OLQ consisting of items 4, 5, 6, 8, 9, 12, 16, 19, 21, 25, 26, 28, 29 from the 29-item scale (Antonovsky, 1987). Antonovsky has labelled items 4, 8, 16 and 28 as measuring meaningfulness (e.g. 4. "Do you have the feeling that you don't really care about what goes on around you?"), 5, 12, 19, 21 and 26 as measuring comprehensibility (e.g. 19. "Do you have very mixed-up feelings and ideas?") and 6, 9, 25 and 29 as measuring manageability (e.g. 29. "How often do you have feelings that you are not sure you can keep under control?"). The respondents were asked to select a response on a seven-point semantic differential scale with two anchoring phrases (e.g. 1 = very often–7 = very seldom or never), yielding a total score ranging from 13 to 91. Five of these items were reverse scored so that a high score of the total scale indicated a strong sense of coherence.

3. Results

3.1. Confirmatory factor analysis

The factor analysis models specified and compared were (1) a *first-order one-factor model*; (2) a *first-order correlated-three factor model*; and (3) a *second-order model with three first-order factors*. Model fitting was done using the LISREL program (Jöreskog and Sörbom, 1996a) with the weighted least squares (WLS) procedure. Because the observed variables were ordinal and not fully normally distributed, the polychoric correlations and the asymptotic covariance matrix of the estimated polychoric correlations were estimated as input to the LISREL. These were obtained by the PRELIS program (Jöreskog and Sörbom, 1996b).

The fit of the various models was judged by using a goodness of fit index (GFI), standardized

root mean square residual (standardized RMR), and chi-square. The GFI is a measure of the relative amount of variances and covariances jointly accounted for by the model, and the standardized RMR measures the average of residual correlations. Typically, a model is presumed to have an adequate fit when the GFI is greater than 0.90 (range 0-1) and the standardized RMR is near to zero. It was reasonable to presume that the χ^2 value would not be the most adequate index of fit in our study because of its high sensitivity to large sample sizes (see Bentler and Bonett, 1980). Consequently, we used the normed fit index (NFI) to evaluate the effect of the sample sizes on the χ^2 value. NFI values above 0.90 (range 0-1) indicate an acceptable model.

3.2. Group comparison

To find the most adequate model for the group comparison between the technical designers, teachers and managers, we simultaneously tested alternative estimations for the data in the case of each model: (a) the models were estimated freely between the groups; (b) the factor loadings were constrained to be equal between the groups; and (c) all the parameters were constrained to be equal between the groups. The third model was chosen for two reasons. First, the analysis of the first and the second estimation results revealed that the values of the parameters for the three occupational groups were virtually identical. Second, the fit of the models with the different estimations did not differ significantly as evaluated by the various fit statistics mentioned above. Hence, all three models presented below were estimated simultaneously for the three occupational groups with all the parameters constrained to be equal.

3.3. Model 1: First-order one-factor model

First, a first-order one-factor model was tested. This model consisted of a single factor construct that included all the items of the short-form OLQ. This model, however, showed a relatively poor fit with the data. Of the fit indices, only the GFI (0.94) showed an adequate fit, whereas the chi-square test (χ^2 (247) = 2188.43, $P < 0.001$), NFI (0.85) and standardized RMR (0.078) were not acceptable. After releasing four error term covariances on the basis of the largest modification indices, the first-order one-factor model provided a satisfactory fit with the data (GFI = 0.97, standardized RMR = 0.058). The chi-square value was still significant (χ^2 (243) = 840.83, $P < 0.001$) but the NFI (0.94) showed that this was due to the large sample sizes rather than a specification error in the model. In this model, the strongest error term covariance occurred between items 5 (the comprehensibility item) and 6 (the manageability item). The other three were found between the meaningfulness items 16 and 28, comprehensibility items 19 and 21, and manageability items 6 and 9. The first-order one-factor model with standardized parameter estimates including the four error term covariances is presented in Fig. 1.

3.4. Model 2: First-order correlated-three-factor model

Next, a model with three first-order factors was tested. The first factor consisted of the meaningfulness items (items: 4, 8, 16, 28), the second of the comprehensibility items (5, 12, 19, 21, 26) and the third of the manageability items (6, 9, 25, 29). As suggested by Antonovsky (1987, 1993), these three factors were allowed to correlate. This model fitted the data well (GFI = 0.96;

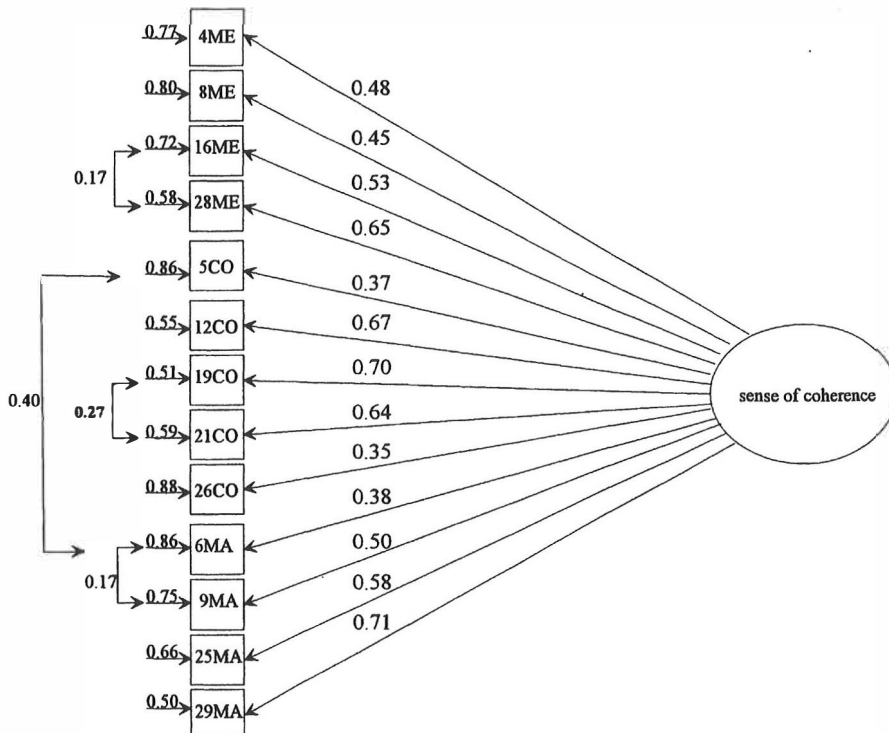


Fig. 1. The first-order one-factor model of the short-form OLQ with standardized parameter estimates. (Note: ME = meaningfulness item, CO = comprehensibility item, MA = manageability item. The observed variables are numbered according to their item numbers as presented in Antonovsky's (1987) 29-item version of the OLQ.)

standardized RMR = 0.066). However, the chi-square test rejected the model ($\chi^2(244) = 1654.17$, $P < 0.001$) and the NFI (0.89) did not fully meet the requirement for an acceptable fit. Consequently, we released the largest modification index between the errors of the observed variables 5 (comprehensibility item) and 6 (manageability item). Including the covariance in these error terms, the first-order correlated-three-factor model provided a good fit with the data (GFI = 0.97, standardized RMR = 0.054). Again, the chi-square test rejected the model ($\chi^2(243) = 900.93$, $P < 0.001$) but the good NFI value (0.94) revealed the influence of large sample sizes on the chi-square test. The first-order correlated-three-factor model with standardized parameter estimates and one error term covariance is presented in Fig. 2. As can be seen, the three first-order factors describing meaningfulness, comprehensibility and manageability showed strong intercorrelations, which is in accordance with Antonovsky's (1987) theoretical considerations.

