

Leadership and adult development: Towards a unified neuro-psycho-economic approach

Marc G. Lucas¹ and Svenja Caspers²

¹ University of Hagen

² Institute of Neuroscience and Medicine (INM-1)

ABSTRACT

The paper first summarizes basic findings of the ongoing interdisciplinary research project on differences in neural processing of individualistic vs. collectivistic oriented test persons (managers vs. non-managers). Test persons had to perform abstract moral decisions within a functional magnetic resonance imaging (fMRI) setting. The obtained neurobiological and behavioral data were compared between the above mentioned extreme groups.

In this paper the integration of dominant psychological trait theories (BIG-5) and theories of adult development (AD) will be first established on a theoretical level via a synopsis of Furnhams (1996) findings on the integration of different psychological trait theories and neuropsychoeconomic dual process theories primarily related to the importance of intuition in decision making (Kahneman, 2003). A characteristic pattern of a combination of traits will be presented as a possible marker for a high System 1 activation. This pattern will be tested as a signifier for a concordant higher development in AD as well. This theoretical approach will be validated by empirical data from the project in which the researchers combined the extreme group analysis with the application of psychological tests as e.g. NEO-FFI and WUSCT.

KEYWORDS: neuropsychoeconomy, individualism vs. collectivism, fMRI, BIG-5 personality traits, dual process theory, WUSCT

NEUROPSYCHOECONOMICS DESCRIBE the human behaviour and experience in economic context with methodological support of neurosciences (Camerer, et al., 2005; Schilke & Reimann, 2007). As transdisciplinary science, it combines theoretical input in particular from psychology, sociology and economic sciences. According to Küppers (2000), it also brings together a broad range of approaches from social sciences and natural sciences, while structural sciences (mathematics, IT and logic) constitute the link. Hence, it approaches the biopsychosocial paradigm of metascience and beyond this it also facilitates empirical research for a broader understanding of empiricism. The useful addition and mutual enhancement of traditional qualitative and quantitative survey and behavioural observation procedures with methods of brain research in the sense of a triangulation lies in the forefront of the neuropsychoeconomical research design. In the field of neuroscientific methods, functional magnetic resonance imaging (fMRI) has distinguished itself in particular. This imaging method allows for measurement of oxygenated blood in the brain using strong magnetic fields. This activation measurement takes place

continuously and enhances while performing activities. Particular insights are hence obtained from precise measurement of parts of the brain which are active at the time of certain activities, versus those which are not involved or inactivated at the time of these activities. Starting with Fischer (1971), the knowledge obtained in the field of neurosciences has also been applied in the research of changed (or higher) states of consciousness. Here, the research with practitioners of meditation has distinguished itself in particular. It shall only be mentioned in passing that here, research is carried out only on the non-ecstatic and at the same time inactivated dimension from the two dimensions of hyperarousal and hypoarousal of higher states of consciousness which have been described by Fischer.

Neuropsychoeconomics primarily focuses on the contribution of new emotion theories to the decision-making behaviour especially of executives. A decision-oriented and neuropsychoeconomically based definition of leadership is provided by Lucas (2012, p. 9; 2013): "Leadership can thus from an integrated multiperspective view be broadly defined as a specific personality, socially and neurologically caused targeted action initiation under pressure to decide, which is at the same time retroactive for these spheres." In a neuro-psycho-economic research par-

Author's note: correspondence regarding this article should be addressed to Marc G. Lucas, Ph.D., Institute of Leadership and Organization, Department of Economics University of Hagen, Hagen Germany, marc.lucas@fernuni-hagen.de

adigm, this approach and definition is being followed through differentiated measurement of the activity in certain regions of the brain and crossparadigmatic convergences are being looked for. Preoccupation with the significance of different activity patterns begins already with the purely psychological circumplex theories of emotion and personality which have a wide scope. Theories are presented here which aim at presenting the different dominant traits of emotions as well as the Big 5 in the field of personality research in a horizontal circle (Gurtman, 1997, p. 83–84; Plutchik, 1997, p. 21–22). Starting with Watson and Tellegen (1985, 1999), circumplex models are increasingly being presented which are based on two independent activation systems in emotion regulation. In particular Schallberger & Pfister (2001, p. 179f) as well as Schallberger (2006, p. 98f) have transferred this representation of positive and negative activation to the context of leadership and to management decisions as well. Csikszentmihalyi (cited according to Aellig, 2004, p. 44) uses this approach for explaining his flow concept as a highly creative and modified state of consciousness of positive activation in absence of negative activation.

Genuinely neuropsychoeconomical theories deal with these insights and examine these within the framework of theories regarding bounded rationality of decisions. Dismissing the key economical premises, they emphasise that an individual does not decide on a purely rational basis and “that the homo economicus lacks an emotional basis” (Peters & Ghadiri, 2011, p.11). Among the dual process theories there, the approach of Kahneman (2003; 2011) has distinguished itself in particular. He believes that humans make decisions on the basis of two basically different but potentially concurrent processing systems in the brain. In his System I (in subcortical-emotional processes, the region of the dorsal striatum is involved), the arriving information is rapidly and intuitively processed. Simple heuristics and the pattern recognition processes lie at the forefront of the processing. On the other hand, System II (cortical-cognitive) assesses information extensively and in a balanced way in order to finally arrive at an adequate decision. The arriving stimuli pass through different cortical perception and cognitive weighting filters which correspond remarkably to the ego-stabilising filter processes mentioned in Loevingers’ (1976, 1993) theory of ego-development. This considerably slower system can therefore be termed as a rational system as well. Quite astonishingly, the strategies of System I proved to be equally successful at least if not better than System II which was initially considered to be more accurate.