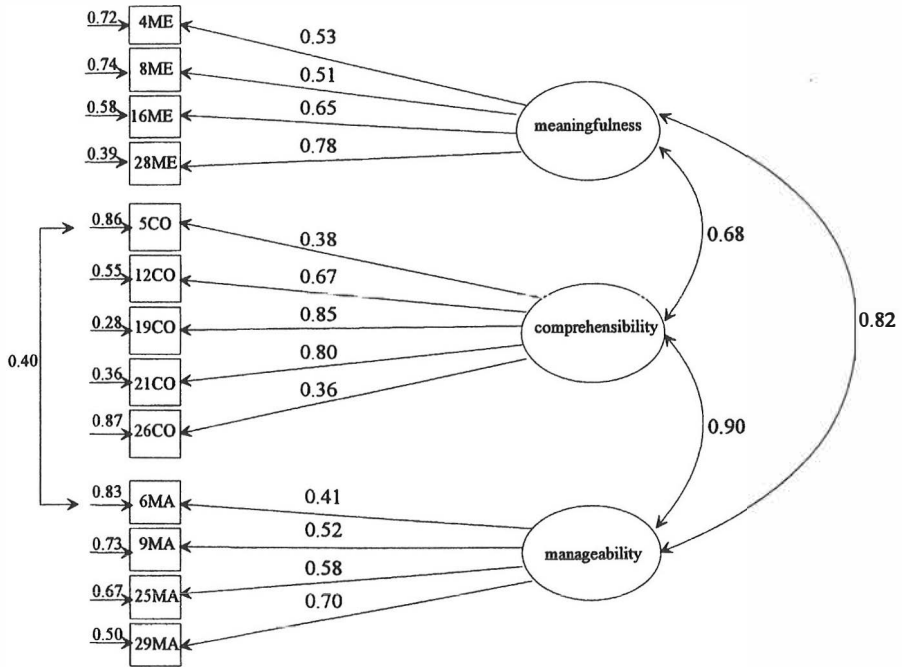


Fig. 2. The first-order correlated-three-factor model of the short-form OLQ with standardized parameter estimates.

3.5. Model 3: Second-order model

It is notable that the first-order correlated-three-factor model served as a boundary model for the viability of the more elaborated, yet constrained, second-order model with three first-order factors. Had a first-order correlated-three-factor model with good fit not been obtained, it would not have been possible to test a second-order model. In the second-order model, the three estimated correlations among the three first-order factors were replaced by a single second-order factor with three factor loadings, one for each of the three first-order factors. In other words, the first-order factors (meaningfulness, comprehensibility and manageability), were hypothesized to be part of a hierarchical structure in which the second-order factor (sense of coherence) determines the common variance contained in all the first-order factors.

It is important to note that because the second-order model is nested within the first-order correlated-three-factor model, the absolute upper limit for the fit of the former would be that of the latter. In contrast, any additional restriction would decrease the fit of the second-order model as compared with the first-order correlated-three-factor model. In the present second-order model, we estimated the variances of the residuals of the first-order factors as equal. Therefore, the fit of the second-order model was slightly below that of the first-order correlated-three-factor model

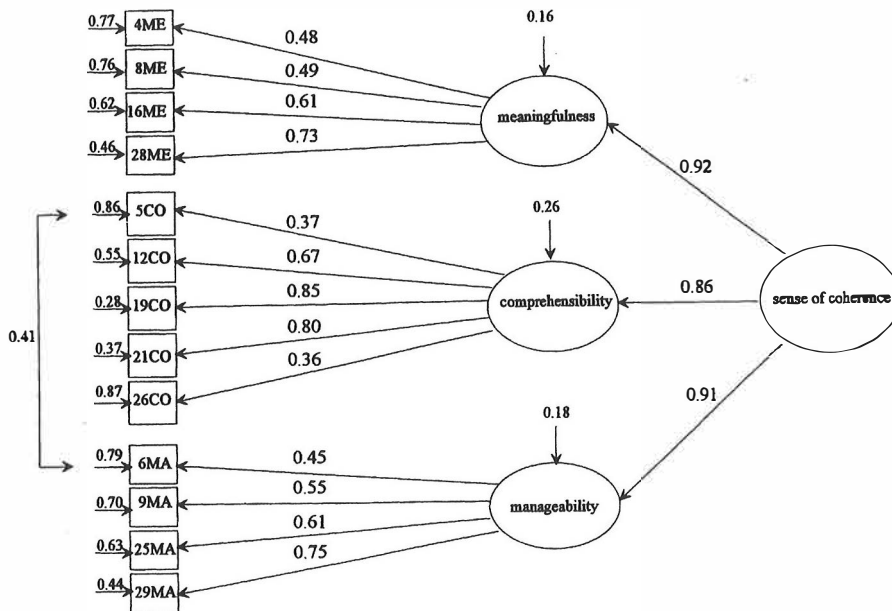


Fig. 3. The second-order model for the short-form OLQ with standardized parameter estimates.

although still satisfactory (GFI = 0.97; standardized RMR = 0.060; χ^2 (245) = 1078.50, $P < 0.001$, NFI = 0.93). Figure 3 shows that the standardized factor loadings of the meaningfulness, comprehensibility and manageability factors on the generalized expectancy factor were 0.92, 0.86 and 0.91, respectively.

4. Discussion

The purpose of the present study was to investigate by confirmatory factor analysis the structure of the short-form (13-item) OLQ (Antonovsky, 1987). The factor analysis models specified and tested in this study were (1) a first-order one-factor structure; (2) a first-order correlated-three-factor structure; and (3) a second-order structure with three first-order factors. The first of these models was performed to test the OLQ single-factor hypothesis derived from previous exploratory factor analysis work (see Antonovsky, 1993; Callahan and Pincus, 1995; Flannery and Flannery, 1990; Frenz et al., 1993). The latter two models were specified on the basis of Antonovsky's (1987) theoretical considerations of the interrelated component structure of sense of coherence and his classificatory design for the OLQ items. These factor analysis models were tested by using three independent samples: technical designers, teachers and managers.

On the basis of the present results, we found more support for the first-order correlated-three-

factor model and the second-order model in describing the structure of the short-form OLQ than the first-order one-factor model. Support for this conclusion came from the fit statistics as well as from the content interpretation of the various models. Firstly, the results revealed that the fit of the 'pure' first-order correlated-three-factor model (the error term covariances were assumed to be zero) proved satisfactory, whereas the corresponding first-order one-factor structure fitted the data poorly. Secondly, although the first-order one-factor model showed an adequate fit after the four error term covariances were released, its content interpretation would be complicated and theoretically meaningless: the OLQ would measure a single expectancy factor, i.e. sense of coherence, and in addition, four specific factors. From a statistical point of view, the high number of error term covariances yielded by the first-order one-factor model indicates that this model was inadequate. In this respect, the first-order correlated-three-factor model as well as its more constrained second-order model were more advantageous because their structure explained three of the error covariances that occurred in one-factor structure (all of which shared the same component facets of sense of coherence) and only one was left unexplained.

The first-order correlated-three-factor model and second-order model were alternative models in describing the interrelated three-component structure of the short-form OLQ. The first-order correlated-three-factor model showed high intercorrelations between the meaningfulness, comprehensibility and manageability components, which is in line with both Antonovsky's theory (1979, 1987) and previous study findings (Bishop, 1993; Flannery and Flannery, 1990; Kravetz, et al., 1993; Pasikowski et al., 1994; Petrie and Brook, 1992). These high intercorrelations can also be seen as a hierarchical structure in the second-order model: a second-order latent variable represents a generalized expectancy factor, sense of coherence, whose common influence is shared among the three first-order expectancy factors, i.e. meaningfulness, comprehensibility and manageability. Hence, the second-order model is very suitable at a theoretical level, because it specifies the three interrelated components (a single second-order factor common to all first-order factors) left unarticulated as correlations between factors in the first-order correlated-three-factor model.

Use of a multisample procedure showed that the same models fitted all three samples: technical designers, teachers and managers. However, on the basis of the present results we cannot conclude that the structural properties of the short-form OLQ would be the same regardless of the characteristics of the sample. Although these three occupational groups deviated from each other as far as the nature of their work as well as their age and gender were concerned, they nonetheless shared the same cultural and socioeconomic background: all of them were Finnish white-collar employees. Therefore, we do not know how far these results can be generalized across other samples, for example, blue-collar workers or persons outside the labour market. Consequently, an important task for future research is to test these various factor analysis models in relation to other groups as well. Cross-cultural studies, especially, would yield further information about the structure of the OLQ.