These hypotheses and initial findings from the field of neuropsychoeconomics received support in the meanwhile from other empirical studies. For example Greene et al. (2001, 2004) and Koenigs et al. (2007) also proved in fMRI studies that in processing of moral dilemmas and complex tasks, cortical cognitive-rational as well as subcortical emotional process components play a role. It must be highlighted however that rapid processing in System I is not exclusively emotionally controlled. Emotions only have a certain influence on it. Hence, emotions are not the only factor that affects intuitive information processing in System I according to Kahneman (Fischer & Wiswede, 2009) but are linked to personality-related factors as well.

The fMRI based research on the dual process theories is of high significance for adult development psychology with respect to its possible contribution. The dual process theories focus on the high significance of non-rational or post-rational intuitive decision-making processes in successful addressing of complex tasks and the decision regarding moral dilemmas. Refer to the discussion on the empirical status of the post-formal development level (Commons et al. 1995; Marchand, 2001) for elaboration. Similarly, the theories and methods available in Adult Development research for measurement of later formal and post-formal development levels could be valuable for crossparadigmatic neuropsychoeconomic research. However, the complete absence of an approach integrating these research fields must be noted. Only Haidt (2001) deals with the postulate of a purely cognitively controlled assessment of morally relevant situations as formulated by Kohlberg (1969). He also reaches the conclusion that in presence of increasing neuroscientific knowledge, this hypothesis is no longer sustainable. In 2003, Kallio & Pirttilä-Backman (p. 137) stated that: “A holistic approach is also needed to achieve an integration of distinct, often separate, research subjects (i.e., cognition, personality, emotions).” Even if we are aware that “research across domains has been inhibited by theoretical and practical problems” as formulated by Commons et al. (1989, p. 33), the initial explorative steps in directing integration of the above-mentioned research fields to a neo-integral theory should be taken with the existing and ongoing work of Caspers et al. (2011, 2012).

» THEORETICAL FOUNDATION

The early and trend-setting insight of Graves (1970) about the necessity of integration and a neurobiological basis of adult development theories within the framework of a bio-psycho-social paradigm was the starting point for the model-theoretical considerations and the research design. In his hierarchical and open-ended development theory, intra-psycho development of the individual (labels A–H) and social development of collective life conditions (labels N–V) are mutually dependent. He has differentiated eight levels in his “theory of human existence levels” at current time which are further divided into six subsistence and two being levels of second order. Each subsistence/being level is seen in humans through a corresponding system of values that characterises their entire perception and behaviour.

Switching between the levels leads to higher complexity and is a result of the fact that a person realizes a dissonance between the perception of “himself” and the environment. Ideally, a distinction is made thereby between development levels in which a human being adjusts his environment to his needs and those levels in which he adapts his needs to his environment. Development takes place in switching between these rather collectivist and rather individualistic systems of values. The characteristics of these levels can be described with regard to various individual and social structures. In table 1 some fundamental values have been described which would predominate in leaders with concentration on one of the eight postulated levels. In the meantime numerous empirical and theoretical studies support the assumption, that life- and work-conditions of leaders are characterized by higher complexity (Beer, 1995; Jacques, 1998) especially in the field of decision making. In consistency with the expectations of the theory of levels

Table 1. levels of existence (LOE) with corresponding leadership values (in dependence on Graves, 1974, Beck & Cowan, 2007 and Hamilton, 2012)

level of existence	basic leadership values
A–N (beige)	<i>reactive values:</i> survival; staying alive through innate sensory equipment.
B–O (purple)	<i>traditionalistic values:</i> belonging to blood relationships, safety, assurance
C–P (red)	<i>exploitive values:</i> enforcing power over self, others, and nature through exploitive dependence, egocentrism
D–Q (blue)	<i>sacrificial values:</i> commanding absolute belief in one right way and obedience to authority, salvation, order, security, absolutism
E–R (orange)	<i>materialistic values:</i> inventing and possibility thinking, focused on making things better for self. rationalism, multiplism, independence
F–S (green)	<i>relativistic values:</i> sharing equality and seeking the well-being of people; building consensus as highest priority, community, affiliation
G–T (yellow)	<i>existential values:</i> adapting flexibly to change through connected, systemic views, self-worth
H–U (turquoise)	<i>experientialistic values:</i> attending to whole-earth dynamics and macro-level actions, communion

of human existence leaders on an individual level generally show centres of gravity in later adult developmental levels also (Smith, 1980; Merron, 1985; Quinn & Torbert, 1987; Corbett, 1995; Rooke & Torbert, 1998; Cooper, 2005; Brown, 2012).

Even if the “theory of human existence levels” remained largely unknown in academic circles due to the early death of Graves and little empirical research has been published till date, it has won a lot of interest just lately. For example, Strack (2011, p.22) has published an empirical study in which evidence is found, that Graves’ theory and Schwartz’s typological theory of the universalistic value circle (Schwartz & Bardi, 2001, Schwartz, 2006) which is dominant in today’s value research are based on the same value structure.

Graves et al. tried to describe a neurobiological correlate of his theory already in 1965 using a tachistoscope. In this study, specific value terminology was presented to the test persons for a few milliseconds at a time. Terms that corresponded to the dominant effective value system of the test person were recognised more quickly than other terms.

This approach was basis for our current studies, which transferred the original idea into an up to date research design backed by fMRI and complemented by numerous psychological procedures (CFT intelligence test, NEO-FFI personality test, Values Test and WUSCT Ego-Development).

» PREVIOUS STUDIES

Study 1:

In the initial study (Caspers et al., 2011), 38 healthy German-speaking test persons (21 male, average age = 39.7 years, 17 female, average age = 33.7 years) were selected from a larger test group. They were asked to choose between value-laden abstract term pairs within the framework of a forced-choice fMRI research design. The terms were partly taken from the original study of Graves and partly from the Values Test, which is a questionnaire-based method based on the theory of Graves. In addition to this, terms were developed with respect to key issues of the ego-development theory which were assigned to the levels set by Graves. This addition was made to allow for orientation to a better understood adult development theory with validated procedures. But it may have also been because of this composition that on basis of fMRI data, only classification of different processing patterns between individualistic and collectivistic value concepts could be established. Such a distinction was also recognisable between subsistence and being levels related value terminology. But the distinction did not prove to be significant due to the low number of test persons which could be explicitly assigned to the last levels.

Study 2:

In a second study (Caspers et al., 2012), 44 healthy German-speaking executives (22 male, 22 female, average age = 44.3 years) from the fields of science and economics and 35 non-managerial staff (average age = 40.4 years, 23 male, 12 female) were examined through fMRI in the same study design. From the 44 healthy German-speaking executives, 35 could be considered for the assessment. The non-managerial staffs were chosen from a large sample of 82 test persons who took part in other functional studies. Here, differences were seen in recruiting of brain areas in terms of dominance of the rational or intuitive processing system as assumed on basis of dual process theories. The executives in the study used a subcortical region within the basal ganglia system (head of caudate nucleus) which is thought to gate the way for automated processing of stimuli. On the other hand, the non-managerial employees used a large network of cortical brain regions, which speaks for the use of the rational processing system II. In this network, areas for visual processing as well as for decision-making processing are involved according to the visually presented stimuli.

» CURRENT STUDY—DESCRIPTION OF SECONDARY ANALYSIS AND HYPOTHESES

This knowledge is now considered as an opportunity to attempt the integration of the following within the framework of a secondary analysis of the data available from both studies:

1. the personality theory of the Big-5 measured through NEO-FFI with focus on a specific pattern for intuition,
2. the behavioural data related to the choices made during execution of the fMRI paradigm and
3. the adult development models (human existence level according to Graves which is measured with Values Test as well as ego-development according to Loevinger which is measured with the Washington University Sentence Completion Test).

The first indication of this integrative approach is provided by some descriptive studies. These descriptive studies adopt the difference between managerial staff and non-managerial staff in *a*) attribution of leadership qualities (Judge et al., 2002), *b*) in the management efficiency and the likeliness that they assume executive positions (Ilies, Gerhardt & Le, 2004, p. 215) and *c*) fundamentals of transformational leadership (Weibler, 2012, p. 112) in the Big-5 personality dimensions. In particular, for the

dimensions “Neuroticism” (negative attribute) and “Extraversion”, and conditionally also for “openness” and “Conscientiousness”, significant correlations have been reported. For “Agreeableness”, no such effect has been found.

If one wants to bring together these findings in form of an explanatory approach, the reported personality-oriented markers of executives can be brought into relation with the result of previous study 2. According to study 2, executives activate the intuitive system I in a large number of cases in an abstract decision-making situation. Furnham (Furnham & Stringfield, 1992; Furnham, 1996) managed to work out a more extensive description of “intuition” as a specific pattern of the Big-5 in a comparison of the Big-5 personality dimensions. The dimensions were “Extraversion-Introversion” and “Sensing-Intuition” of Myers Briggs Type Indicators (MBTI). Furnham also associated these dimensions with leadership qualities. Thereby he recognised “Neuroticism” as a general characteristic of negative emotionality or of increased potential for negative activation which at high levels can lead to wrong decisions in the sense of aversion and stress reactions. A pattern of low neuroticism, high extraversion and high openness could be described as “intuitive” and a pattern of low neuroticism. But low extraversion and high conscientiousness at the same time could be described as “largely perceptual” as a specific personality trait. A mixture of both patterns can only be seen in case of middle levels of extraversion.

The association of intuition with leadership qualities or with the executives, mentioned in our former study 2 or in Furnham’s study, suggests that the activation pattern described as intuitive system I in the dual process theory of Kahneman has its counterpart in the pattern consisting of personality traits. This was described by Furnham as “intuition” and the rational system II according to Kahneman. The rational system II is associated in our studies with significant activation of cortical areas of perception processing. It has its counterpart in the personality pattern of “largely perceptual” in case of Furnham. If one adds the significance of pattern recognition and intuition for higher levels of adult development, it may be assumed that the described personality traits of intuition and system I activation should also correlate with more complex levels of adult development.

This leads to the central hypotheses of this study:

Hypothesis 1: Executives show a higher level of development in adult development theories. This is due to selective processes and tasks which are characterised by higher complexity. The executives also make corresponding selection decisions in the forced-choice fMRI design, which show a preference for higher existence-level values.