Taken as a whole, confirmatory factor analysis proved to be a largely successful method for investigating the structure of the short-form OLQ in the present study. The analysis of the various factor analysis models revealed that a second-order model with three first-order factors was an advantageous way to characterize the theoretically based structure of the OLQ. In accordance with Antonovsky's (1979, 1987) theoretical considerations, the second-order model indicated that the short-form OLQ measures the general expectancy factor, sense of coherence, the influence of

which is shared among the three interrelated first-order expectancy factors, i.e. meaningfulness, comprehensibility and manageability.

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II

**Longitudinal factor analysis models in the assessment
of the stability of sense of coherence**

by

Taru Feldt, Esko Leskinen, Ulla Kinnunen and Saija Mauno

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Longitudinal factor analysis models in the assessment of the stability of sense of coherence

Taru Feldt*, Esko Leskinen, Ulla Kinnunen, Saija Mauno¹

University of Jyväskylä, Department of Psychology, PO Box 35, FIN-40351, Jyväskylä, Finland

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Abstract

The present study examined the stability of sense of coherence using longitudinal factor analysis models. Sense of coherence was measured by Antonovsky's [Antonovsky, A. (1987a). *Unraveling the mystery of health. How people manage stress and stay well*. San Francisco: Jossey-Bass.] short-form (13-item) Orientation to Life Questionnaire (OLQ). Analyses were carried out using one-year follow-up data consisting of 219 Finnish employees working in four organizations. A three-step analytic procedure was used. First, a one-factor, a three-factor, and a second-order factor model were specified and compared separately in two measurements. Second, the stability of the constructs in the three alternative models were tested by longitudinal factor analysis models. Third, changes in the level of the latent factors over time were studied. The results showed that the three-factor and the second-order factor model fitted the data better than the one-factor model. Sense of coherence was also found to be a moderately stable personality factor across the one-year period. Mean changes in the latent factors (i.e., total sense of coherence and its three components) over time were not found. © 1999 Elsevier Science Ltd. All rights reserved.

Keywords: Orientation to Life Questionnaire; Sense of coherence; Stability; Longitudinal factor analysis

1. Introduction

According to Antonovsky (1979), an individual with a strong sense of coherence will,

* Corresponding author. Tel.: +358-14-601211; fax: +358-14-602841.

E-mail address: tafe@psyka.jyu.fi (T. Feldt)

¹ Taru Feldt, Ph.Lic, and Saija Mauno, MA, are researchers and Ulla Kinnunen, Ph.D., is a professor at the Department of Psychology, University of Jyväskylä. Esko Leskinen, Ph.D., is a professor at the Department of Statistics, University of Jyväskylä.

compared to a person with a weak sense of coherence, be more likely to appraise stimuli as nonstressors, to define them as irrelevant or benign, to approach rather than avoid potentially stressful situations, and to select flexibly the most appropriate coping strategy. All these contribute to a greater likelihood of preventing disregulation and achieving a more positive health outcome. The health-promoting effect of sense of coherence has also become evident in recent research (Coward, 1996; Feldt, 1997; Feldt, Kinnunen & Mauno, in press; Forsberg, Bjorvell & Cedermark, 1996; Gilbar, 1998; Kivimaki et al., 1997; Lundberg, 1997).

Some important issues related to the sense of coherence theory, however, have remained unclear. One of the most central under researched areas concerns the stability of sense of coherence, which Antonovsky (1993) himself has also mentioned as in need of further investigation. As with many other personality attributes related to the individual's internal resources, such as hardiness (Kobasa, 1979, 1982), locus of control (Rotter, 1966, 1975), and self-efficacy (Bandura, 1977), sense of coherence (Antonovsky, 1979, 1987a, 1991) is also assumed to represent a relatively stable personality factor after young adulthood. This hypothesis, however, has not been tested, the previous research into sense of coherence being primarily cross-sectional (see Geyer, 1997). The present study focuses on this issue, investigating the stability of sense of coherence among a sample of Finnish employees with a heterogeneous background, using longitudinal factor analysis models over a one-year follow-up period.

Antonovsky's (1979, 1987a) sense of coherence construct consists of three dynamically interrelated components: meaningfulness, comprehensibility and manageability. *Meaningfulness* refers to the degree to which an individual feels that life is emotionally meaningful and that, at least, some of his or her daily problems and difficulties are perceived rather as challenges than as hindrances. *Comprehensibility* expresses to what extent an individual perceives the situations that confront him or her as cognitively meaningful and predictable. *Manageability* refers to the degree to which an individual perceives his or her resources to be sufficient to meet internal and external demands. Antonovsky (1987a) takes the view that the meaningfulness component is the most central aspect of sense of coherence because of its motivational element. On the other hand, Antonovsky (1979, 1987a, 1993) has argued that successful coping depends on sense of coherence as a whole and therefore there is no justification for measuring these components as distinct constructs.

Sense of coherence is measured by the Orientation to Life Questionnaire (OLQ) (Antonovsky, 1987a). In forming the OLQ, Antonovsky was influenced by Guttman's facet theory (see Guttman, 1974), which is based on the assumption that social phenomena are most adequately understood when they are seen as multidimensional. Antonovsky (1987a) developed the OLQ after extensive interviews with individuals who were known to have undergone severe trauma with inescapable major consequences for their lives, and yet were perceived to be functioning remarkably well. He drew up a profile on the basis of words and phrases used by respondents who were judged to have either a strong or weak sense of coherence.

In the final phase of developing the scale, Antonovsky made a theoretically guided choice to have each item include one of the three components of sense of coherence (comprehensibility, manageability, meaningfulness). In addition, he designed the items to include the four other facets of stimulus; these were the modality of stimulus (instrumental, cognitive or affective), its source (internal, external or both), the nature of the demand it posed (concrete, diffuse or

affective) and its time reference (past, present, future). Thus, each item in the OLQ is in the first place specified as comprehensibility, manageability or meaningfulness, but shares elements (modality, source, demand, time) with the other four facets of stimulus.

The OLQ exists in two forms. The longer version consists of 29 items, of which eight represent the meaningfulness, eleven the comprehensibility and ten the manageability components of sense of coherence. The abridged 13-item OLQ contains four meaningfulness, five comprehensibility and four manageability items. Antonovsky (1987a, 1993) has stressed that these three components of sense of coherence should not be measured as self-sufficient constructs because the scale was developed to measure a global orientation, sense of coherence, consisting of three interrelated components. This is supported by the fact that high intercorrelations (0.50–0.78) between the three components have been found in several studies (Bishop, 1993; Flannery & Flannery, 1990; Hart, Hittner & Paras, 1991; Kravetz, Drory & Florian, 1993; Pasikowski, Sek & Scigala, 1994; Petrie & Brook, 1992).

The previous factor analytic studies using Antonovsky's (1987a) OLQ have primarily relied on exploratory factor analyses. The majority of these factor analyses have yielded a one-factor solution for the 29-item OLQ. For example, Antonovsky (1993) has referred to three unpublished studies all of which have shown the OLQ to be a unidimensional instrument for measuring sense of coherence. The one-factor solution is also found in three published studies, which have been conducted among a sample of 828 patients with rheumatoid arthritis (Callahan & Pincus, 1995), 374 patients and nonpatients (Frenz, Carey & Jorgensen, 1993), and 95 evening college students (Flannery & Flannery, 1990). Moreover, Hawley, Wolfe and Cathey (1992), on the basis of the factor analysis they performed among a sample of 1333 patients with rheumatoid disorders, concluded that the OLQ is best used as unidimensional.