Hypothesis 2: Executives exhibit a personality pattern which is closer to the “intuitive” type. Non-managerial staff members have a personality pattern which is closer to the “largely perceptual” type.

Hypothesis 3: The personality pattern of the “intuitive”-type correlates with a higher level of adult development and corresponding choice decisions made during execution of the fMRI paradigm.

Hypothesis 4: The “largely perceptual” personality pattern correlates with the intermediate forms of adult development and the corresponding preference of the choices made during execution of the fMRI paradigm.

Hypothesis 5: The personality trait of “neuroticism”, as a trait of aversive affectivity and overload through complexity and decision-making under pressure, correlates with a low grade of adult development and the preference for choices made during execution of the fMRI paradigm.

The initially described development theory of human existence levels does not primarily and exclusively relate to individual traits. Similarly, no adequately validated methods are available for this theory. Only a study of Karsten (2006) deals with the Values Test and draws the conclusion that this method has inadequate internal consistency. Karsten also concluded that it was difficult for the test persons to understand the formulations of the questionnaire or to correctly perform the repeatedly requested allocation of 15 points to seven dimensions. Therefore, a better established, projective and hence bias-free and at the same time better validated adult development theoretical procedure (Loevinger, 1970, 1976) was implemented. This development theoretical procedure was implemented in the form of the Washington University Sentence Completion Test (WUSCT) which is oriented to the theory of ego-development. This procedure has been implemented in several leadership-oriented studies (Lucas, 2012, p. 13, Lucas, 2013) and according to Robinson (2013, p. 157) can be attributed to the adult personality development approaches. For scoring, an analysis could only be carried out by a trained rater by way of derogation from the procedural guidelines.

» RESULTS

Sample characteristics: The combined sample that is presented here comprises the data sets of Studies 1 and 2. It was enhanced by the extended dataset of the 82 preliminary subjects from the Forschungszentrum Jülich in the Helmholtz Association. After excluding one incomplete dataset, this produced a combined sample of 125 people. In accordance with the guidelines we had set for Studies 1 and 2, these were equally divided between women ($n = 61$) and men ($n = 64$). The distribution was also almost equal with respect to leadership function—defined as having leadership responsibility for at least 5 employees—(leadership function = 52, no leadership function = 73). The slight preponderance of subjects without leadership responsibility was due to the fact that this selection criterion was not applied in the preliminary study. However, the leadership and employee functions are equally distributed between the sexes.

The presence of WUSCT protocols, which can be attributed to the postformal stages, is of particular interest and is therefore displayed separately in these results. Unfortunately, as there was no pre-selection process for participating in the study based on such ratings, even when including later protocols of the individualistic stage (4/5) it was only possible to identify 4.8% of all participants in the combined sample with postformal ego identity. In absolute figures this corresponds to just six cases, which unfortunately makes it impossible to provide statistical evidence.

The data from the fMRI study could be taken into account in so far as it was possible to classify the individual subjects as individualists or collectivists using the choice pattern made during execution of the fMRI paradigm. This produced an almost equal distribution, with a total of 69 individualists and 56 collectivists.

Table 2. descriptive statistics of current study (gender, leadership, postformal stage and neurosplitgroup)

	total sample	female	male
number	125	61	64
leadership <i>N</i>	52	25	27
no leadership <i>N</i>	73	36	37
postformal stage <i>N</i> (beginning WUSCT late individualist)	6	2	4
neurosample individualist	69	31	37
neurosample collectivist	56	30	26

There were only minimal differences between men and women, with a slightly stronger individualistic tendency in men and a slightly stronger collectivist tendency in women.

At 42, the average age of the subjects was quite high. This was because participation in the study was restricted to adults and because of the large number of leaders in the study. And as the study was focused solely on people in employment, the oldest participant in the study was 61 years of age. The participants had an average IQ of 124 as measured by the Culture Fair Intelligence Test (CFIT 20). This high level was due to the fact that some of the subjects were acquired via Mensa, but it also reflects the high proportion of leaders in the study. However, a statistically significant correlation to the level of adult development could not be identified for the ego identity or for the levels of existence. With respect to the tendency towards particular personality traits in the intuitive type and the perceptive information processing type, there was no evidence of a correlation to IQ levels.

After evaluating an abbreviated version of the WUSCT with 18 sentence stems, a small statistical spread of overall ratings was established. The range included only five levels with the sample size being too small at the postformal stages for a statistical evaluation. The focus of the protocol was on the Self-Aware ($n = 68$) and Conscientious ($n = 29$) stages. A problem for the evaluation was posed by the often very short answers given by the subjects, something that may have been due to the fact that participants not only had to fill in detailed questionnaires for this study but also other questionnaires for a parallel study.

The levels of existence were measured using an abbreviated version of the Values Test, consisting solely of the preferred choices for the individual stages of the theory. The second part of the test, which included the same questions in the form of degrees of rejection, was not used for practical reasons and because of the aforementioned comprehension problems experienced by the participants. A wider statistical spread was noted across the eight levels of existence. However, the range of centres of gravity that were allocated to the individual subjects was spread across all eight levels of existence. These major differences between the two procedures for measuring adult development can to some extent be explained by the relative independence of the underlying construct. However, the different ways of evaluating the procedures applied could also be responsible for the different variances. It should also be noted that the instructions for the z -transformation

of the procedure's raw data are now 30 years old. Similarly, the subjects in our study had problems answering the questions. As a result, it was necessary to correct a number of false cumulative values that arose during the procedure, which involved distributing 15 points over 8 possible answers to a question.

In setting up the System I (intuitive) and System II (sensing) variables, the individual results of the NEO-FFI test to identify

the Big Five personality traits were collected in accordance with Furnham's theories, as described earlier. This resulted in a four-step scale ranging from 1 (very slight characteristics) to 4 (very strong characteristics). In line with Kahneman's theories, the two systems were considered as being independent and the results are reported separately. Both systems produced on average figures in the average range (2.64/2.35), but the "intuition" variable was more widely distributed.

Table 3. descriptive statistics of current study contd. (age, IQ, AD stage, intuitive and sensing)

	age	CFT IQ	ego development TPR	gravity levels of existence	system 1 (intuitive)	system 2 (sensing)
mean/median	42.26	123.78	self-aware (3/4)	relativistic (F-S)	2.64	2.35
SD	10.23	11.80	—	—	0.43	0.29
min	18	94	conformist (3)	reactive (A-N)	1.56	1.61
max	61	153	autonomous (5)	experientialistic (H-U)	3.53	3.11

Testing of hypotheses:

Hypothesis 1a: Managers show a higher degree of development with regard to adult development theories than non-managers.

In order to test this hypothesis, a t -test was run using managers as the grouping variable and two test variables:

- Centre of gravity for the Levels of Existence
- Total protocol rating in the Sentence Completion Test

In the Sentence Completion Test there was a highly significant correlation between group membership and rating. All six high-level protocols were also attributed to the management group sample. This correlation could not be established for the centre of gravity for the Levels of Existence. So the results are varied, with the hypothesis for Ego Development being proven and the hypothesis for the Levels of Existence being rejected. Managers differ from our highly selective sample of non-managers in their level of Ego Development, in the sense of a higher level of development, but not in the Levels of Existence.

Hypothesis 1b: Managers make abstract value choices during execution of the FMRI paradigm that demonstrate a tendency towards the values of a higher Level of Existence.

Table 4. independent samples t -test comparing stage of ego-development, levels of existence and choices of words related to the levels of existence depending on leadership role

variable	<i>F</i>	<i>p</i>
ego development	12.48	< 0.01
gravity levels of existence	0.46	ns
neurochoices	1.98	ns

Table 5. independent samples *t*-test comparing intuition and sensing personality patterns depending on leadership role

variable	<i>F</i>	<i>p</i>
system I (intuition)	1.38	ns
system II (sensing)	1.64	ns

To test this hypothesis, a *t*-test with leadership as grouping variable and “neurochoices” as test variable was carried out, producing a weighted score for the choices made in the FMRI scenario. This added up all the choices made for the individual Levels of Existence and calculated an overall total from the cumulative values using a simple ascending weighting factor for the individual stages.

It was also not possible to establish a statistically significant correlation to membership of one of the two groups (managers/non-managers) (cf. Table 4). Therefore hypothesis 1b has to be rejected.

Hypothesis 2a: Managers display a personality type that is closer to the “intuitive” type than non-managers.

In order to test this hypothesis, a *t*-test was carried out using leadership as grouping variable and System I (intuitive) as test variable. The variable corresponded to Furnham’s theories, as described earlier.

Hypothesis 2b: Non-managers display a personality type that is closer to the “globally perceptive” type than managers.

In order to test this hypothesis, a *t*-test was carried out using leadership as grouping variable and System II (globally perceptive) as the test variable. The variable corresponded to Furnham’s theories, as described earlier.

It was not possible to establish a statistically significant correlation to membership of one of the two groups (managers/non-managers) for either the “intuitive” or the “globally perceptive” personality traits. Further *t*-tests with the five NEO-FFI factors only produced a negative correlation between neuroticism and the management role ($p < 0.05$) and a positive correlation between agreeableness and the management role ($p < 0.05$). Therefore hypothesis 2 (a and b) has to be rejected.

Hypothesis 3a: The “intuitive” personality type correlates strongly to a higher level of adult development than the “globally perceptive” personality type.

In order to test this hypothesis, a multiple linear regression was used with the following independent variables:

1. Total protocol rating in the Sentence Completion Test
2. Centre of gravity for the Levels of Existence and the predictors system I (intuitive) and system II (globally perceptive).

In the multiple linear regressions, only the “intuitive” predictor variable makes a minor contribution to explaining the total variances of ego development ($R = 0.40$, corresponding to 16% of the total variance) and levels of existence ($R = 0.33$, corresponding to 11% of the total variance). Hypothesis 3a can therefore be considered as proven.

Table 6. effects of personality clusters “intuition” and “sensing” on WUSCT total protocol rating

intuition	ego development	sensing
$\beta = 0.41$	$R = 0.40$	$\beta = -0.04$
$p < 0.01$	$R^2 = 0.16$	$p = ns$

Table 7. effects of personality clusters “intuition” and “sensing” on center of gravity in values test

intuition	levels of existence	sensing
$\beta = 0.33$	$R = 0.33$	$\beta = -0.08$
$p < 0.01$	$R^2 = 0.11$	$p = ns$

Hypothesis 3b: The “intuitive” personality type is linked to choices made during execution of the FMRI paradigm that can be attributed to higher levels of existence.

In the multiple linear regressions, only the “intuitive” predictor variable makes a minor contribution to explaining the total variances of choices made during execution of the FMRI paradigm ($R = 0.21$, corresponding to 6% of the total variance). Hypothesis 3b can therefore be considered as proven.