The factor structure of the short-form (13-item) OLQ has been investigated less. Feldt and Rasku (1998) performed a confirmatory factor analysis to investigate the structure of this abridged version using a multisample procedure consisting of three independent samples of 989 technical designers, 1035 managers and 1012 teachers. In this study, three alternative factor analysis models were fitted to the data. First, a *one-factor structure* was specified to test the unidimensional hypothesis derived from previous exploratory factor analytic work (see Callahan & Pincus, 1995; Flannery & Flannery, 1990; Frenz et al., 1993; Hawley et al., 1992). In addition, the theoretically based interrelated three-component structure of sense of coherence was established by a *first-order correlated-three-factor model* and a *second-order factor model with three first-order factors*. The results revealed that the first-order correlated-three-factor model (the 13-item OLQ measures three interrelated components of sense of coherence) and the second-order model (OLQ measures a generalized expectancy factor, i.e., sense of coherence, whose influence is shared among the three first-order expectancy factors, i.e., comprehensibility, manageability, meaningfulness) fitted the data better than the one-factor model (all the items of the OLQ measure one expectancy factor, i.e., sense of coherence).

According to Antonovsky (1979, 1987a,b, 1991), the foundation for a strong sense of coherence in adulthood, is laid on by consistency in life experiences, load balance and participation in decision-making in childhood and adolescence. During early adulthood an individual's location along the sense of coherence continuum becomes more or less fixed. Antonovsky (1987a) has suggested the age of thirty as a critical point in this development; after that a person with a strong sense of coherence will be able to cope with the subsequent

vicissitudes of life. This does not mean, however, that his/her sense of coherence would then be rigidly fixed. Some temporary changes, ‘fluctuations around a mean’, as Antonovsky calls the variation in sense of coherence, may occur due to radical environmental events, e.g., threat of unemployment. However, sooner or later, a person returns to his or her mean level of sense of coherence.

Regarding the stability of sense of coherence, only the results of a few studies are available. Frenz et al. (1993) have indicated a high test-retest reliability ($r = 0.92$) for the 29-item version in a group of undergraduate students with a one-week retest interval. Again, in a group of social service employees with a 7–30 days’ interval a high test-retest reliability ($r = 0.93$) was found. On the other hand, Carmel and Bernstein (1990) found relatively high changes in sense of coherence among young medical students in their three-stage follow-up study; the mean level of sense of coherence decreased systematically over time as the workload in medical school increased during the first two years of their studies. However, in this study the intercorrelations of the sense of coherence scores between the measurement occasions were not given, and, therefore, the amount of stability of sense of coherence over time and situations was left unknown.

In sum, the aim of the present study is to investigate the stability of sense of coherence using longitudinal factor analysis models using the 13-item OLQ (Antonovsky, 1987a). In addressing this issue, a stepwise procedure is used. First, the same cross-sectional confirmatory factor analysis models as in the earlier study by Feldt and Rasku (1998) are evaluated before the longitudinal factor analysis models to ensure that the operationalization of the hypothetical constructs (i.e., sense of coherence and its three components) into the observed variables has been successful. Second, the stabilities of the constructs (correlations between factors over time) are investigated by connecting these cross-sectional factor analysis models to a longitudinal factor analysis model using structural equations between the latent factors (see Joreskog, 1979; Tisak & Meredith, 1990). Third, changes in the mean level of the hypothetical constructs over time are evaluated.

2. Method

2.1. Participants

The study was a part of a longitudinal research project, ‘Job Insecurity and Well-being’, conducted among four organizations in central Finland. The organizations were chosen to represent various economic areas: export industry (a paper mill), the domestic market (a bank and a supermarket) and the public sector (a municipal social and health care department).

In each organization a number of changes took place during the follow-up period (1995–96). In the paper mill, which is part of the larger forestry group of industries, a variety of rationalization plans have been under implementation since the early 1980s. Personnel cuts have usually been achieved by means of early retirement. The bank is a regional co-operative bank which has been hit by the deep recession of the 1990s in the domestic sector. It has shed personnel by conducting early retirements and layoffs. The supermarket is part of a national retail co-operative chain. In spite of the domestic recession it has coped relatively well

compared to smaller retailers. In 1995–96 the number of personnel in the supermarket remained largely unchanged, although an increase in part-time working and job transfers occurred. The municipal social and health care department has suffered from financial problems: its funding has been cut. This has decreased the number of temporary employees.

The study was conducted in two stages. In the first stage (1995), 636 employees (response rate 65%) and in the second stage (1996), 518 employees (response rate 53%) working in the four organizations answered a questionnaire. This article is based on the responses of those employees who participated in both stages of the study ($N = 219$). The participants' background is described by the following variables:

1. *Organization*: (1) municipal social and health care 45% ($n = 98$), (2) bank, 24% ($n = 53$), (3) factory 27% ($n = 59$), (4) supermarket 4% ($n = 9$).
2. *Age*: mean = 43 years (range 22–62 years, $SD = 7.8$ years).
3. *Gender*: (1) women 73% ($n = 159$), (2) men 27% ($n = 60$).
4. *Education*: (1) no vocational education 17% ($n = 37$), (2) lower vocational education 39% ($n = 87$), (3) higher vocational education 32% ($n = 69$), (4) university degree 12% ($n = 26$).

There were some significant gender differences in the background variables; the majority of the men (63%) worked in the paper mill, whereas the majority of the women (56%) were employed in the social and health care department.

2.2. Procedure

The data collection was performed in February 1995 and 1996, using a questionnaire distributed to each employee through inter-office mail. All the employees at the supermarket participated in the study. In the other organizations, a random sample of employees was selected from a list provided by the organization. Respondents returned their completed questionnaires in closed envelopes to a mailbox at the workplace. In order to ensure anonymity, respondents' names were not used. Therefore, to create the panel data, the data collected in the two stages of the study were matched according to certain stable key variables concerning the respondents' demographic characteristics, for example, gender, year of birth, education, organization and position in their organization.

2.3. Measurement

The participants completed Antonovsky's (1987a) 13-item Orientation to Life Questionnaire on both measurement occasions. The 13-item OLQ consists of the items numbered 4, 5, 6, 8, 9, 12, 16, 19, 21, 25, 26, 28, 29 on the original 29-item scale. Antonovsky has labelled items 4, 8, 15, 28 as measuring meaningfulness (e.g., 4: "Do you have the feeling that you don't really care about what goes on around you?"), 5, 12, 19, 21 and 26 as measuring comprehensibility (e.g., 19: "Do you have very mixed-up feelings and ideas?") and 6, 9, 25 and 29 as measuring manageability (e.g., 29: "How often do you have feelings that you are not sure you can keep under control?"). The respondents were asked to select a response on a seven-point semantic differential scale with two anchoring phrases (e.g., 1 = very often, 7 = very seldom or never),

yielding a total score ranging from 13–91. Five of these items were reverse scored so that a high score on the total scale indicated a strong sense of coherence.

2.4. Statistical analysis

In the present study, the stability of sense of coherence is investigated by longitudinal factor analysis models using the LISREL 8 program (Joreskog & Sorbom, 1996). The analyses comprise three major phases. First, the alternative factor analysis models are specified