Hypothesis 4a: The “globally perceptive” personality type is linked to average levels of adult development.

Hypothesis 4b: The “globally perceptive” personality type is linked to a tendency to make choices during execution of the FMRI paradigm that can be attributed to the middle levels of existence.

In order to test hypotheses 4a and 4b, the aforementioned multiple linear regressions were enhanced by individual correlations of the two personality types with the various overall measures of adult development and particular characteristics at specific stages in order to attempt to find evidence of U-shaped relationships.

In this respect it was generally assumed that attempts to perceive situations in a global way are more often displayed in the middle stages of adult development. This is because in the lower stages there is an aversive rejection of complexity and in the higher stages there is a strongly intuitive recognition of patterns that tends to replace global perceptiveness.

Whereas for the “intuitive” type the pattern of correlations that is consistent with the hypothesis shows significant negative correlations at lower levels and significant positive correlations at higher levels. This was true for both Ego Development and the Levels of Existence. For the “perceptive type” the picture was less uniform. A significant correlation with the “perceptive type” can only be identified in the middle stage of ego development, which corresponds with theoretical expectations. But for the levels of existence we see a picture that is the exact opposite. Here the earliest B–O level in our study has a negative correlation to the “perceptive type” and the highest level has a positive correlation to the “perceptive type”. As far as the choices during execution of the FMRI paradigm are concerned, there was no significant correlation to the “intuitive” type and no correlation to the “perceptive” type. However, there was a positive correlation to the total value and a negative correlation to the choices made at the earliest level studied.

Overall, hypothesis 4a can only be proven for Ego Development. For the Levels of Existence, the results can be explained by the fact that the B–O level is generally less concerned with or capable of

Table 8. effects of personality clusters “intuition” and “sensing” on neurochoices

intuition	neurochoices	sensing
$\beta = 0.19$	$R = 0.21$	$\beta = -0.06$
$p < 0.05$	$R^2 = 0.06$	$p = ns$

Table 9. correlations of personality clusters “intuition” and “sensing” with adult developmental measures

variable	intuition	sensing
ego development	0.39 [‡]	0.09
no. conformist SC	-0.22 [†]	-0.01
no. self-aware SC	-0.27 [‡]	-0.08
no. conscientious SC	0.41 [‡]	0.21 [†]
no. higher SC	0.22 [†]	-0.10
levels of existence	0.33 [‡]	0.11
z-value B-O	-0.31 [‡]	-0.26 [‡]
z-value C-P	-0.11	-0.14
z-value D-Q	-0.36 [‡]	0.01
z-value E-R	0.09	0.12
z-value F-S	-0.17	-0.16
z-value G-T	0.32 [‡]	0.25 [‡]
neurochoices	0.20 [†]	0.12
choose B-O	-0.24 [‡]	-0.02
choose C-P	0.14	-0.17
choose D-Q	-0.16	0.09
choose E-R	0.15	0.15
choose F-S	-0.09	-0.12
choose G-T	0.17	0.10

† $p < 0.05$; ‡ $p < 0.01$

individual data collection and complex processing of information. In contrast, the F-s level of existence prefers this complexity and immediately addresses new information.

Hypothesis 5a: The “neuroticism” personality trait is linked to a low level of adult development.

Hypothesis 5b: The “neuroticism” personality trait is linked to a tendency to make choices during execution of the fMRI paradigm that can be attributed to the lower levels of existence.

A one-way ANOVA with the “neuroticism” factor (z-transformed values) was used to test this hypothesis, along with the following three dependent variables:

1. Total protocol rating in the Sentence Completion Test
2. Centre of gravity for the Levels of Existence
3. Choices made during execution of the fMRI paradigm.

As expected, there was a significant negative correlation between the state of development in the Levels of Existence and neuroticism. However, this correlation could not be proven for Ego Development. Therefore hypothesis 5a could only be partially proven. It is likely that the Levels of Existence are more strongly bound up with emotions—particularly the degree of aversive activation of the circumplex model of emotion—while ego development is more closely linked to the System I and System II activation. However, this should be qualified by noting that this correlation to the forced choice scenario as implemented in the fMRI paradigm could not be replicated.

» GENERAL DISCUSSION

All in all, this study was able to throw an exploratory light on the correlation between different adult development theories and different types of personalities and emotions on the background of leadership responsibility. The notional “intuitive” and “globally perceptive” personality types were replicated and linked to the status of Ego Development. In contrast, the measurement of Levels of Existence seems to have a greater link to a negative activation component, as described in the circumplex models of emotion. So for the first time this indicates a potentially comprehensive integration of neuroscientific and psychological theories and findings with the three activation components of negative affect, intuitive processing and cognitive appraisal. These are correlated to the corresponding neurological processes and also to the corresponding stages in adult development.

Of course this study also shows many gaps that could be filled by further investigations in this area of research. The questionnaire-based processes used are out of date and were designed for completely different groups of subjects (girls and women in general for the WUSCT, rather than leaders). Too few statistical validation studies have been carried out ending up in insufficient results concerning test reliability. Similarly, the structure of the questionnaire used proved to be too complicated for the test subjects. Data collection of values furthermore has some special restrictions regarding answer tendencies of test persons especially in the field of an assumed social desirability. From a research economical perspective, numerous questions arise about such a comprehensive study. The time required to carry out the tests, particularly the WUSCT, was criticized by many of the participants, which may to some extent have contributed to the shortness of the answers given, making them difficult to evaluate during the rating process.

With a view to future research, it would be a useful next step to use fMRI data to gain further insights into the neurobiological correlates of the postulated System I and System II variables created using Furnham’s personality clusters.

It would also be desirable to use a longitudinal design for future questionnaire-based research. This is because it is only possible to make hypothetical statements about the causal relationships of the data studied when it is based on a cross-sectional design. It would therefore be very useful to repeat this kind of study at various times on the same subjects. The first author is currently developing a free web-based test system for researchers in order to provide a comprehensive and yet research-economic means of carrying out longitudinal research in this area. Please contact us for more details. ■

Table 10. one-way ANOVA comparing levels of existence, stage of ego-development and choices of words related to the levels of existence depending on neuroticism

variable	F	p
ego development	1.17	ns
gravity levels of existence	2.00	< 0.01
neurochoices	1.29	ns

REFERENCES

- Aellig, S. (2004). *Über den Sinn des Unsinn: Flow-Erleben und Wohlbefinden als Anreize für autotelische Tätigkeiten*. Waxmann Verlag, Münster.
- Beer, S. (1995). *Diagnosing the System of Organizations*. Chichester: Wiley.
- Beck, D. & Cowan C. (2007). *Spiral Dynamics - Leadership, Werte und Wandel: Eine Landkarte für das Business, Politik und Gesellschaft im 21. Jahrhundert*. Kamphausen, Bielefeld.
- Brown, B. C. (2012). Leading complex change with post-conventional consciousness. *Journal of Organizational Change Management*, 25(4), 560–577.
- Camerer, E., Loewenstein, G. & Prelec, D. (2005): Neuroeconomics – How Neurosciences can inform economics. *Journal of Economic Literature*, 43, 9–64.
- Caspers, S., Heim, S., Lucas, M. G., Stephan, E., Fischer, L., Amunts, K., & Zilles, K. (2011). Moral Concepts Set Decision Strategies to Abstract Values. *PLOS One*, 6(4), e18451. Doi: 10.1371/journal.pone.0018451.
- Caspers, S., Heim, S., Lucas, M. G., Stephan, E., Fischer, L., Amunts, K. & Zilles, K. (2012). Dissociated neural processing for decisions in managers and non-managers. *PLOS One*, 7(8), e43537. Doi: 10.1371/journal.pone.0043537.
- Commons, M. L., Armon, C., Richards, F. A., Schrader, D. E., Farrell, E. W., Tappan, M. B., et al. (1989). A multidomain study of adult development. In D. Sinnott, F. A. Richards & C. Armon (Eds.), *Adult development, Vol. 1: Comparisons and applications of developmental models* (pp. 33–56). New York: Praeger Publishers.
- Commons, M. L., Goodheart, E., Bresette, L., Bauer, N. F., Farrell, E. W. & McCarthy, K. G. (1995). Formal, systematic and metasystematic operations with a balance-beam task series: A reply to Kallio's claim of no distinct systematic stage. *Journal of Adult Development*, 2(3) 193–199.
- Cooper, P. (2005). Developing transformational leadership capacity in the public service. *Public Administration Today*, 3, 66–76.
- Corbett, R.P. (1995): *Managerial style as a function of adult development stage*. Unpublished Dissertation, University of Massachusetts, Amherst.
- Fischer, L. & Wiswede, G. (2009). *Grundlagen der Sozialpsychologie*. Oldenbourg Wissenschaftsverlag, München.
- Fischer, R. A. (1971). A cartography of the ecstatic and meditative states. *Science*, 174(26), 132–146.
- Furnham, A. (1996). The Big Five versus the Big Four: The relationship between the Myers-Briggs Type Indicator (MBTI) and NEO-PI Five factor model of personality. *Personality and Individual Differences*, 21(2), 303–307.
- Furnham, A. & Stringfield, P. (1992). Personality and work performance: Myers-Briggs Type indicator correlates of managerial performance in two cultures. *Personality and Individual Differences*, 14(1), 145–153.
- Graves, C. W., Huntley, W. C. & LaBier, D.W. (1965). Personality structure and perceptual readiness: an investigation on their relationship to hypothesized levels of human existence. Retrieved September, 2014, from www.claregraves.com/articles.html.
- Graves, C.W. (1970). Levels of existence: An open system theory of values. *Journal of Humanistic Psychology*, 10, 131–155.
- Graves, C. W. (1974). Human nature prepares for a momentous leap. *The Futurist*, 4, 72–87.
- Greene, J. D., Nystrom, L. E., Engell, A. D., Darley, J. M. & Cohen, J. D. (2004). The neural basis of cognitive conflict and control in moral judgment. *Neuron*, 44(2), 389–400.
- Greene, J. D., Sommerville, R. B., Nystrom, L. E., Darley, J. M. & Cohen, J. D. (2001). A fMRI investigation of emotional engagement in moral judgment. *Science*, 293, 2105–2108.
- Gurtman, M. B. (1997). Studying Personality Traits: The Circular Way. In: Robert Plutchik & Hope R. Conte (Eds.): *Circumplex models of personality and emotions*, (pp. 81–102). Washington: APA.