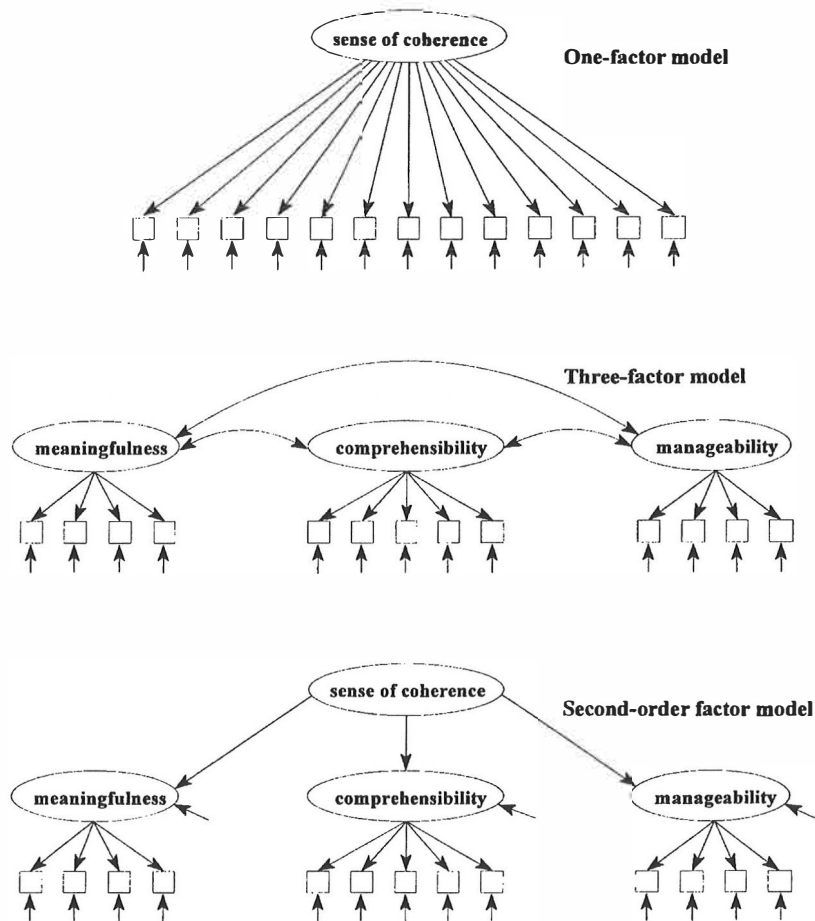


Fig. 1. Three alternative confirmatory factor analysis models of the structure of the short-form (13-item) Orientation to Life Questionnaire (OLQ) in constructing sense of coherence.

separately for the two time points as a preliminary to our analyses of the stability of sense of coherence over time. This procedure offers the safeguard of explicitly verifying the acceptability of the measurement of the constructs (i.e., sense of coherence and its three components) before proceeding to a stability evaluation of the constructs. If the measurement model fails to fit the observed data, there is little sense in proceeding to evaluate stability among the latent variables. Second, to evaluate the stability of the hypothetical underlying constructs, the cross-sectional factor analysis models are connected together in longitudinal factor analysis models by using structural equations posited between the factors. In these analyses, the measurement invariance across the time points is established by constraining the factor loadings to be equal across the two time points. The stability of the constructs is evaluated by the correlation coefficient between the latent factors. Third, changes in the mean level of the factors between the two time points are evaluated.

Because the above-mentioned analyses are primarily based on model fitting and selection, several statistics are used to specify how well the hypothesized models describe the input data set. The goodness of the models was evaluated by using (a) the chi-square test, (b) a goodness-of-fit index (GFI), (c) the standardized root mean squares residuals (SRMR), (d) the root mean square error of approximation (RMSEA) and (e) Akaike's Information Criterion (AIC) (see Joreskog & Sorbom, 1993). A model typically provides a good fit with the data when the *P*-value associated with the chi-square test is nonsignificant, the GFI is above 0.90 (range 0–1), the SRMR is small and the RMSEA is below 0.05. The AIC measure compares the goodness of the alternative models tested through the same data. The best model is the one which has the smallest AIC value (Akaike, 1987).

3. Results

3.1. Cross-sectional factor analysis models

To address the construct validity of sense of coherence, we first tested the alternative cross-sectional factor analysis models separately for the two time points. Fig. 1 provides a schematic representation of the three confirmatory factor analysis models specified and subsequently compared in this study. *The one-factor model* is specified to test the unidimensional hypothesis of sense of coherence derived from previous exploratory factor analysis work (see Antonovsky, 1993; Callahan & Pincus, 1995; Flannery & Flannery, 1990; Frenz et al., 1993; Hawley et al., 1992). The first-order factor consists of all thirteen items in the short-form OLQ.

Based on Antonovsky's (1987a) theoretical considerations and his classificatory design for the OLQ items, we test whether the three components of sense of coherence form a correlated *three-factor model*. In this model, the first factor consists of the meaningfulness items (items 4, 8, 16, 28), the second of the comprehensibility items (5, 12, 19, 21, 26) and the third of the manageability items (6, 9, 25, 29). The three-factor model serves as a boundary model for the viability of the more elaborated *second-order factor model* where the three estimated correlations among the three first-order factors are interpreted as a second-order factor with the three first-order factors. In other words, the first-order factors (meaningfulness, comprehensibility, manageability) are hypothesized to be part of a hierarchical structure in

Table 1
Goodness-of-fit statistics for the alternative cross-sectional factor analysis models in constructing sense of coherence

Measurement model	Time 1		Time 2	
	Error covariances assumed to be zero	Error covariances estimated	Error covariances assumed to be zero	Error covariances estimated
One-factor model (13 items)	$\chi^2 (65) = 194.86, P = 0.000,$ GFI = 0.87, SRMR = 0.077, RMSEA = 0.098, AIC = 246.86	$\chi^2 (60) = 75.86, P = 0.081,$ GFI = 0.95, SRMR = 0.048, RMSEA = 0.036, AIC = 137.86	$\chi^2 (65) = 210.32, P = 0.000,$ GFI = 0.86, SRMR = 0.077, RMSEA = 0.10, AIC = 375.09	$\chi^2 (61) = 106.30, P = 0.000,$ GFI = 0.93, SRMR = 0.057, RMSEA = 0.060, AIC = 166.30
One-factor model (12 items) ^a	$\chi^2 (54) = 136.59, P = 0.000,$ GFI = 0.90, SRMR = 0.063, RMSEA = 0.086, AIC = 184.59	$\chi^2 (50) = 63.22, P = 0.099,$ GFI = 0.95, SRMR = 0.043, RMSEA = 0.036, AIC = 119.22	$\chi^2 (54) = 137.75, P = 0.000,$ GFI = 0.90, SRMR = 0.060, RMSEA = 0.087, AIC = 289.86	$\chi^2 (51) = 92.89, P = 0.000,$ GFI = 0.93, SRMR = 0.053, RMSEA = 0.063, AIC = 146.89
Three-factor model (12 items) ^a	$\chi^2 (51) = 98.91, P = 0.000,$ GFI = 0.93, SRMR = 0.058, RMSEA = 0.067, AIC = 152.91		$\chi^2 (51) = 101.57, P = 0.000,$ GFI = 0.92, SRMR = 0.056, RMSEA = 0.069, AIC = 155.57	
Second-order model (12 items) ^a	Equivalent with the three-factor model (same goodness-of-fit statistics)		Equivalent with the three-factor model (same goodness-of-fit statistics)	