- Haidt, J. (2001). The emotional dog and it's rational tail: a social intuitionist approach to moral judgement. *Psychological Review*, 108, 814–834
- Hamilton, M. (2012). Leadership to the power of 8: Leading self, others, organization, system and supra-system. *Wirtschaftspsychologie*, 14(3), 58–64.
- Hy, L. X. & Loevinger, J. (1996). *Measuring Ego Development*. (2nd ed.). Mahwah, New Jersey: Lawrence Erlbaum Associates.
- Ilies, R., Gerhardt, M. & Le, H. (2004). Individual differences in leadership emergence: Integrating metaanalytic findings and behavioral genetics estimates. *International Journal of Selection and Assessment*, 12(3), 207–219.
- Jacques, E. (1998). *Requisite Organizations*. Arlington: Cason Hall & Co.
- Judge, T. A., Bono, J. E., Ilies, R. & Gerhardt, M. W. (2002). Personality and leadership. *Journal of Applied Psychology*, 87(4), 765–780.
- Kahneman, D. (2003). Maps of bounded rationality: A perspective on intuitive judgment and choice. *American Economic Review*, 93(5), 1449–1475.
- Kahneman, D. (2011). *Thinking Fast and Slow*. Farrar, Strauss and Giroux: New York.
- Kallio, E. & Pirttilä-Backman, A.-M. (2003). Developmental processes in adulthood – European research perspectives. *Journal of Adult Development*, 10(3), 135–138.
- Karsten, E. (2006): *Spiral Dynamics onderzocht – Een studie naar de validering en betrouwbaarheid van vragenlijsten op het gebied van spiral dynamics*. Unpublished Master Thesis, University of Amsterdam.
- Kohlberg, L. (1969). State and sequence: The cognitive-developmental approach to socialisation. In: D. A. Goslin (Ed.): *Handbook of socialization theory and research*, 347–480, Rand McNally: Chicago.
- Küppers, B. O. (2000). Die Strukturwissenschaften als Bindeglied zwischen Natur- und Geisteswissenschaften. In B. O. Küppers (Ed.): *Die Einheit der Wirklichkeit*, (pp. 89–105). München: Fink.
- Loevinger, J. (1970). *Measuring Ego Development*. Jossey-Bass: San Francisco.
- Loevinger, J. (1976). Ego development. Conceptions and theories. Jossey-Bass: San Francisco.
- Loevinger, J. (1993). Ego development: Questions of method and theory. *Psychological Inquiry*, 4, 56–63.
- Lucas, M. (2012). Grundlagen einer neo-integralen transformationalen führung und organisationsentwicklung. *Wirtschaftspsychologie*, 3, 4–20.
- Lucas, M. (2013). Foundations of a neo-integral transformational leadership and organizational development. *Integral Leadership Review*, 1, 12–27.
- Marchand, H. (2001). Some reflections on postformal thought. *The Genetic Epistemologist*, 29, 3.
- Merron, K. (1985). *The relationship between ego-development and managerial effectiveness under conditions of high uncertainty*. Unpublished Dissertation, Harvard University
- Peters, T. & Ghadiri, A. (2011). *Neuroleadership – Grundlagen, Konzepte, Beispiele*. Gabler: Wiesbaden.
- Plutchik, R. (1997). The Circumplex as a General Model of the Structure of Emotions and Personality. In: Robert Plutchik & Hope R. Conte (Eds.): *Circumplex models of personality and emotions*, (pp. 17–46). Washington: APA.
- Quinn, R. & Torbert, W.R. (1987). *Who is an effective transforming leader?* Unpublished paper, University of Michigan.
- Robinson, O. (2013): *Development through Adulthood*. Palgrave: Basingstoke.
- Rooke, D. & Torbert, W. R. (1998). Organizational transformation as a function of CEO's developmental stage. *Organizational Development Journal*, 16(1), 11–28.
- Schallberger, U. (2006). Die zwei gesichter der arbeit und ihre rolle für das wohlbeinden: Eine aktivierungstheoretische interpretation. *Wirtschaftspsychologie*, 2(3), 96–102.
- Schallberger, U. & Pfister, R. (2001). Flow-Erleben in arbeit und freizeit. Eine untersuchung zum paradoxon der arbeit mit der Experience Sampling Method (ESM). *Zeitschrift für Arbeits- und Organisationspsychologie*, 45, 176–187.
- Schilke, O. & Reimann, M. (2007). Neuroökonomie: Grundverständnis, Methoden und betriebswirtschaftliche Anwendungsfelder. *Journal für Betriebswirtschaft*, 57, 247–262.
- Schwartz, S. H. & Bardi, A. (2001). Value hierarchies across cultures: Taking a similarities perspective. *Journal of Cross-Cultural Psychology*, 32(3), 268–290.
- Schwartz, S. H. (2006): Basic human values: Theory, measurement, and applications. *Revue française de sociologie*, 47(4), 1–43.
- Smith, S.E. (1980). *Ego development and the problems of power and agreement in organizations*. Unpublished Dissertation, Fielding Institute.
- Strack, M. (2011). Graves werte-system, der wertekreis nach schwartz und das competing values modell nach quinn sind wohl deckungsgleich. *Wissenswert*, 1, 18–24.
- Watson, D. & Tellegen, A. (1985). Toward a consensual structure of mood. *Psychological Bulletin*, 98(2), 219–235.
- Watson, D. et al. (1999). The two general activation systems of affect. *Journal of Personality and Social Psychology*, 76(5), 820–838.
- Weibler, J. (2012). Personalführung, Vahlen, München