^a Comprehensibility item 5 dropped from the model.[

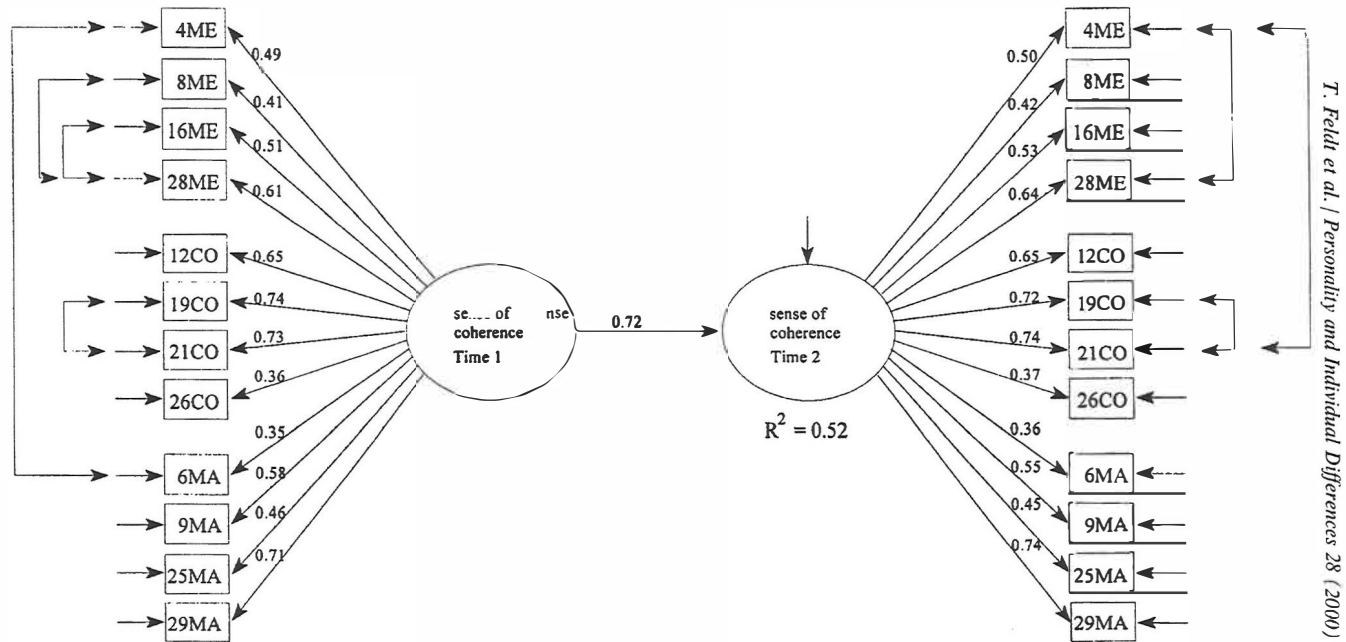


Fig. 2. The longitudinal two-factor model with completely standardized parameter estimates. These estimates can be interpreted as the correlations between corresponding variables. The observed variables are numbered according to their item numbers as presented in Antonovsky's (1987a) 29-item version of the OLQ. ME = meaningfulness item, CO = comprehensibility item, MA = manageability item. The cross-sectional error covariances released at both measurements are presented in the model. Nine autocovariances between the errors of the same observed variables (items 4ME, 8ME, 16ME, 28ME, 12CO, 26CO, 6MA, 9MA, 25MA), were estimated in the model.

which the second-order factor (sense of coherence) determines the common variance contained in all the first-order factors (meaningfulness, comprehensibility, manageability).

The model-fitting process of the alternative factor analysis models are described in detail below and the goodness-of-fit indices of the models are presented in Table 1.

3.1.1. One-factor model (13 items)

As seen in Table 1, the original one-factor structure with the assumption of uncorrelated errors showed a very poor fit with the data at both time points. After the estimation five error covariances at Time 1 and four covariances at Time 2 on the basis of the modification indices, the fit of the one-factor models improved. However, the value of the chi-square test still showed an inadequate fit for the model at Time 2. It is notable that in both measurements the highest modification index (43.9 at Time 1, 50.4 at Time 2) existed between the errors of the comprehensibility item 5 (Has it happened in the past that you were surprised by the behaviour of people whom you thought you knew well?) and manageability item 6 (Has it happened that people you counted on disappointed you?). A more detailed analysis of these models showed that item 5 had the lowest reliability on the factor on both occasions (0.08 at Time 1; 0.12 at Time 2). Consequently, we discarded it and estimated a one-factor model comprising only 12 items from the OLQ.

3.1.2. One-factor model (12 items)

The 12-item one-factor model fitted the data better at both time points than the corresponding 13-item one-factor models (see Table 1). However, despite excluding item 5, the model did not fully meet the requirement for an acceptable fit on account of the relatively high modification indices for the error covariances. The fits of the 12-item one-factor models improved significantly when we released four error covariances on the first occasion and three error covariances on the second occasion. It is worth noting that at Time 1 three of these error covariances occurred between items which shared the same component facet of sense of coherence (the error covariances are shown further in Fig. 2).

3.1.3. Three-factor model (12 items)

Comprehensibility item 5 was also dropped from the three-factor models. Hence, the three-factor model consisted of four meaningfulness items, four comprehensibility items and four manageability items. At both time points, the initial three-factor structure (error covariances assumed to be zero) provided a better fit with the data than the corresponding one-factor models (see Table 1). In the three-factor models, the high modification indices for the error covariances of the observed variables were not so high that covariances needed to be estimated.

3.1.4. Second-order factor model (12 items)

The second-order factor model was equivalent with the three-factor model tested earlier in the sense that both models had the same number of independent parameters, the same fitted residuals and the same goodness-of-fit measures (for a review, see Joreskog & Sorbom, 1996). Therefore these models fitted the given data equally well (see Table 1).

According to the present results, we found that the theoretically-based three-factor structure as well as its equivalent second-order factor structure were more adequate models in

characterizing the structure of sense of coherence than the one-factor structure. The goodness-of-fit statistics as well as the error covariances supported this conclusion. Firstly, the three-factor model and second-order factor model with the assumption of no error covariances provided a better fit with the data than the corresponding one-factor models. Secondly, in the case of the three-factor and second-order factor models, there were no high modification indices, whereas several of these emerged in the one-factor models. However, since it might be too premature to condemn the 12-item one-factor model (comprehensibility item 5 excluded) as compared with the other two structures, we included it in the further analyses for the sake of comparability. Hence, the following stability analyses of sense of coherence are performed by connecting all three models to the longitudinal factor analysis models using structural equations between the factors.

3.2. Longitudinal factor analysis models

The next phase of the study was to investigate the stability of sense of coherence using longitudinal factor analysis models. In the case of each longitudinal factor analysis model, i.e., the longitudinal two-factor model (cross-sectional one-factor models connected together), longitudinal six-factor model (cross-sectional three-factor models connected together) and longitudinal second-order factors model (cross-sectional second-order factor models connected together), comprehensibility item 5 was excluded on the basis of the preliminary analyses.

3.2.1. Longitudinal two-factor model

First, we estimated a longitudinal two-factor model where only the covariances between the errors of the observed variables measured at the same time were released. This model fitted the data poorly ($\chi^2(244) = 546.17$, GFI = 0.82, SRMR = 0.069, RMSEA = 0.077, AIC = 658.17). Next, nine autocovariances between the errors of the same observed variables across the two measurements were estimated on the basis of high modification indices ($\chi^2(235) = 362.25$, GFI = 0.88, SRMR = 0.058, RMSEA = 0.051, AIC = 492.25). These estimates explicitly account for the unique aspect of each measured variable that is correlated over time. The improvement of the model with the estimated autocovariances compared to its predecessor was statistically significant ($\chi^2(9) = 183.92$).

Finally, in order to evaluate whether the structure of the one-factor is invariant over time, we set the factor loadings across the two measurements to be equal. This model fitted the data as well as its predecessor ($\chi^2(246) = 370.79$, GFI = 0.88, SRMR = 0.062, RMSEA = 0.050, AIC = 478.79), producing a nonsignificant loss of fit ($\chi^2(9) = 8.54$). Hence, the factor loadings of the one-factor structure can be assumed to be equal over time.

The completely standardized solution of this estimated longitudinal two-factor model is presented in Fig. 2. The completely standardized coefficients between the variables in this model can be interpreted as the correlations between corresponding variables. The reliabilities of the observed variables are squares of these standardized coefficients, e.g., $0.49^2 = 0.25$ for meaningfulness item 4. The results revealed that the stability coefficient between the two first-order factors describing the total sense of coherence was 0.72. The squared multiple correlation (R^2) for the structural equation was 0.52, which indicated that the proportion of variance in a factor on the second occasion as predicted by that factor on the first occasion was 52%.

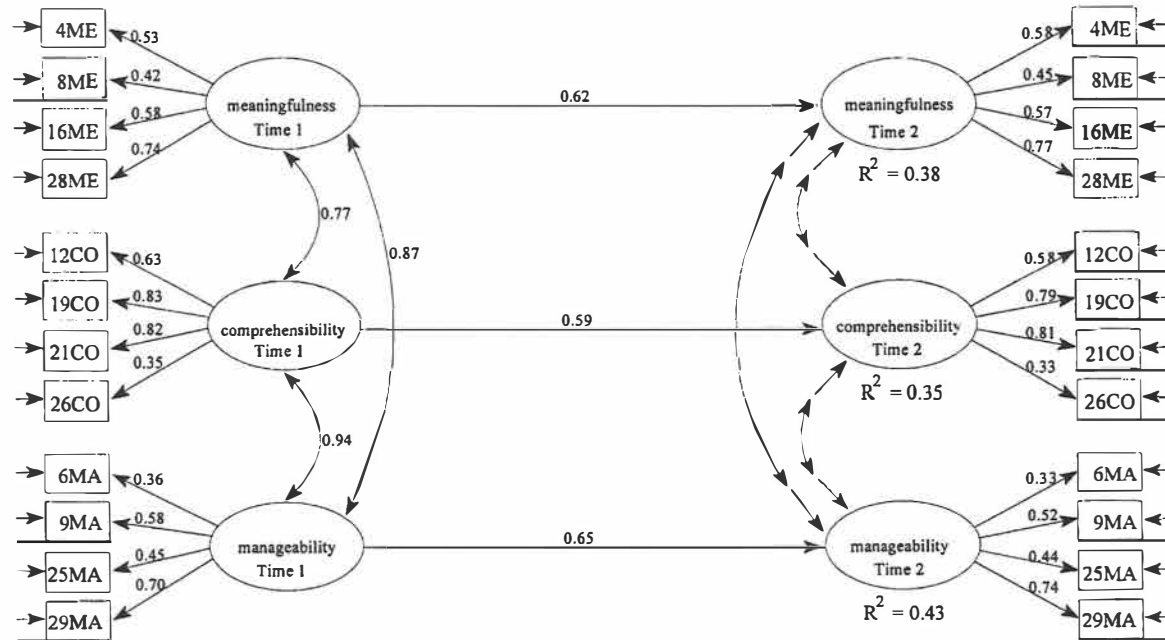


Fig. 3. The longitudinal six-factor model with completely standardized parameter estimates. These estimates can be interpreted as the correlations between corresponding variables. The observed variables are numbered according to their item numbers as presented in Antonovsky's (1987a) 29-item version of the OLQ. ME=meaningfulness item, CO=comprehensibility item, MA=manageability item. Nine autocorrelations between the errors of the same observed variables (items 4ME, 8ME, 16ME, 28ME, 12CO, 26CO, 6MA, 9MA, 25MA), and three covariances between residuals of the structural equations, were estimated in the model.

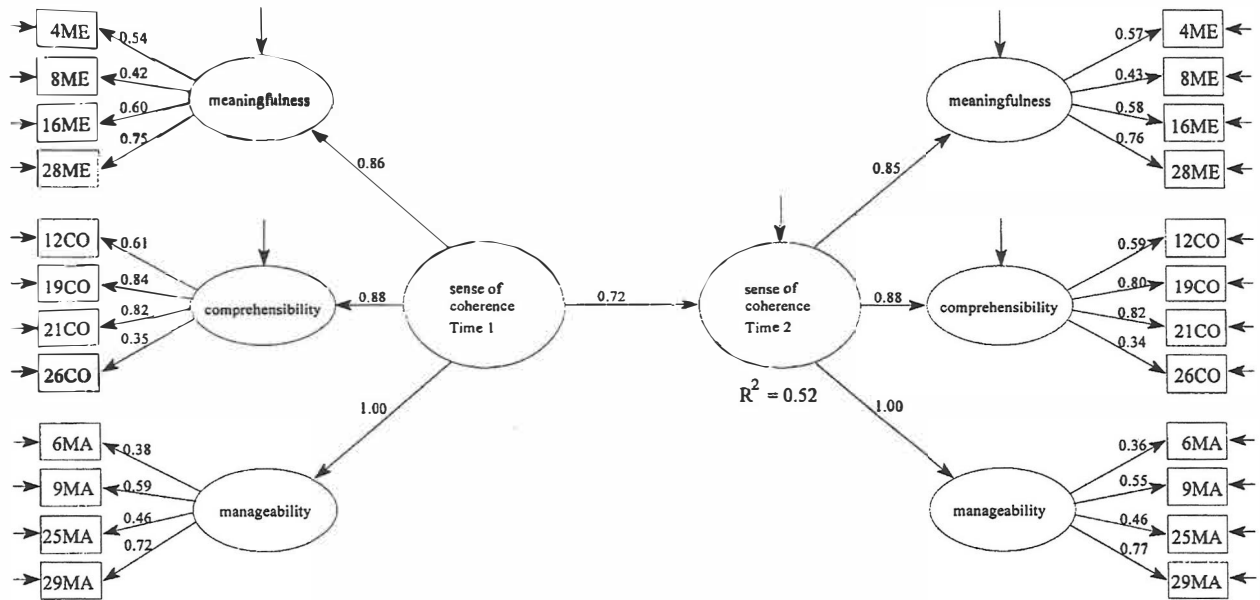


Fig. 4. The longitudinal second-order factors model with completely standardized parameter estimates. (Note: the observed variables are numbered according to their item numbers as presented in Antonovsky's (1987a) 29-item version of the OLQ. ME=meaningfulness item, CO=comprehensibility item, MA=manageability item). Nine autocovariances between the errors of the same observed variables (items 4ME, 8ME, 16ME, 28ME, 12CO, 26CO, 6MA, 9MA, 25MA), are estimated in the model.

3.2.2. Longitudinal six-factor model

The longitudinal six-factor model was specified in such a way that the same first-order factors were connected to each other across the two time points by structural equations. Unlike in the case of the longitudinal two-factor model, it was unnecessary to release any error covariances cross-sectionally in the longitudinal six-factor model (see Table 1). The initial longitudinal six-factor model showed a relatively poor fit with the data ($\chi^2(243)=574.67$, GFI=0.81, SRMR=0.076, RMSEA=0.081, AIC=688.67), but the release of nine autocovariances between the errors of the same observed variables across the two time points improved its fit ($\chi^2(234)=399.47$, GFI=0.87, SRMR=0.074, RMSEA=0.058, AIC=531.47). This improvement was statistically significant ($\chi^2(9)=175.20$).

The next modification was to test the hypothesis of invariance in the factor loadings by constraining them to be equal over time. This model fitted the data reasonably well ($\chi^2(243)=409.35$, GFI=0.87, SRMR=0.074, RMSEA=0.058, AIC=523.35) and the nonsignificant change in the chi-square values ($\chi^2(9)=9.88$) indicated that the factor loadings were equal over time. The final longitudinal six-factor model with completely standardized parameter estimates is presented in Fig. 3. As the figure shows, the stability coefficients were for the meaningfulness factor 0.62, for the comprehensibility factor 0.59, and for the manageability factor 0.65. The squared multiple correlations for the three factors were 0.38, 0.35 and 0.43, respectively.

3.2.3. Longitudinal second-order factors model

Finally, the longitudinal second-order factors model was estimated. It is worth noting that although the cross-sectional three-factor model and second-order factor model were equivalent models, this was not the case with the corresponding longitudinal models. Instead of the three structural equation parameters estimated in longitudinal six-factor model, only one structural equation parameter between the second-order factors was estimated in the longitudinal second-order factors model.

The results showed that the longitudinal second-order factors model, including the nine released autocovariances, fitted the data even better than the longitudinal six-factor model ($\chi^2(245)=396.36$, GFI=0.87, SRMR=0.070, RMSEA=0.055, AIC=506.36). Next, we estimated the second-order factor loadings to be equal across the two time points. In addition, the residual variances of the first-order factors were estimated as equal. Because the estimates of the residual variances of the manageability factors were near to zero, we set these residual variances equal to zero. With these constraints, the longitudinal second-order factors model fitted the data well ($\chi^2(250)=402.58$, GFI=0.87, SRMR=0.070, RMSEA=0.054, AIC=502.58) and the nonsignificant change in the chi-square values ($\chi^2(5)=6.22$) also indicated that the second-order factor loadings across time were virtually equal.

Fig. 4 presents the longitudinal second-order factors model with the completely standardized parameter estimates. The stability coefficient between the second-order factors was 0.72, which was the same as the stability coefficient of the longitudinal two-factor model (see Fig. 2). Moreover, the proportion of the variance in the second-order factor at Time 2 explained by the first measurement was 52%, which was also identical to that of the longitudinal two-factor model tested earlier.

On the whole, the three alternative longitudinal factor analysis models tested in the study fitted the data relatively well. Although the values of some of the fit indices, e.g., chi-square

and GFI, were somewhat below the levels traditionally taken to represent a good fit, it is still reasonable to suggest that the present longitudinal models were indeed acceptable. In particular, it should be noted that the alternative longitudinal factor models were quite large in size, yet the models were tightly constrained. For example, the longitudinal second-order factors model included 24 observed variables, 6 first-order factors, 2 second-order factors and 50 freely estimated parameters.

3.3. Estimation of the mean changes in the factors

The final phase of the analyses focused on the changes in the means of the factors over time. Because the loadings of the factors were invariant over time in the case of each longitudinal factor analysis model, we considered mean changes in the factors. We assumed and tested to the invariance of the intercept terms in the means of the observed variables over time. The means of the factors at Time 1 were fixed to zero and the means of the factors at Time 2 were estimated. These estimates represented the mean changes in the factors over time.

3.3.1. Mean change in the longitudinal two-factor model

The model describing the mean change of the first-order factors in the longitudinal two-factor model fitted the data quite well ($\chi^2(257)=381.04$, GFI=0.88, SRMR=0.062, RMSEA=0.048). In estimating the mean change parameter in the sense of coherence factor and testing the invariance of the intercept terms, we obtained a nonsignificant loss of fit ($\chi^2(11)=10.25$) with respect to the unconstrained mean structure of the longitudinal factor model. The estimated mean change in the sense of coherence was 0.08 with a *t*-value of 1.28. This result indicated that there was no mean change in the first-order sense of coherence factor over time.

3.3.2. Mean changes in the longitudinal six-factor model

This estimated model fitted the data reasonably well ($\chi^2(252)=417.86$, GFI=0.87, SRMR=0.074, RMSEA=0.056). When we estimated the mean changes in the meaningfulness, comprehensibility and manageability factors and tested the invariance of the intercept terms we obtained a nonsignificant loss of fit ($\chi^2(9)=8.51$) with respect to the longitudinal unconstrained mean structure factor model. The estimated mean changes with corresponding *t*-values of these factors were 0.05, *t* = 0.62 for the meaningfulness factor, 0.06, *t* = 0.62 for the comprehensibility factor and 0.12, *t* = 1.75 for the manageability factor. This result indicated that there were no mean changes in the three factors.

4. Discussion

Our study investigated the stability of Antonovsky's (1979, 1987a) sense of coherence construct by longitudinal factor analysis models using one-year follow-up data. The sample consisted of 219 Finnish employees with a heterogeneous background, working in four organizations. The analyses were based on a stepwise procedure where, in the first phase, the cross-sectional factor analysis models, i.e., one-factor, three-factor and second-order factor

structures, were evaluated. After meeting the preliminary requirements for testing the efficacy of the three measurement models, we estimated the longitudinal factor analysis models. In this process, equality constraints were imposed on the corresponding factor loadings across the two waves of data to detect invariance in the latent constructs over time. In the third and final set of analyses, the mean changes in the factors over time were investigated.

In constructing sense of coherence, the unidimensional hypothesis derived from the previous exploratory factor analytic work (Antonovsky, 1993; Callahan & Pincus, 1995; Flannery & Flannery, 1990; Frenz et al., 1993; Hawley et al., 1992) was not fully supported in our study. The major weakness of the estimated one-factor models was that they yielded several error covariances between the observed variables. Thus, the content interpretation of these one-factor models was complicated and theoretically meaningless because the models indicated that the short-form OLQ measured one general expectancy factor (sense of coherence), which included several irrelevant specific factors (non-zero error covariances). The strongest error covariance was found for comprehensibility item 5 and manageability item 6. This finding was also confirmed in the study by Feldt and Rasku (1998). In addition, in the study by Frenz et al. (1993), this pair of items formed a unique factor which the authors termed 'interpersonal trust'.

By estimating the correlated three-factor model, the problem of error covariances could be avoided. The content interpretation of this model was also theoretically sensible: the short-form OLQ measured three interrelated factors, i.e., sense of meaningfulness, comprehensibility and manageability. It is notable, however, that the three-factor model showed very high correlations between the factors, especially between the factors of comprehensibility and manageability (see Fig. 3).

We consider, therefore, that it is meaningful to characterize the structure of the short-form OLQ by the second-order factor model. In the second-order factor model, the high correlations among the first-order factors were explained by a second-order factor. The second-order factor model was suitable at the theoretical level because it indicated that the short-form OLQ measured a generalized expectancy factor, i.e., sense of coherence, whose influence was shared among the three interrelated first-order expectancy factors, i.e., meaningfulness, comprehensibility, and manageability. In addition, the advantage of the second-order factor model was that it specified the three interrelated components of sense of coherence which would otherwise remain unarticulated as correlations between the factors in the correlated three-factor model.

As for the major issue addressed in this paper, we found that sense of coherence represented a moderately stable personality factor over the twelve-month follow-up. This was seen in the longitudinal two-factor and longitudinal second-order factors models which revealed exactly the same stability coefficient for the latent constructs of sense of coherence. The longitudinal six-factor model resulted in somewhat lower stabilities for the three subconstructs of sense of coherence (meaningfulness, comprehensibility, manageability), although the coefficients remained reasonably high. In addition, the third set of analyses showed that no mean changes in the level of sense of coherence and its three components occurred over the follow-up period.

Comparing the alternative longitudinal factor analysis models from the statistical point of view, the longitudinal second-order factors model emerged as the most adequate model in assessing the stability of sense of coherence. Naturally, the longitudinal two-factor model

suffered from the same weakness as the cross-sectional one-factor models, i.e., non-zero covariances between the errors of the observed variables. The comparison of the longitudinal six-factor and second-order factors models indicated, in turn, that the chi-square test and AIC values supported the latter model slightly more than the former.

Certain shortcomings and limitations of the current study suggest avenues for future research. First, we want to encourage caution in generalizing the results beyond the present sample. Although the present study focused on employees varying widely in educational and demographic background, it must be noted that nearly all of them were full-time employees working on a permanent basis (only 10% were part-time workers and only 2% had temporary employment) and aged mostly over 30 years (95%). Extending the investigations to cover unemployed groups as well as younger age groups could yield more information about the stability of sense of coherence. Regarding these groups, Antonovsky (1987a,b) has stated that radical life changes such as experiences of unemployment may cause tangible changes in an individual's sense of coherence. Moreover, investigating the stability of sense of coherence among younger adults could reveal different patterns of results, especially given the fact that sense of coherence is assumed to be more stable after young adulthood (see Antonovsky, 1987a,b, 1991). Second, it must be noted that our data design was based on a 12-month follow-up. Longitudinal data with several measurements over a longer period would add to our knowledge of the long-term changes in sense of coherence.

In conclusion, longitudinal factor analysis proved to be a largely successful method for investigating the stability of sense of coherence using the short-form OLQ. The present results showed that the theoretically-based structure of sense of coherence was supported by the well-fitting second-order factor model, which indicated that the OLQ measured one general expectancy factor (sense of coherence), whose influence was shared among the highly interrelated three first-order factors (meaningfulness, comprehensibility, manageability). In addition, in the present study, the short-form OLQ worked best as a 12-item measure comprising four meaningfulness, four comprehensibility and four manageability items. The longitudinal factor analysis models revealed that sense of coherence represented a moderately stable personality factor over the one-year interval and no mean changes in the latent structures of sense of coherence were detected. The current methodological results relating to measuring stability of sense of coherence offer a good basis for future studies such as, for example, the investigation of possible age differences in the stability of and mean changes in sense of coherence.

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III

**The effect of age and employment experiences on the
stability of sense of coherence: A 5-year follow-up study**

by

Taru Feldt, Esko Leskinen, Ulla Kinnunen and Isto Ruoppila

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IV

**A mediational model of sense of coherence in the work
context: A one-year follow-up study**

by

Taru Feldt, Ulla Kinnunen and Saija Mauno

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V

**The role of sense of coherence in well-being at work:
Analyses of main and moderator effects**

by

Taru Feldt

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